

HSC Controller Installation Manual

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The HSC50 controller, © 1983 by Digital Equipment Corporation, is covered by one or more of the following U.S. patents: 4,475,212, 4,434,487, 4,413,339, 4,648,035, 4,543,626, 4,592,072, 4,241,399, 4,338,663, 4,349,871, 4,450,572, 4,811,278, 4,811,279, and other patents pending.

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About This Manual

Purpose

This installation manual is to be used for the following:

- Planning and preparing for a Hierarchical Storage Controller (HSC) installation
- Performing initial HSC controller installation
- Testing the HSC subsystem operation after installation
- Installing upgrade kits into lesser performance HSC controller models
- Installing HSC controller options

Please review this entire installation manual before installing HSC controllers, upgrade kits, or options.

Audience

This manual is primarily written for Digital Customer Services personnel performing HSC controller installation and upgrades. The secondary audience is Digital customers performing their own HSC controller installations and upgrades.

Contents

This manual describes installation procedures for the family of HSC controllers, and includes:

- Descriptions of the hardware and a discussion of HSC controller roles in a VAXcluster
- Preparing the HSC controller site including: HSC controller unpacking, cabling, and console terminal configuration references
- Configuring the HSC controller and its storage devices for optimum performance
- Powering up the HSC controller
- Verifying the functionality of the HSC controller and storage devices using device integrity tests
- Enabling the HSC controller to function in a cluster by setting system parameters
- Installing HSC components including: upgrade kits, auxiliary power supplies, additional tape or disk data channel modules, and the HSC60/90 M.cache module option

NOTE

Chapter 4 of this manual duplicates the device integrity test documentation in the *HSC Controller Service Manual*. Chapters 6 through 12 are printed separately and included as part of the appropriate upgrade/installation kits.

This manual does not specifically address:

- MSCP (Mass Storage Control Protocol) or TMSCP (Tape Mass Storage Control Protocol)
- Information on HSC software utility programs, such as SETSHO. This information is contained in the *HSC Controller User Guide*
- Logic or code implementations of HSC controller components
- Error messages: refer to the *HSC Controller User Guide* or the *HSC Controller Service Manual*
- Repair and troubleshooting information: this information is contained in the *HSC Controller Service Manual*

Conventions

In this installation manual, the term “HSC controller” refers to all HSC controller models, including:

- HSC40 controller
- HSC50 controller
- HSC50 (modified) controller (definition in Section 1.2.2)
- HSC60 controller
- HSC70 controller
- HSC90 controller

Any models not included in the term “HSC controller” are specifically addressed in an accompanying section. When a specific HSC controller model is being addressed, it is referred to by its model name. The term “HSC50 controller” includes the HSC50 and HSC50 (modified) controllers, unless otherwise stated.

Related Documentation

For additional user and service information, refer to the following Digital Equipment Corporation documents:

- *HSC Controller Service Manual* (EK-HSCMA-SV)
- *HSC Controller User Guide* (AA-PFSQA-TK)
- *Installing and Using the LA50 Printer* (EK-0LA50-UG)
- *Installing and Using the LA75 Printer* (EK-0LA75-UG)
- *Star Coupler User Guide* (EK-SC008-UG)
- *TU58 DECtape II User Guide* (EK-0TU58-UG)
- *VT220 Installation Guide* (EK-VT220-IN)
- *VT220 Owners Manual* (EK-VT220-UG)
- *VT220 Programmer Pocket Guide* (EK-VT220-HR)
- *VT320 Installation Guide* (EK-VT320-IN)

- *VT320 Owner's Manual* (EK-VT320-UG)
- *VT320 Programmer Pocket Guide* (EK-VT320-HR)
- *VT420 Installation Guide* (EK-VT420-IN)
- *VT420 Owner's Manual* (EK-VT420-UG)
- *VAXcluster Systems Quorum* (EC-P0754-xx)

The *HSC Controller Installation Manual* can be ordered by telephone or direct mail order. (See Table 1 for telephone numbers and addresses.)

Table 1 Telephone and Direct Mail Orders

Your Location	Call	Contact
Continental USA, Alaska, or Hawaii	800-DIGITAL	Digital Equipment Corporation P.O. Box CS2008 Nashua, New Hampshire 03061
Puerto Rico	809-754-7575	Local DIGITAL subsidiary
Canada	800-267-6215	Digital Equipment of Canada Attn: DECdirect Operations KAO2/2 P.O. Box 13000 100 Herzberg Road Kanata, Ontario, Canada K2K 2A6
International	—	Local Digital subsidiary <i>or</i> approved distributor
Internal ¹	—	SDC Order Processing—WMO/E15 <i>or</i> Software Distribution Center Digital Equipment Corporation Westminster, Massachusetts 01473

¹For internal orders, you must submit an Internal Software Order Form (EN-01740-07).

1.1 Introduction

This chapter provides the following information for Hierarchical Storage Controllers (HSCs):

- A general description of each HSC controller
- A table of HSC controller component configurations by model
- A table of HSC module nomenclatures
- HSC controller module descriptions
- A description of a basic VAXcluster

The procedures in this manual are written to apply to all models of the HSC controller; the differences between models are addressed separately. Refer to the “About This Manual” section at the front of this manual for details about HSC model conventions used in this manual.

1.2 HSC Controller General Descriptions

The HSC controller is mounted in a modified H9642 40-inch tall cabinet (actual height is 41.62 inches) similar to the extended H9642 cross-products series. The HSC controller contains the following:

- A card cage
- Extended hex modules
- A dual load device
- A self-contained power controller
- Main and optional auxiliary power supplies
- An exhaust duct
- A blower

The following sections give a brief description of each HSC controller model. The size of the CPUs in a VAXcluster system and the system applications are the primary factors that determine which HSC controller is best for each user's needs.

1.2.1 HSC40 Controller Description

The HSC40 controller is designed for entry level VAXcluster systems. The HSC40 controller has a lower cost and uses the same technology as the HSC70 and HSC90 controller models, but has fewer ports. The HSC40 controller performs up to 800 I/O requests per second. It supports up to 3 disk or tape data channel modules and 12 mass storage devices. The HSC40 controller is field upgradable to an HSC60, HSC70, or HSC90 controller. The HSC40 controller must be upgraded to an HSC60 or HSC70 controller before it can be upgraded to an HSC90 controller.

1.2.2 HSC50 and HSC50 (modified) Controller Descriptions

The HSC50 controller was the first member of the hierarchical storage controller product family. The HSC50 controller performs up to 550 I/O requests per second. It supports up to 6 disk or tape data channel modules and up to 24 mass storage devices. The HSC50 controller is no longer manufactured.

The term HSC50 (modified) controller refers to the HSC50 controller manufactured with some components previously used only on the HSC70 controller. The following list specifies the components of the HSC50 (modified) controller that differ from the original HSC50 controller:

- Front and rear door assemblies
- Model 881 power controller
- I/O bulkhead panel
- Exhaust duct

The serial numbers differentiating the HSC50 (modified) controller from the original HSC50 controller are as follows:

- HSC50-AA (60 HZ.) controller, including and subsequent to serial number 7770
- HSC50-AB (50 HZ.) controller, including and subsequent to serial number 53018

The HSC50 (modified) has the same characteristics as the original HSC50 controller. The HSC50 (modified) controller is no longer manufactured.

1.2.3 HSC60 Controller Description

The HSC60 controller is an entry level controller for VAXcluster systems. It features lower cost and the same technology as the HSC90 controller. The HSC60 controller differs from the entry-level HSC40 in that it can use the 8-port K.si module, and the M.cache module. The HSC60 controller supports up to 20 SDI (standard disk interface) disk drives or 12 STI (standard tape interface) tape drives. The HSC60 controller is field upgradable to an HSC90 controller.

1.2.4 HSC70 Controller Description

The HSC70 controller performs up to 1,150 I/O requests per second. Its supports up to 8 disk or tape data channel modules and up to 32 mass storage devices. The HSC70 controller is field upgradable to an HSC90 controller.

1.2.5 HSC90 Controller Description

The HSC90 controller is the high-end controller of the HSC product family. The HSC90 controller is capable of connecting to a large number of drives and multiple hosts. The HSC90 controller supports up to 8 disk or tape data channel modules and up to 48 SDI disk drives or 24 STI tape drives.

As a mass-storage controller, the HSC90 controller interfaces one or more host computer systems to a set of mass storage devices. The HSC90 controller attaches to the host computer system(s) through the CI interconnect.

1.3 Major Components of HSC Controllers by Model Number

Table 1-1 lists the major components contained within each HSC controller model at the time this manual was published. Future business or marketing considerations may dictate changes to this table.

Table 1-1 Configuration of HSC Controller Models

Item Name	Engineering Designation	Module Designation	HSC90	HSC70	HSC60	HSC50	HSC40
Port processor	K.pli	L0107-YA	No	Yes	No	Yes	Yes
Port processor	K.pli2	L0124-AA	Yes	No	Yes	No	No
Port link	LINK	L0100 E2 L0118-00	No	Yes	No	Yes	Yes
Port link	LINK2	L0118-YA	Yes	No	Yes	No	No
Port buffer	PILA	L0109	No	Yes	No	Yes	Yes
Port buffer	PILA2	L0125-AA	Yes	No	Yes	No	No
I/O control processor	P.ioc	L0105-00	No	No	No	Yes	No
I/O control processor	P.ioj	L0111-00	No	Yes	No	No	No
I/O control processor	P.ioj	L0111-YA	No	No	No	No	Yes
I/O control processor	P.ioj-18	L0111-YC	Yes	No	No	No	No
I/O control processor	P.ioj-18	L0111-YD	No	No	Yes	No	No
Memory	M.std	L0106-AA	No	No	No	Yes	No
Memory	M.std2	L0117-AA	No	Yes	No	No	Yes
Memory	M.std4	L0123-AA	Yes	No	Yes	No	No
32-Mbyte Cache	M.cache	L0121-AA	Option	No	Option	No	No
Disk data channel	K.sdi	L0108-YA	Option	Option	Option	Option	Option
Tape data channel	K.sti	L0108-YB	Option	Option	Option	Option	Option
Disk/tape data channel	K.si 4-port	L0119-YA	Option	Option	Option	Option	Option
Disk data channel	K.si 8-port	L0119-YB	Option	No	Option	No	No
Maximum data channels	-	-	8	8	3	6	3
Maximum ports	-	-	48	32	20	24	12
Load devices	-	-	RX33	RX33	RX33	TU58	RX33
Aux power supply	-	-	Yes	Yes	¹	²	No

¹The HSC60-AA/AB/BA/BB without the cache option does not have an auxiliary power supply. The HSC60-AA/AB/BA/BB with the cache option has the auxiliary power supply installed. The auxiliary power supply is supplied as part of the HSC6X-BA/BB cache option installation kit.

²If the HSC50 has four or more requestors, it requires an auxiliary power supply.

Table 1-2 provides the Digital part number for each HSC controller module, the module name used for each module by the Digital engineering community, and formal module name used for each HSC controller module. Order numbers are not provided in this table.

Table 1-2 HSC Module Nomenclatures

Module Part Number	Engineering Designation	Formal Name	Application/Remarks
L0100 Rev E1/E2	LINK	Port LINK	HSC50 controller only
L0118-00	LINK	Port LINK	HSC40/50/70 controllers
L0118-YA	LINK	Port LINK	HSC60 and HSC90 controllers only
L0109-00	PILA	Port buffer	HSC40/50/70 controllers only
L0125-AA	PILA2	Port buffer	HSC60 and HSC90 controllers only
L0107-YA	K.pli	Port processor	HSC40/50/70 controllers only
L0124-AA	K.pli2	Port processor	HSC60 and HSC90 controllers only
L0108-YA	K.sdi	Disk data channel	All HSC controllers
L0108-YB	K.sti	Tape data channel	All HSC controllers
L0119-YA	4-port K.si	Disk/tape data channel	All HSC controllers
L0119-YB	8-port K.si	Data channel	HSC60 and HSC90 controllers only
L0105-00	P.ioc ¹	I/O control processor	HSC50 controller only
L0111-00	P.ioj ¹	I/O control processor	HSC70 controller only
L0111-YA	P.ioj ¹	I/O control processor	HSC40 controller only
L0111-YD	P.ioj-18 ¹	I/O control processor	HSC60 controller only
L0111-YC	P.ioj-18 ¹	I/O control processor	HSC90 controller only
L0106-AA	M.std	Memory standard	HSC50 controller only
L0117-AA	M.std2	Memory standard 2	HSC40 and HSC70 controllers only
L0123-AA	M.std4	Memory standard 4	HSC40/60/70/90 controllers only; replaces L0117-AA
L0121-AA	M.cache	32-Mbyte cache	HSC60 and HSC90 controllers only

¹References in text to both the P.ioj, and the P.ioc will be given as P.ioj/c.

NOTE

Do not attempt to mix older model modules with newer, higher performance modules. This practice can cause module compatibility problems resulting in performance problems. For example, do not mix older L0100 port LINK modules with new port LINK modules in some clusters.

1.4 HSC Controller Module Descriptions

Each HSC controller model contains modules for communicating on the CI (computer interconnect) bus, communicating with disk drives and tape formatters/drives, and controlling HSC functions.

The Digital Equipment Corporation module part number is stamped on each module handle.

The module names, module part numbers, module functions, and card cage slot locations of each module follow:

- The **port LINK module** (L0100 E1/E2, or L0118-00, or L0118-YA also known as CI LINK) is part of the host interface module set (K.ci). The port LINK module interfaces through line drivers/receivers directly to the CI coaxial cables. On the HSC controller interior side, the port LINK module interfaces to the port buffer module through a set of interconnect link signals. The port LINK module also interfaces to the port processor module (indirectly through the port buffer module) using a set of port link interface (PLI) signals. The port LINK module resides in card cage slot 14.
- The **port buffer module** (L0109-00, PILA; L0125-AA, PILA2) provides a limited number of high-speed buffers to accommodate the difference between the burst data rate of the CI bus and HSC internal memory buses. The port buffer module also interfaces to the port LINK (CI LINK) module through the internal link interconnect (ILI) signals and the port processor module through PLI signals. The port buffer module resides in card cage slot 13.
- The **port processor module** (L0107-YA, K.pli; L0124-AA, K.pli2) functions as the interface between the CI transmissions and the HSC controller global memory structures. The port processor module resides in card cage slot 12 and is dedicated as Requestor 1.
- The **disk data channel module** (L0108-YA, K.sdi) operation is controlled by an on-board microprocessor with a local programmed read-only memory (PROM). Currently, the HSC40 controller supports combinations of up to three disk data or tape data channel modules. The HSC50 controller supports combinations of up to six, the HSC60 controller supports combinations of up to three, the HSC70 controller supports combinations of up to eight, and the HSC90 controller supports combinations of up to eight disk data or tape data channel modules.

NOTE

Refer to the guidelines in Section B.2.1 before assigning disk and tape data channel modules in the HSC controller.

Disk or tape data channel modules reside in the following card cage slots according to the type of HSC controller model:

- Any card cage slot from 10 to 8, as Requestors 2 through 4 in the HSC40 controller
- Any card cage slot from 10 to 4, except slot 5, as Requestors 2 through 7 in the HSC50 and HSC50 (modified) controllers
- Any card cage slot from 10 to 8, as Requestors 2 through 4 in the HSC60 controller
- Any card cage slot from 10 to 3, as Requestors 2 through 9 in the HSC70 and HSC90 controllers

NOTE

Refer to the 8-port K.si module description for its specific card cage slot restrictions.

- The **tape data channel module** (L0108-YB, K.sti) supports up to four STI tape formatters (for example: TA78 and TA81). The TA90 tape subsystem is not supported by this module. Refer to the configuration guidelines in Section B.2 for module slot locations.

- The **disk/tape data channel module** (4-port K.si) (L0119-YA) is an interface between the HSC controller and the SDI or STI bus, and is a direct replacement for the K.sdi or K.sti data channel modules.

The 4-port K.si module is configured for disk or tape interface when the HSC controller is initialized. The 4-port K.si module functions are the same as the K.sdi or K.sti modules. The 4-port disk/tape data channel module resides in the same card cage slots and requestors as L0108-xx disk or tape data channel modules. (Follow the configuration guidelines listed under the disk data channel module description.)

- The **8-port disk data channel module** (8-port K.si module) (L0119-YB) can only be configured as a disk controller, and is only supported by version 6.0 or later versions of HSC software.

The 8-port K.si module can only be used in HSC60 and HSC90 controllers. The 8-port K.si module can be used only in Requestors 3 and 4 in the HSC60 controller, and Requestors 3, 4, 5, and 6 in the HSC90 controller. The HSC60 and HSC90 controllers are cabled at the factory or during upgrade for these restrictions.

- The **HSC50 memory module** (L0106-AA, M.std) contains 512 KB of memory including program memory (256 KB), control memory (128 KB), and data memory (128 KB). The HSC50 memory module resides in card cage slot 2.
- The **memory standard 2 module** (L0117-AA, M.std2) contains program memory (1024 KB), control memory (256 KB), data memory (256 KB), and the RX33 disk drive controller. The M.std2 module is used in HSC40 and HSC70 controllers. The memory standard 2 module resides in card cage slot 2.

CAUTION

The switchpack on the M.std2 or M.std4 memory module is factory set to calibrate the RX33 disk drive controller. Do not change the setting of this switchpack; the switch settings are unique to each module and cannot be restored outside of the manufacturing environment.

- The **memory standard 4 module** (L0123-AA, M.std4) contains 3 MB of program memory, 256 KB of control memory, 512 KB of data memory, and the RX33 floppy disk drive controller logic. The M.std4 module resides in card cage slot 2 in the HSC60 and HSC90 controllers.
- The **I/O control processor module** (P.ioj/c) contains memory management and memory interface logic. These processors set up and direct all internal processes within the HSC subsystem. The five I/O control processor module part numbers are:
 - The HSC40 controller uses the P.ioj module (L0111-YA) with a PDP-11 ISP (J-11) processor.
 - The HSC50 and HSC50 (modified) controllers use the P.ioc module (L0105-00), with a PDP-11 ISP (F-11) processor.
 - The HSC60 controller uses the P.ioj-18 module (L0111-YD) with a PDP-11 ISP (J-11) processor.
 - The HSC70 controller uses the P.ioj module (L0111-00) with a PDP-11 ISP (J-11) processor.
 - The HSC90 controller uses the P.ioj-18 module (L0111-YC) with a PDP-11 ISP (J-11) processor.

The P.ioj/c module resides in card cage slot 1.

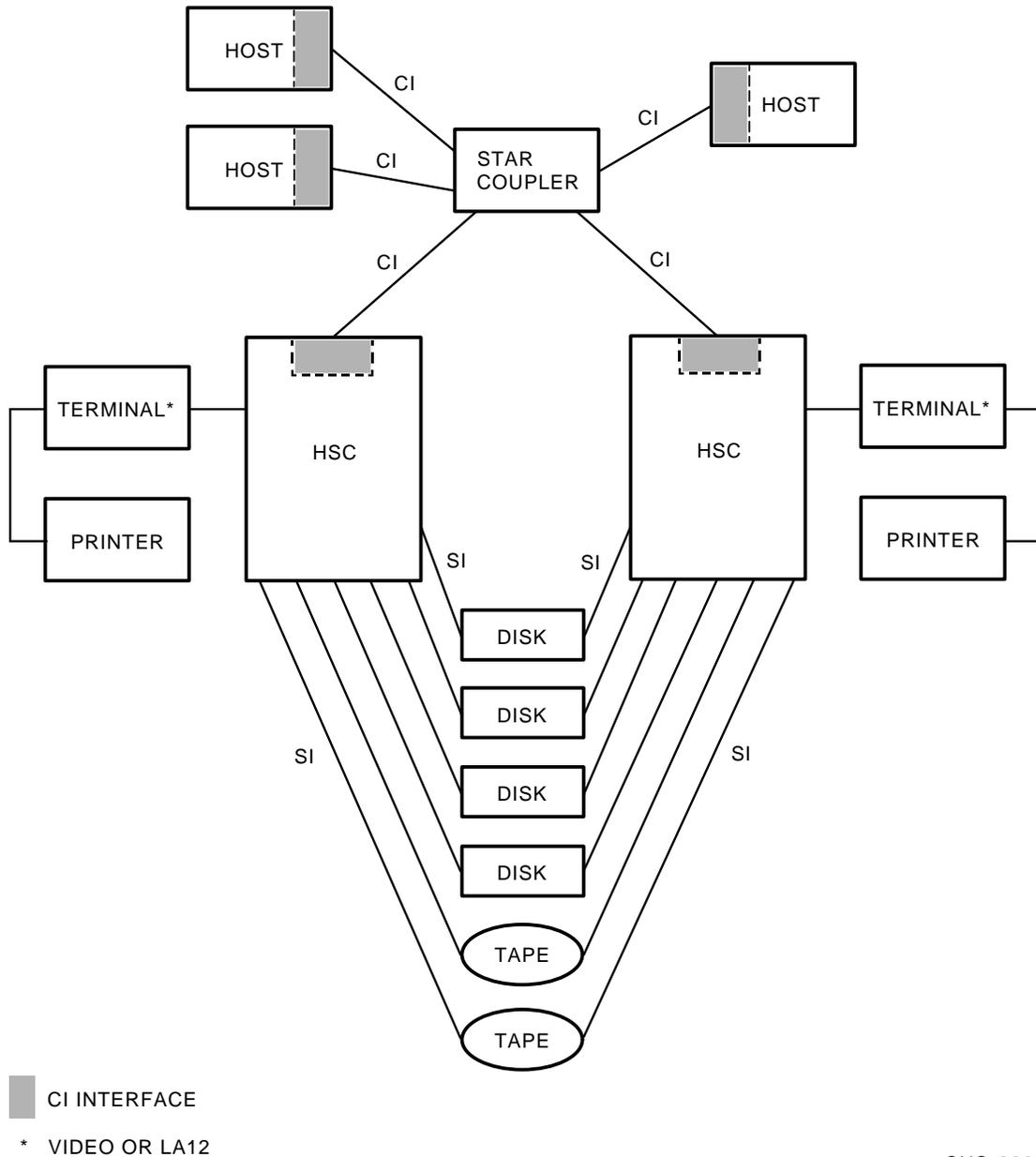
- The optional HSC60/HSC90 controller **cache memory** module (L0121-AA, M.cache) contains 32 MB of dynamic error correction code (ECC) memory used as a disk cache for any disks attached to the HSC controller. The M.cache module also contains 512 KB of dual-ported data memory. Other features of the M.cache module include:
 - Single-bit error correction and double-bit error detection for cache memory.
 - High-speed state machine logic to move data between cache data memory and cache memory.
 - High-speed self-test of all cache data memory and cache memory upon power-up.

The M.cache module must be used with the M.std4 memory module.

When the M.cache option is installed, the data memory on the M.std4 module is disabled and the data memory residing on the M.cache module is enabled. The M.cache module occupies card cage slot 11.

1.5 Basic Cluster Description

Figure 1-1 shows a basic cluster configuration. A cluster is a collection of processors, storage servers, and associated storage devices connected together through a star coupler. Processors and storage servers are intelligent entities called nodes. The central hub (common connection point) for all VAXcluster nodes connected to the CI bus is a star coupler. The star coupler is a cabinet that contains cable connectors and transformers through which all the nodes of a cluster are connected.



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Figure 1-1 Basic Cluster

For a list of current Digital Equipment Corporation processors that can be configured into a VAXcluster, refer to the operating system *Software Product Description*, shipped with your VMS and ULTRIX software.

The DECsystem-10 and DECsystem-20 processors can be configured into a cluster with HSC50 controllers only. These processors cannot be configured in the same cluster as VAX computer systems.

The following list describes hardware elements specific to clusters:

- Star coupler—A passive device used as a common connection point for all nodes on a VAXcluster connected to the CI bus. The star coupler connects all CI bus cables from individual nodes in a radial or star arrangement. Physically, the star coupler is a cabinet containing two internal transformer panels. One transformer connects the "A" path send and receive, the other connects the "B" path send and receive. This redundancy means that there is no single point of failure. Typically, the star coupler connects up to 16 nodes. More than 16 nodes can be configured in a cluster with the CI star coupler extender (CISCE). The CISCE connects up to 32 nodes (a maximum of 16 CPU nodes and 16 HSC nodes).
- CI (computer interconnect) bus—A high-speed bus connecting all nodes in a cluster to the star coupler, and thus to each other.
- CI interface—An intelligent microprocessor controller within each VAX computer or DECsystem connecting each node to the CI bus. (The HSC controller K.ci is the HSC controller interface to the CI.)
- HSC controller—A high-speed server for management of data between disk/tape drives and the host.
- Disk drive—A storage unit where data is stored on magnetic disks and data is randomly accessed.
- Tape drive—A storage unit where data is stored on magnetic tapes and data is sequentially accessed.

1.6 HSC Controller Operating Software

The HSC controller operating software is shipped to the user along with the *HSC Controller User Guide* and the *HSC Software Release Notes*. The HSC50 software is distributed on two TU58 tape cassettes. One cassette contains the operating software; the other contains the device integrity tests and utilities. The HSC software is distributed on one RX33 floppy diskette that contains operating software, device integrity tests, and utilities.

NOTE

Information for the HSC controller software commands and utilities can be found in the *HSC Controller User Guide*.

2

Installation

This chapter will help you with the unpacking and initial setup of your HSC controller. This chapter contains procedures for:

- Preparing the site
- Unpacking and deskidding the HSC controller
- Setting the node address
- Cabling
- Setting the power controller switches

A brief section on video terminal and printer cabling is provided. References for finding video terminal and printer setup parameter procedures are provided.

2.1 Preparing the Site

Site preparation and planning are necessary before installing an HSC controller. Use Figure 2–1 to plan for HSC controller physical, electrical, and environmental specifications. Figure 2–2 lists specifications for HSC controller models with the 881 power controller (3-phase ac) installed.

WARNING

To prevent damage to equipment and personnel, ensure all power sources meet the specifications required for this equipment.

HSC power controllers intended for single phase, 50 Hz, 240 Vac operation have a power cord that plugs into a socket in the back panel. These power controllers are supplied with one of the various line cords listed in Table 2–1 for each country's service.

Table 2–1 Line Cord Part Numbers For Various Countries

Line Cord Part Number	Service
17-00199-10	Central Europe
17-00198-05	Australia
17-00364-06	Italy
17-00209-05	United Kingdom
17-00209-05	Europe (IEC 309 plug and harmonized cordage)
17-01256-01	220 Vac service in U.S., Canada, and Japan (IEC 309 plug with UL/CSA cord.)

2-2 Installation

DESCRIPTION							OPTION DESIGNATION			
HSC MASS STORAGE SERVER WITH HSC POWER CONTROLLER							HSCXX-BA = 60 HZ, 100/120 V			
							HSCXX-BB = 50 HZ, 220/240 V			
MECHANICAL										
MOUNTING CODE	WEIGHT		HEIGHT		WIDTH		DEPTH		CAB TYPE (IF USED)	
	LBS	KG	IN	CM	IN	CM	IN	CM		
FS	450	240.0	41.1	105.9	21.3	54.0	35.0	91.4	MODIFIED H9642	
POWER (AC)										
AC VOLTAGE NOMINAL	AC VOLTAGE TOLERANCE	FREQUENCY AND TOLERANCE		PHASE	STEADY-STATE CURRENT (RMS)	POWER CONSUMPTION (MAX)				
100/120	90 - 132	60 HZ ± 3		1	22.5A	1846 WATTS				
220/240	174 - 264	50 HZ ± 3		1	12.2A	1846 WATTS				
POWER (AC)										
PLUG TYPE	POWER CORD LENGTH		INTERRUPT TOLERANCE		APPARENT POWER (KVA)					
NEMA - L5 - 30P	15 FT (4.5 M)		4 MS (MIN)		1.5 (KVA)					
IEC 320 - C20*	15 FT (4.5 M)		4 MS (MIN)		1.7 (KVA)					
POWER (AC)										
HSC OPTION			INRUSH CURRENT			SURGE DURATION				
HSCXX - BA			140 AMPS			16 MS				
HSCXX - BB			140 AMPS			20 MS				
DEVICE ENVIRONMENT										
TEMPERATURE		RELATIVE HUMIDITY		RATE OF CHANGE		HEAT DISSIPATION				
OPERATING**	STORAGE	OPERATING	STORAGE	TEMP	HUMIDITY	60 HZ	50 HZ			
59 - 90° F	.40 - 151° F	20 - 80%	5 - 95%	20° F/HR	20%/HR	1568 BTU/HR	1656 KJ/HR			
15 - 32° C	.40 - 66° C			11° C/HR						
DEVICE ENVIRONMENT										
ALTITUDE (MAX) **		AIR VOLUME (AT INLET)		AIR QUALITY						
OPERATING	STORAGE	FT ³ /MIN	M ³ /MIN	PARTICLE COUNT (MAX)						
8000 FT	30,000 FT	210	5.92	N/A						
2.4 KM	9.1 KM									

* HSCXX-BB HAS INLET FOR REMOVABLE LINE CORD OPTIONS.

**ALTITUDE CHANGES: DERATE THE MAXIMUM TEMPERATURE 1.8° C PER THOUSAND METERS (1.0° F PER THOUSAND FEET).

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Figure 2-1 Specifications for HSC Controllers Using Single-Phase AC Power

DESCRIPTION	OPTION DESIGNATION
HSC MASS STORAGE SERVER WITH 881 POWER CONTROLLER	HSCXX-AA = 60 HZ, 120/180 V
	HSCXX-AB = 50 HZ, 380/415 V

MECHANICAL

MOUNTING CODE	WEIGHT		HEIGHT		WIDTH		DEPTH		CAB TYPE (IF USED)
	LBS	KG	IN	CM	IN	CM	IN	CM	
FS	450	240.0	41.1	105.9	21.3	54.0	35.0	91.4	MODIFIED H9642

POWER (AC) (881 POWER CONTROLLER)

AC VOLTAGE NOMINAL	AC VOLTAGE TOLERANCE	FREQUENCY AND TOLERANCE	PHASE	STEADY-STATE CURRENT (RMS)	POWER CONSUMPTION (MAX)
120/208	90-132/155-228	60 HZ \pm 3	3	N/A	2250 WATTS
220-240/330-415	174-264/301-457	50 HZ \pm 3	3	N/A	2245 WATTS

POWER (AC) (881 POWER CONTROLLER)

AMP (MAX) BY PHASE			
120 V	PHASE A = 1	380 V	PHASE A = 1
	PHASE B = 12		PHASE B = 7
	PHASE C = 12		PHASE C = 7
	NEUTRAL = 17		NEUTRAL = 9

POWER (AC)

PLUG TYPE	POWER CORD LENGTH	INTERRUPT TOLERANCE	APPARENT POWER (KVA)
NEMA - L21 - 30P	15 FT (4.5 M)	4 MS (MIN)	3.4 (KVA)
HUBBELL - 520 P6	15 FT (4.5 M)	4 MS (MIN)	3.4 (KVA)

POWER (AC)

HSC OPTION	INRUSH CURRENT	SURGE DURATION
HSCXX - AA	70 AMPS/PHASE	16 MS
HSCXX - AB	70 AMPS/PHASE	20 MS

DEVICE ENVIRONMENT

TEMPERATURE		RELATIVE HUMIDITY		RATE OF CHANGE		HEAT DISSIPATION	
OPERATING*	STORAGE	OPERATING	STORAGE	TEMP	HUMIDITY	60 HZ	50 HZ
59 - 90° F	.40 - 151° F	20 - 80%	5 - 95%	20° F/HR	20%/HR	7676 BTU/HR	8078 KJ/HR
15 - 32° C	.40 - 66° C			11° C/HR			

DEVICE ENVIRONMENT

ALTITUDE (MAX) *		AIR VOLUME (AT INLET)		AIR QUALITY
OPERATING	STORAGE	FT ³ /MIN	M ³ /MIN	PARTICLE COUNT (MAX)
8000 FT	30,000 FT	210	5.92	N/A
2.4 KM	9.1 KM			

*ALTITUDE CHANGES: DERATE THE MAXIMUM TEMPERATURE 1.8° C PER THOUSAND METERS (1.0° F PER THOUSAND FEET).

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Figure 2-2 Specifications for HSC Controllers Using Three-Phase AC Power

2.1.1 Environmental Considerations

The HSC 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 HSC controller requires these same standards.

2.1.1.1 Electrostatic Discharge

Electrostatic discharge (ESD) is a common problem for any electronic device and may cause lost data, system downtime, 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 electrostatic discharge problems:

- Maintain more than 40 percent relative humidity in the computer room.
- Place the system away from heavy traffic paths.
- Do not use carpet, if possible. If carpet is necessary, choose an antistatic carpet. If a carpet is already in place, place antistatic mats around the system to help decrease electrostatic discharge.
- Always use ESD wrist straps when handling modules.

The HSC controller conforms to Digital Standard 102 (Sections 0 through 3, and 7) in regard to electrostatic discharge.

2.1.1.2 Floor Space Requirements

The floor space needed for the HSC controller is shown in Figure 2-3. The minimum service clearance required is 91.44 cm (36 inches) for access to both the front and rear of the HSC controller. No service clearance is required on either side of the HSC controller.

2.1.1.3 Power and Safety Requirements

The HSC 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 HSC controller conforms to Digital Standard 119-0 Product Safety standards.

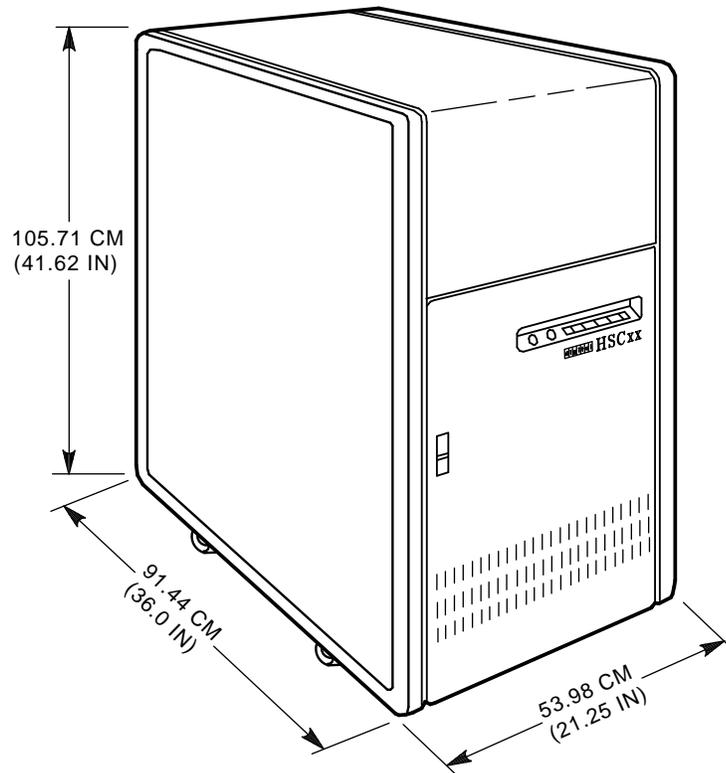
Each HSC controller is shipped with a grounding connection on its frame. The main circuit breaker on the power controller removes ac power from the HSC logic, fans, blower, and power supplies. Figure 2-4 shows the ac power plug and receptacle diagrams for both 60 Hz and 50 Hz models.

WARNING

To prevent damage to equipment and personnel, ensure power sources meet the specifications required for this equipment. Use the specifications listed in Figure 2-1 to plan for adequate power, floor space, and weight requirements.

2.2 Unpacking the HSC Controller

When delivered, the HSC controller is packed in a cardboard sleeve attached to a shipping pallet as shown in Figure 2-5. Remove the HSC controller packing material using the unpacking procedure attached to the outside of the cardboard sleeve.



NOTE: A SERVICE CLEARANCE OF 91.44 CM (36.0 IN) IS REQUIRED, BOTH IN FRONT AND IN BACK OF THE HSC.

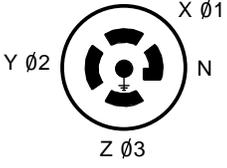
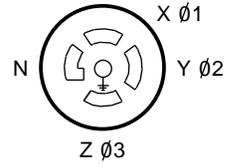
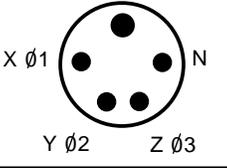
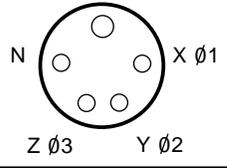
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Figure 2-3 HSC Controller Floor Space Requirements

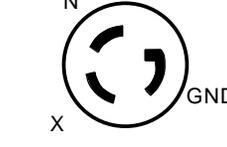
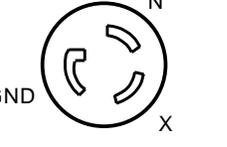
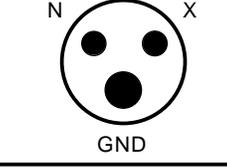
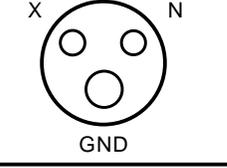
2.2.1 Removing Shipping Material

To remove the HSC controller shipping material (refer to Figure 2-5), use the following procedure:

1. First check the cardboard sleeve and pallet for signs of shipping damage. Report any damage to the Digital Customer Services or Digital Sales office in your area, 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 when moving equipment to a new site.
3. Remove the shipping straps, top cover, and the cardboard sleeve from the HSC controller.
4. Remove the carton containing the unloading ramps from the top of the HSC controller.
5. Remove the poly bag covering the HSC controller.

SOURCE		PLUG	RECEPTACLE
120/208V 30A 3 PHASE Y 60 HZ HSCXX-AA	NEMA	L2130P 	L2130R 
240/416V 16A 3 PHASE Y 50 HZ HSCXX-AB	IEC309 EQUALS HUBBELL	516 P6W 	516 R6W 

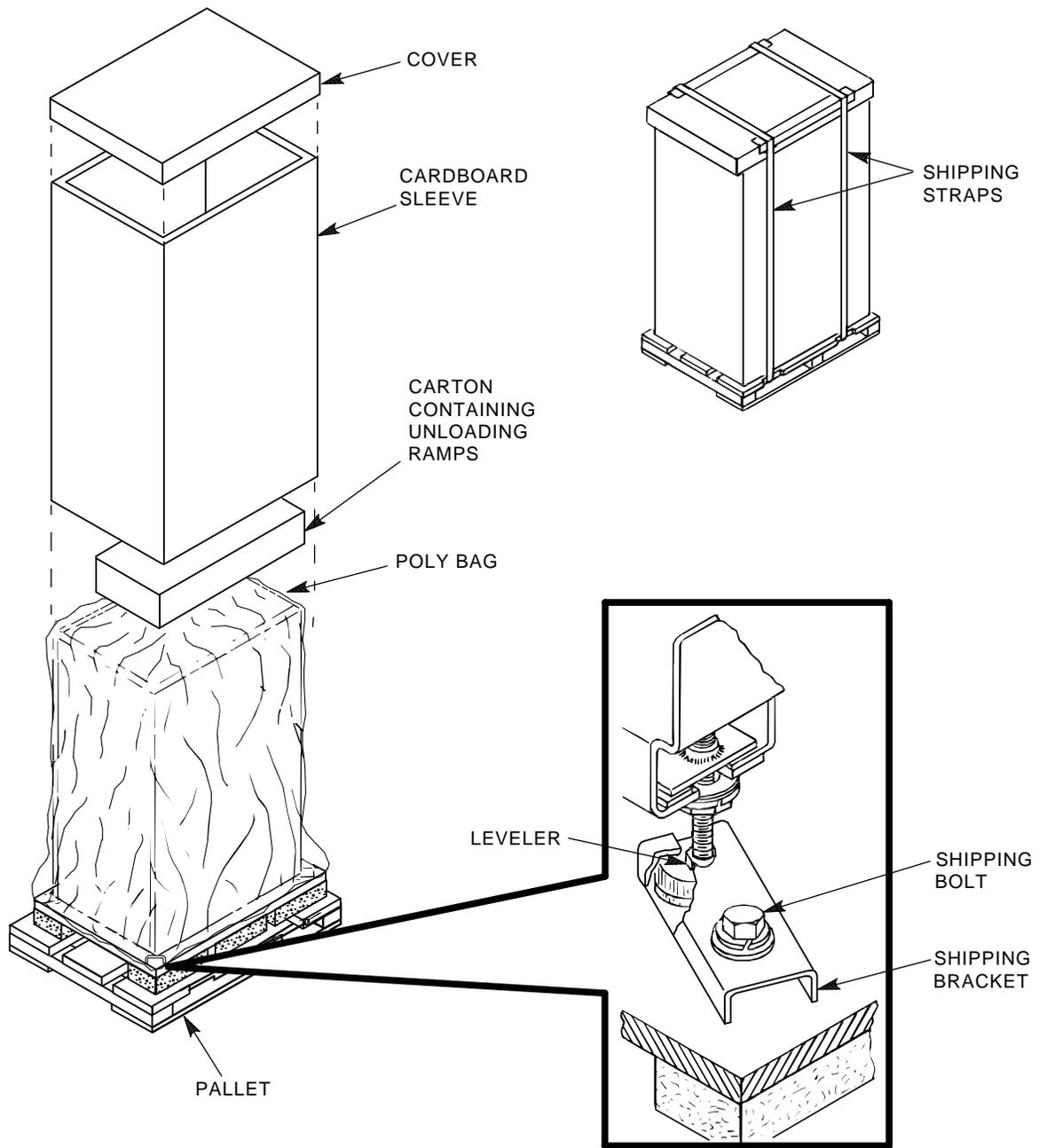
CONNECTORS FOR 881 POWER CONTROLLER

SOURCE		PLUG	RECEPTACLE
125V 30A 1 PHASE 60HZ HSCXX-AA	NEMA	L5-30P 	L5-30R 
250V 16A 1 PHASE 50HZ HSCXX-AB	IEC309 OR HUBBELL	320P6W 	320R6W 

CONNECTORS FOR 30-35415-XX POWER CONTROLLER

CXO-3134A

Figure 2-4 HSC Controller Line Voltage Plugs and Receptacles



CXO-393D_S

Figure 2-5 Unpacking the HSC Controller

2.2.2 Removing Shipping Hardware and Deskidding the HSC Controller

To ready the HSC controller for module and/or cabling installation, remove the shipping bolts, attach the unloading ramps, adjust the cabinet levelers, and deskid the HSC controller as follows:

1. Remove the shipping bolt from each shipping bracket (at each corner of the cabinet) that secures the HSC controller to the shipping pallet. See the insert in Figure 2-5 for a detailed view of the shipping bracket and bolt.
2. Remove the unloading ramps from their carton. Inspect the ramps, ramp side rails, and metal hardware for defects described in the following list:
 - 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 conditions exist, do not use the ramp. Investigate alternate means of removing the HSC controller and/or order a new ramp. The part number for the left ramp is 99-07689-01; the part number for the right ramp is 99-07689-02.
3. Extend each ramp to its full length, and insert the steel dowel through the hole in the ramp as shown in Figure 2-6.
4. Attach the unloading ramp to the shipping pallet by fitting the metal tabs of each ramp over the mating hole on the rear of the pallet as shown in Figure 2-6. The rear of the shipping pallet is labeled as such.
5. Make sure the arrows on the unloading ramps line up with the arrows on the deck of the shipping pallet.

WARNING

Failure to properly set up the ramps and adjust the cabinet levelers could cause the HSC controller to tip over during removal from its shipping pallet. Injury to personnel and/or damage to the HSC controller may result.

6. Screw the HSC levelers all the way up into the cabinet housing. Refer to Figure 2-7. This allows the HSC controller to roll smoothly down the ramps without ramp-to-leveler interference.

WARNING

A fully-loaded HSC controller weighs approximately 415.8 pounds (188.4 kilograms). Therefore, the next step requires a minimum of two people.

7. Carefully roll the HSC cabinet down the ramps and to the desired final destination.
8. Lower the levelers and adjust them until the cabinet is level. Make sure the levelers support the weight of the cabinet and not the cabinet rollers. Ensure the HSC controller is stable.

2.3 Preparing the HSC Controller for Power Up

The following sections list the steps that must be completed prior to applying power to and checking the functionality of the HSC controller. Node addressing, slot count timing, cabling, console video terminal set up, and printer set up are among the tasks to be completed before applying power to the HSC controller.

HSC controllers communicate with host computers by means of the CI (computer interconnect) bus. One CI bus can attach up to 32 nodes (with a maximum of 16 being VMS nodes).

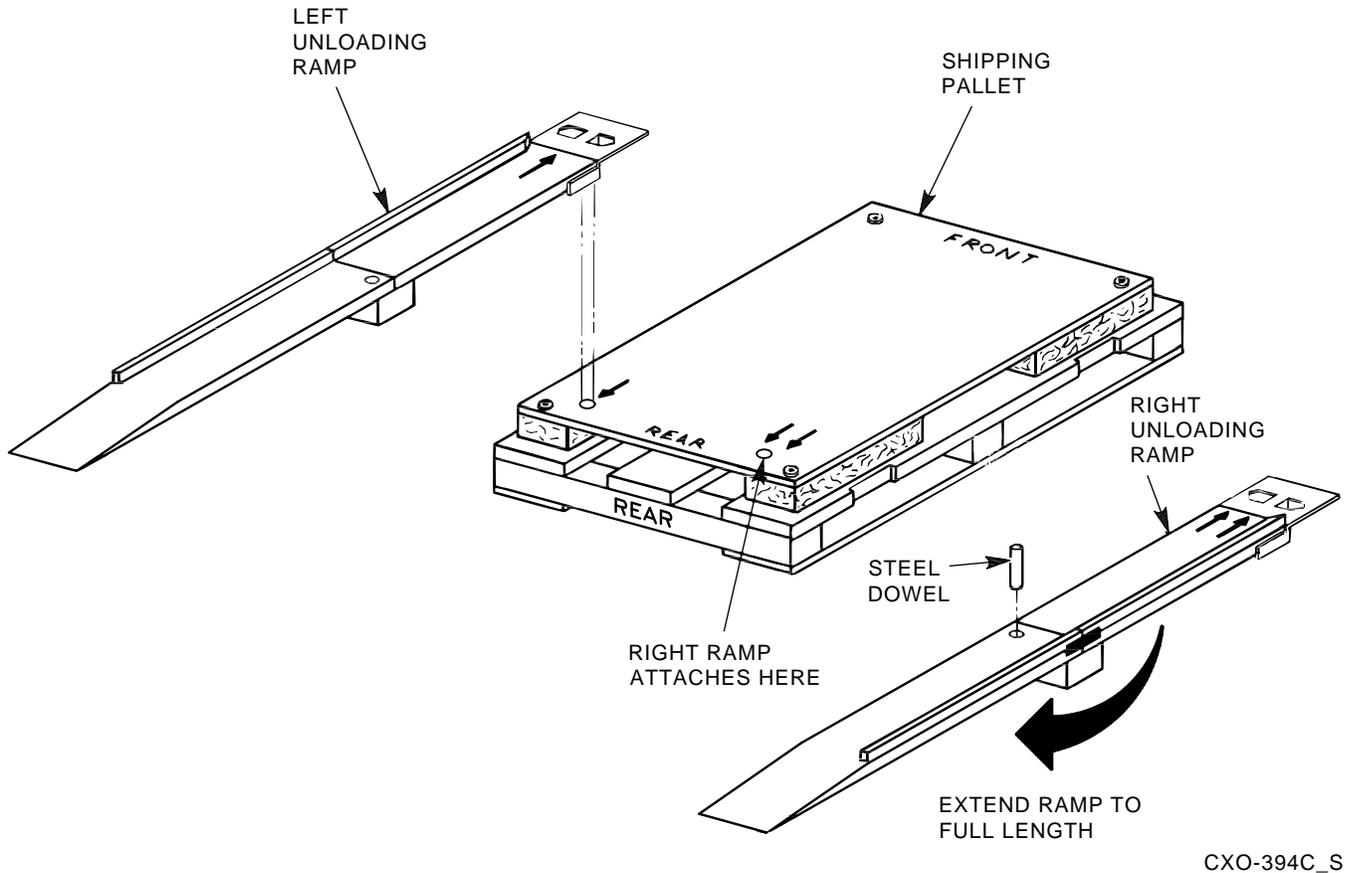


Figure 2-6 Attaching the Unloading Ramps to the Pallet

HSC controllers are capable of providing mass storage control for various quantities of CPUs depending on the HSC controller model. Because of this, it is imperative to establish the HSC controller as a **unique** node in the cluster.

2.4 Setting the Node Address Switches on Port LINK Modules

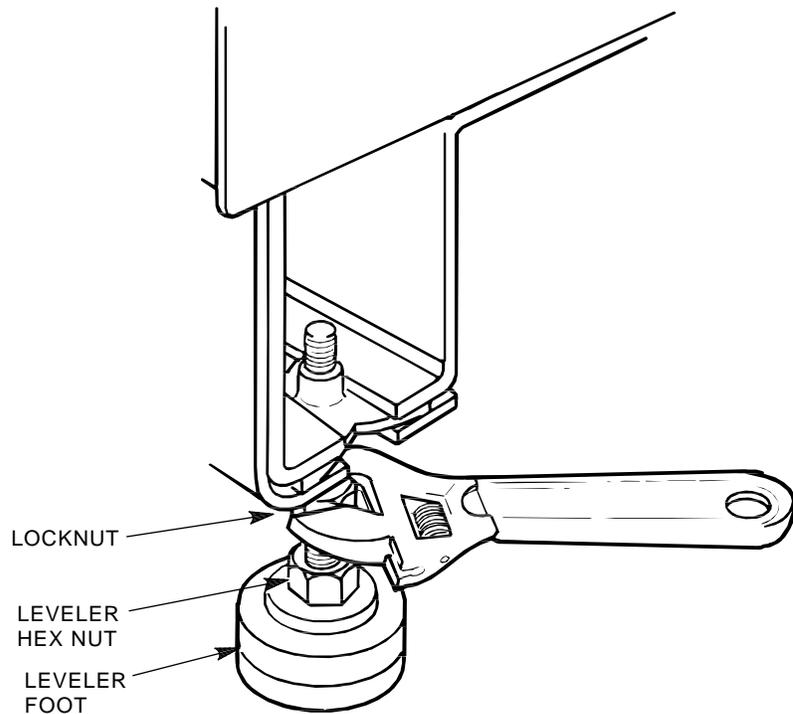
Unique node addresses are set using the two node address switches on the HSC port LINK (LINK) module. The procedure that follows details the steps for setting the unique node address. The HSC controller should be assigned to lower node addresses.

There are several versions/revisions of HSC controller LINK modules in the field. Only L0118-00 and L0118-YA LINK modules are shipped today. Therefore, only L0118-00 and L0118-YA modules are discussed in this chapter.

Some HSC controller models may contain L0100 LINK modules.

After your HSC controller has been moved into place, use the following procedure to set the HSC L0118-00 or L0118-YA Port LINK module node address switches:

1. Connect the HSC controller to its ac power source. If you have an HSC controller 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 HSC power controller. This cable is packed with the HSC controller cabinet. HSC controllers using 120 Vac source power have the power cable permanently installed on the power controller.



CXO-395C_S

Figure 2-7 Adjusting the HSC Levelers

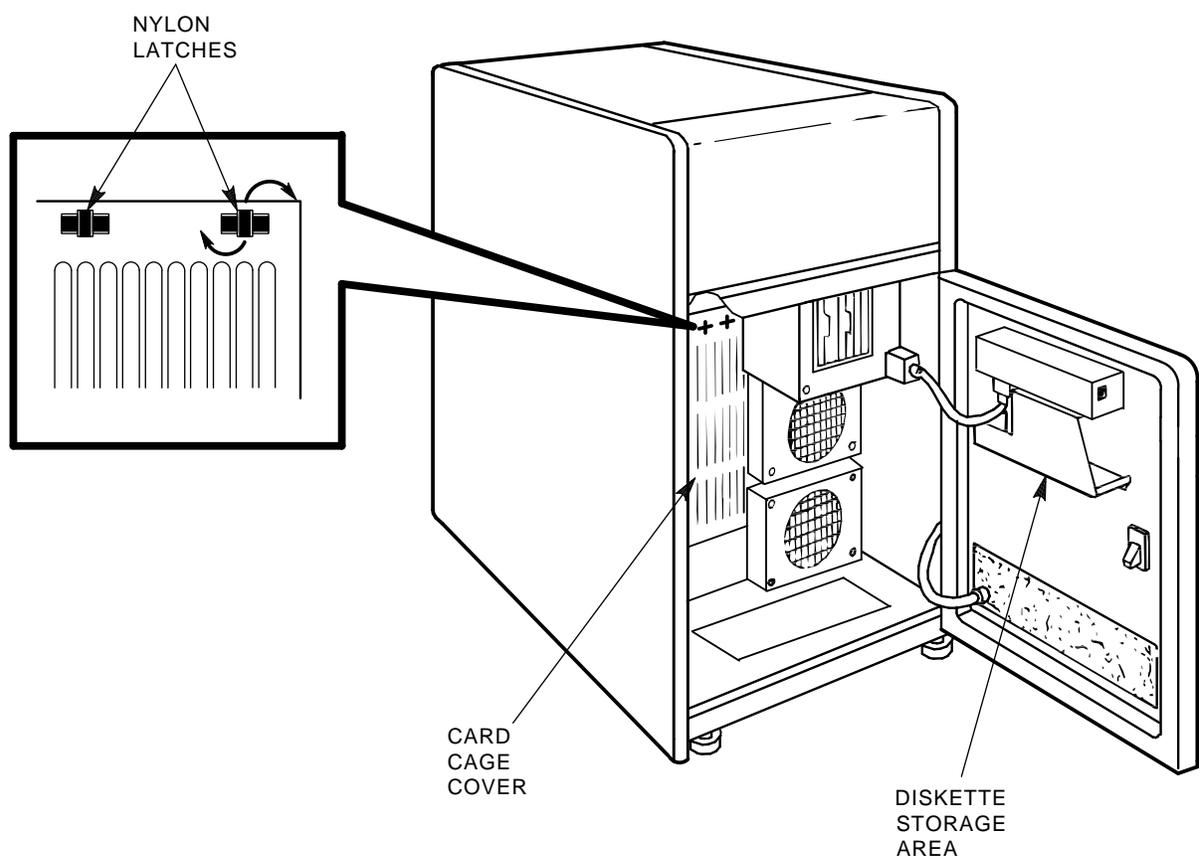
Do not apply power to the HSC controller at this time. The purpose of this step is to properly ground the HSC controller chassis for ESD protection when handling modules.

2. Ask the system manager to identify the unique node address for each device on the CI bus.
3. Unlock and open the HSC front door with the key provided.
4. Open the HSC card cage cover by turning the card cage cover nylon latches as shown in Figures 2-8 and 2-9.
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.

NOTE

Remember to plug the HSC controller into a wall receptacle to properly ground the unit before using the ESD wrist strap.

6. Locate the LINK module in the HSC controller card cage. The LINK module is the left-most module in the card cage. Refer to Figure 2-10 for the location of the node address switches on the L0118-00 and L0118-YA LINK modules.



CXO-887B_S

Figure 2-8 All HSC Controllers (except HSC50) Front Inside View

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.

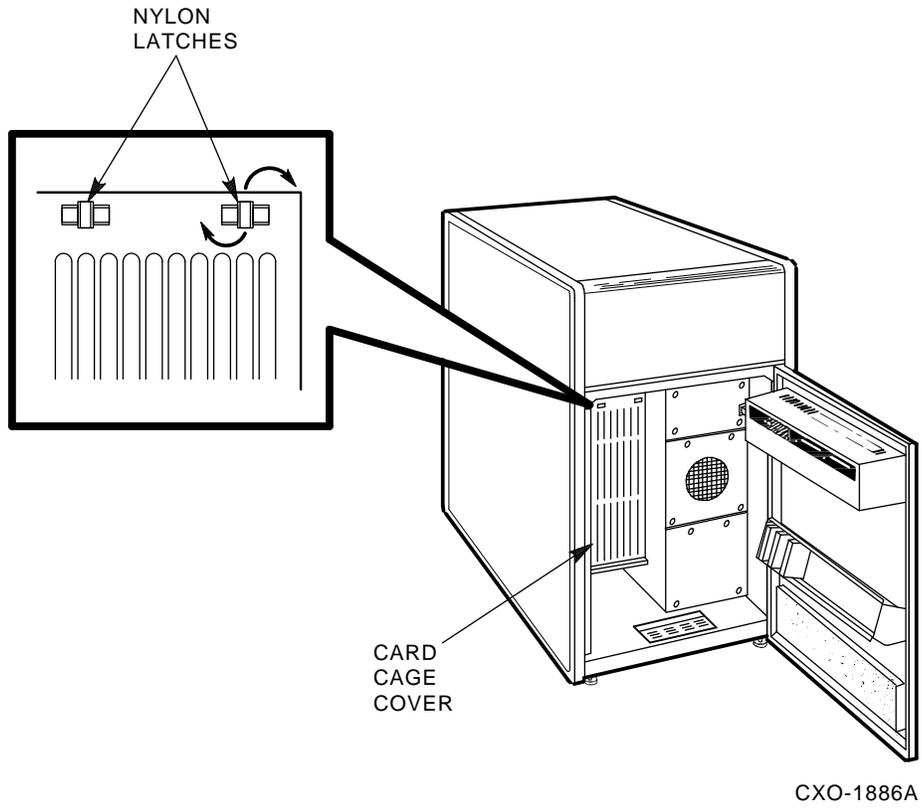


Figure 2-9 HSC50 Controller Front Inside View

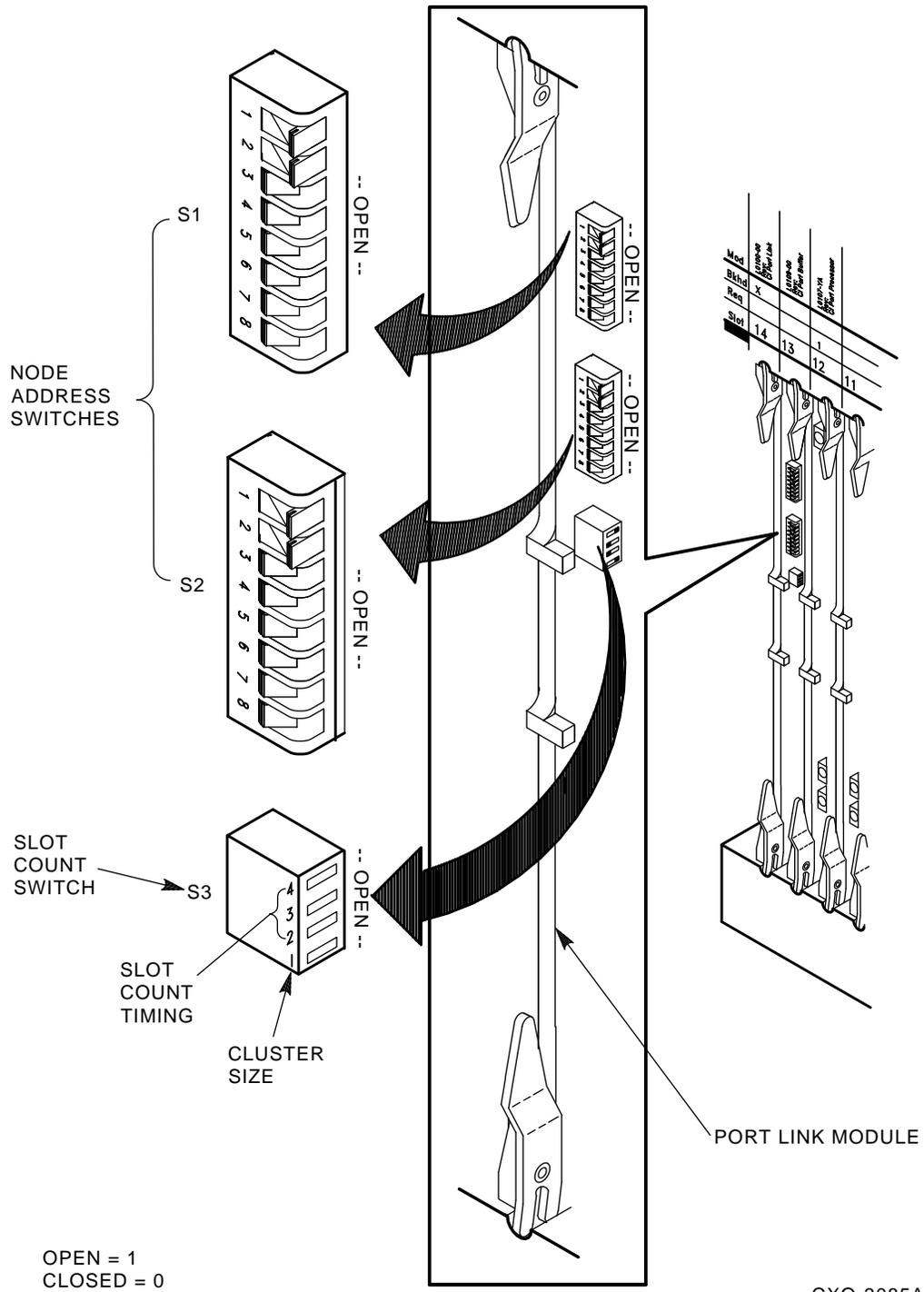


Figure 2-10 Locating the Node Address Switches on L0118-xx LINK modules

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2.4.1 Guidelines for L0118–xx LINK Module Node Addresses

When setting the node address switches on your L0118–xx port LINK module, use the following procedure:

1. If the HSC controller is presently part of a cluster to which no new nodes have been added, but a L0118 module has been replaced, ensure the node address on the new L0118 module is set to the same address as the previous module.
2. 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.
3. Ensure the solderless jumpers (W1, W2, W3, W4) on your L0118–00 LINK module are set to the default positions.

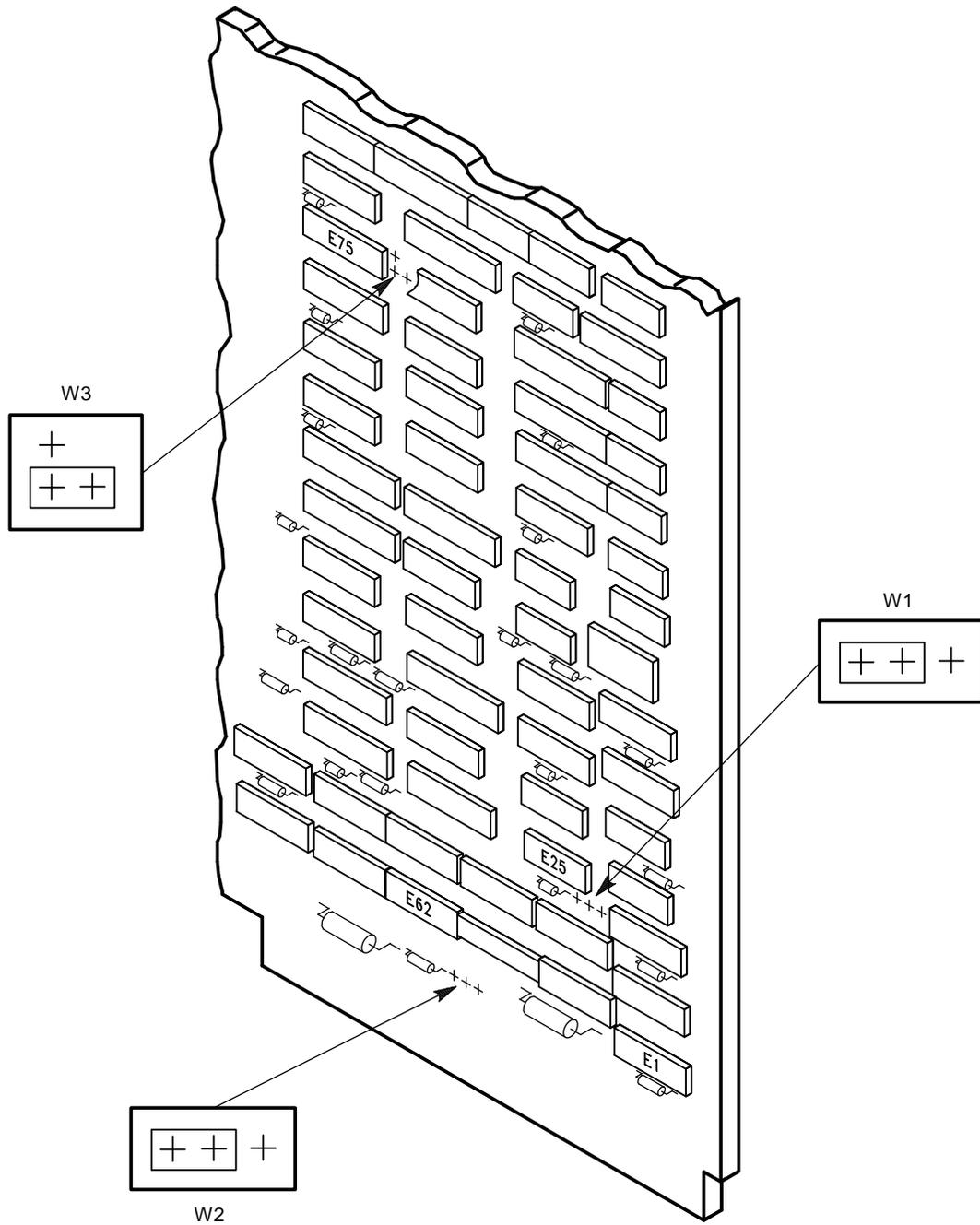
2.4.2 Setting the Node Address Switches on L0118–00 LINK Modules Revisions A1, B1, and B2

The HSC controller L0118 LINK module revisions are functionally identical. They are physically differentiated by the presence or absence of a wire jumper as described later in this section.

The L0118–xx LINK modules have two switches (S1 and S2) for setting the node address. The third switch (S3) sets the slot count timing and cluster size as described in Section 2.5.

The L0118–00 and L0118–YA LINK modules replace the L0100–00 LINK module. Set the S1 and S2 node address switches to the same value on the LINK module before rebooting the HSC controller.

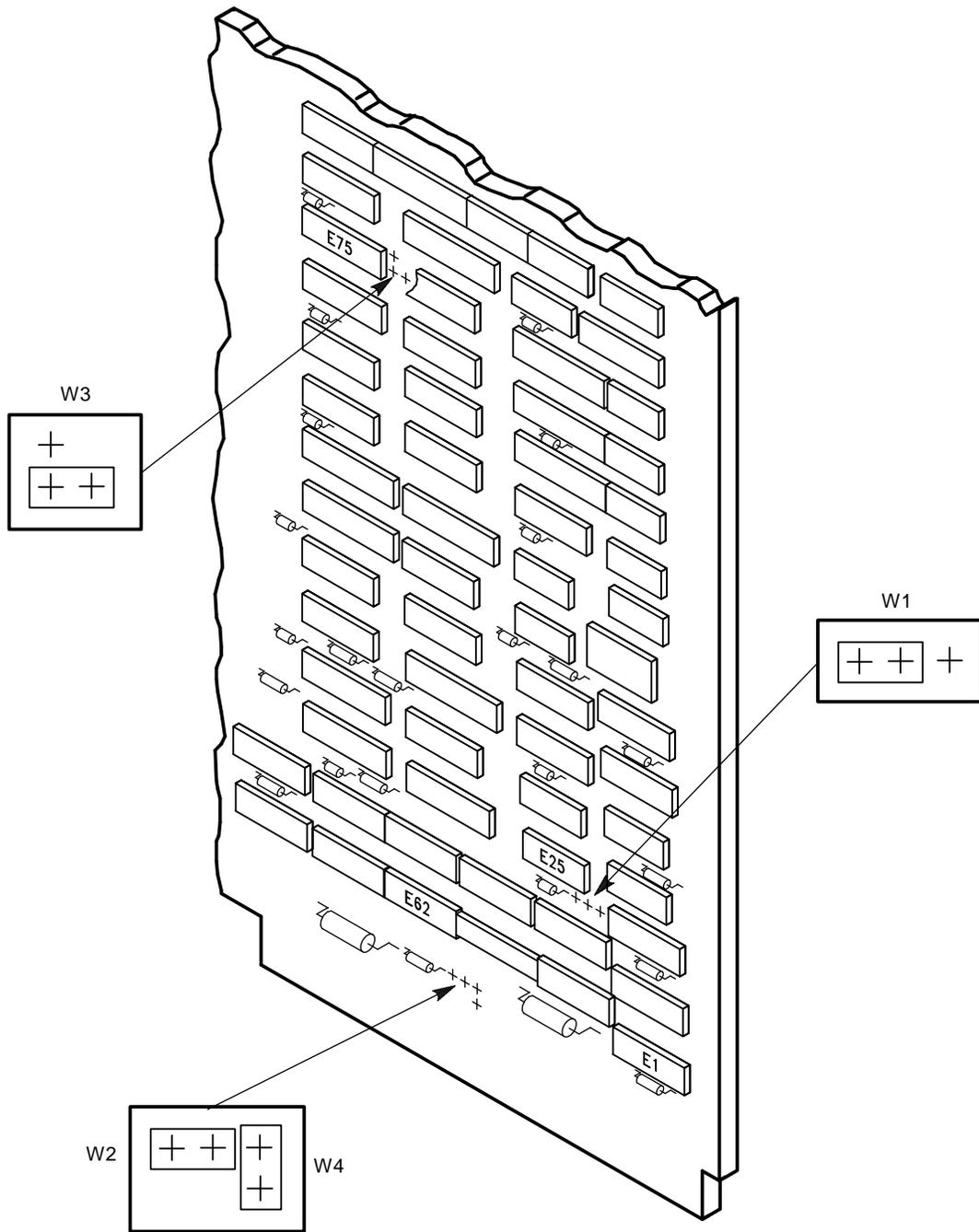
Ensure the solderless jumpers (W1, W2, W3, W4) on your L0118–00 LINK module are set to the default positions as indicated by the reference boxes shown in Figures 2-11, 2-12, or 2-13.



NOTE: BOXES INDICATE THE DEFAULT JUMPER POSITIONS.

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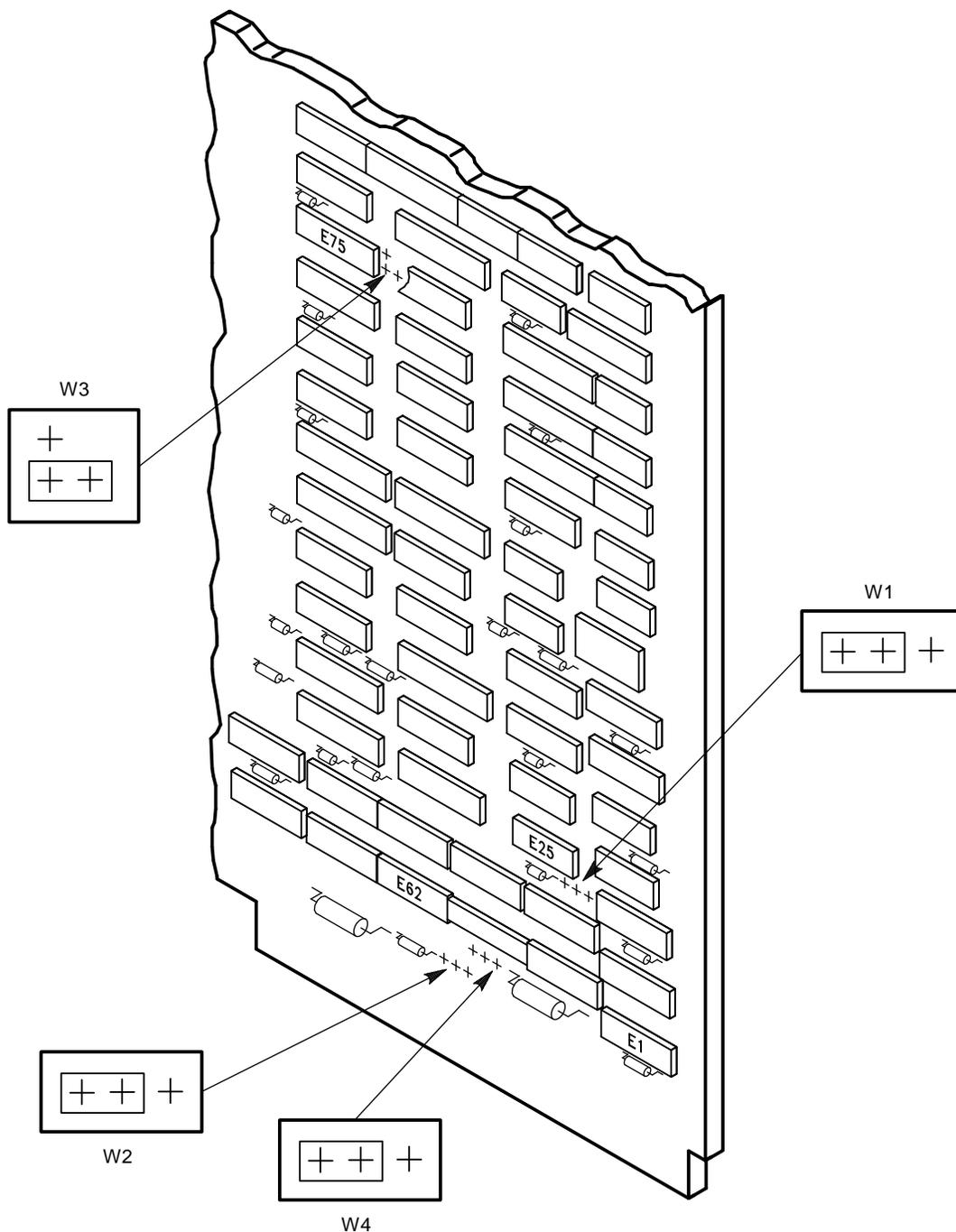
Figure 2-11 Jumper Locations on Revision A1 L0118-00 LINK module



NOTE: BOXES INDICATE THE W1 AND W3 DEFAULT JUMPER POSITIONS. THE DEFAULT FOR JUMPERS W2 AND W4 IS "OUT".

CXO-1911C

Figure 2-12 Jumper Locations on Revision B1 L0118-00 LINK module



NOTE: BOXES INDICATE THE DEFAULT JUMPER POSITIONS.

CXO-1912B

Figure 2-13 Jumper Locations on Revision B2 L0118-00 LINK module

Use the following list to identify the revision and establish the proper jumper settings on L0118-00 LINK module revisions A1, B1, and B2:

- Revision A1 is characterized by a wire connected to E83, pin 3, but not to E150, pin 1. For revision A1, set the three jumpers to their default positions as indicated by the boxes around the pins as shown in Figure 2-11.
- Revision B1 is characterized by wires attached to E83, pin 3 and E150, pin 1. For revision B1, set jumpers W1 and W3 to their default positions as indicated by the boxes around the pins as shown in Figure 2-12. The default parameters for W2 and W4 are set by ensuring the jumpers are not in place.
- Revision B2 is characterized by having no wires attached to E83, pin 3 and no wires attached to E150, pin 1. Set jumpers W1 through W4 to their default positions as indicated by the boxes around the pin's location in Figure 2-13.

2.5 Locating and Setting the Slot Count Timing Switch (S3) on L0118-xx Modules

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 VMS bugchecks, most commonly CLUEXIT

The cause of these disturbances is 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 L0100/L0118 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.

It is highly recommended that the slot count for all CPU and HSC controller nodes within a cluster be set to a value of 10 (not 7). HSC60 and HSC90 controllers, as well as recently manufactured HSC40 and HSC70 controllers, are shipped with their LINK modules set to a slot count of 10.

However, LINK modules for previously installed HSC controllers 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 HSC60 or HSC90 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, all LINK and CI adapter modules should already be set to 10, since the CIXCD does not support a slot count of 7.

To assist you with setting the slot count in your cluster, Table 2-2 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 2-2 also contains a list of LINK and adapter module switch and jumper settings to select the appropriate cluster size.

Table 2-2 L0118 LINK Module and CI Adapter Module Switch and Jumper Settings

Adapter Type	Host System	LINK Module	Function	Switch/Jumper Setting
CI750	VAX-11/750	L0100 Rev E ^{1 2}	Slot=7	S3-1=Open
CI780	VAX-11/78x, VAX 86x0		Slot=10	S3-1=Closed
CIBCI	VAX 82x0, VAX 83x0 VAX 87x0, VAX 8800		Clu_size=16	Fixed
	HSC40, HSC50, HSC70	L0118 RevB ³	Slot=7	S3-4=Open
			Slot=10	S3-4=Closed
			Clu_size=16	S3-1=Open
			Clu_size=32	S3-1=Closed
	HSC60, HSC90	L0118-YA	Slot=7	S3-4=Open
			Slot=10	S3-4=Closed
			Clu_size=16	S3-1=Open
			Clu_size=32	S3-1=Closed
CIBCA-Ax, CIBCA-Bx ^{4 5}	VAX 82x0, VAX 83x0 VAX 85x0, VAX 8700 VAX 88x0, VAX 6000	T1025 T1046	Slot=7	Jumper E11-41=Out
			Slot=10	Jumper E11-41=In
			Clu_size=16	Jumper D30-60=Out
			Clu_size=32	Jumper D30-60=In
CIXCD-xx ⁵	VAX6000, VAX9000	T2080	Slot=7	Not Supported
			Slot=10	Jumper E15-45=In
			Clu_size=16	Jumper D15-45=Out
			Clu_size=32	Jumper D15-45=In

¹L0100 Rev "D" modules are not supported.

²On L0100 Rev "E" modules, S3-2 serves no function.

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

⁴For 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.

⁵For CIBCA and CIXCD options, install *only* those backplane jumpers listed and those required to specify the node address.

Locate the slot count timing switch (S3) on the L0118-xx port LINK module. Set the slot count timing as follows:

1. 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 2-2 for a listing of LINK module switch and jumper settings for various VAXcluster configurations.

2. 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 2-2. Refer to Figure 2-14 for the location of the slot count switch pack.

Table 2-3 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 Customer Services.

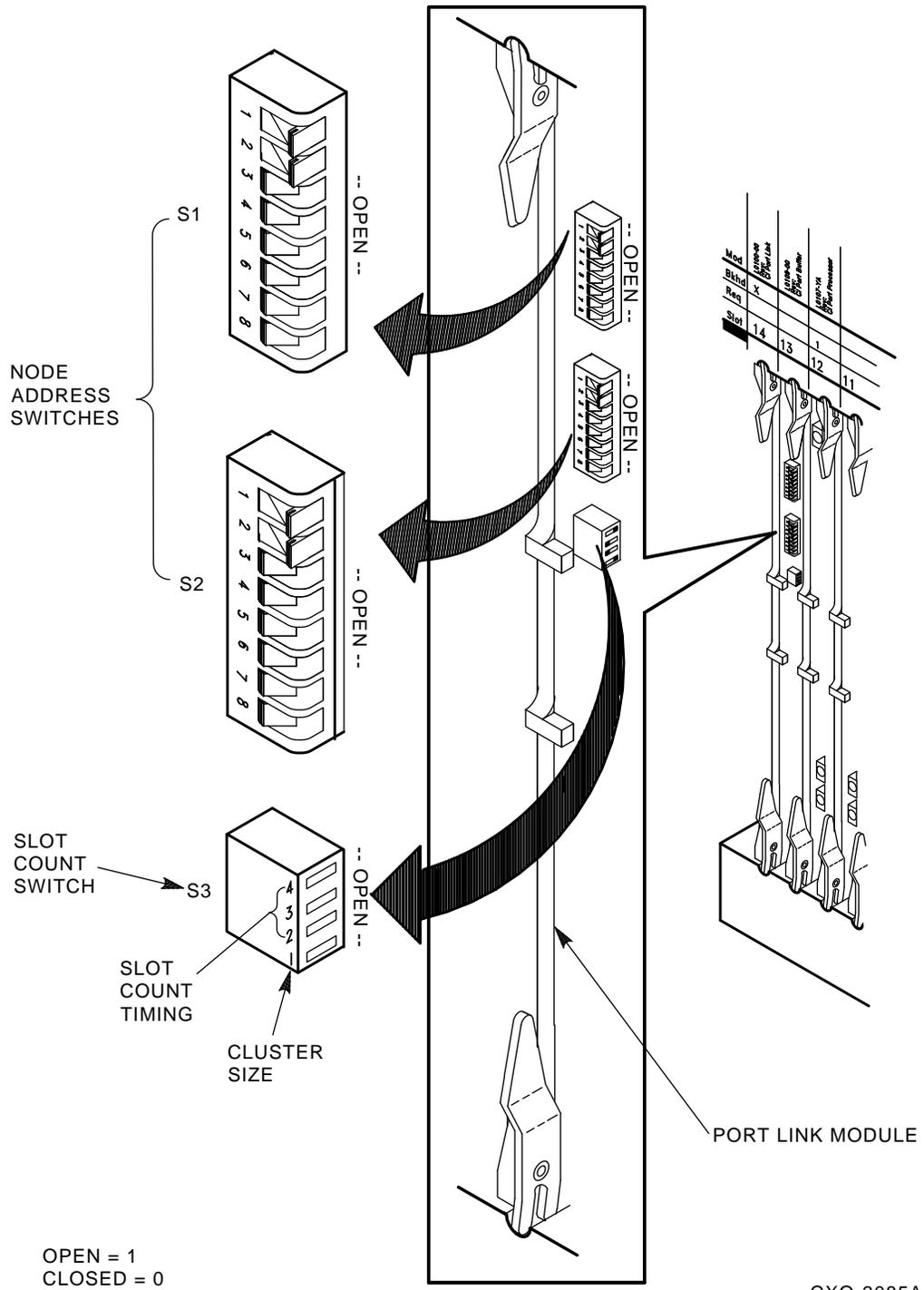
Table 2-3 L0118 LINK Module S3 Switch Slot Count Timing Settings

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.

3. Insert the L0118 LINK module into the backplane slot after the node address (S1 and S2) and slot count (S3) switches have been set.
4. Replace the card cage cover and close the HSC controller front door.



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Figure 2-14 Locating the Slot Count Switch (S3) on L0118 LINK Modules

If this is a new HSC controller installation, move on to the cabling installation sections of this manual. If you have just replaced a failed LINK module or reset your node address, restore power to the HSC controller by performing the following steps:

1. Replace the HSC controller power plug in the wall receptacle.
2. On the power controller, set the circuit breaker (CB) to the 1 (ON) position.
3. At the front of the HSC controller, set the DC power switch to ON. The HSC automatically boots.

2.6 Installing CI Bus Cables

NOTE

Before connecting CI bus cables, verify that the LINK module node address switches are set to a unique node address value. Refer to Section 2.4.

The HSC controller communicates with the host(s) over the CI bus cables. Between the HSC controller and the host is a coupling device called the star coupler. The CI bus cables connect the HSC controller to the star coupler. The star coupler is then connected to the host(s) with another set of CI bus cables.

NOTE

The star coupler transformer coupling allows nodes to be connected or disconnected during normal operation without affecting the rest of the VAXcluster system, without powering down any equipment, or without impacting the functionality of the CI bus.

The base CI bus cable part number is BNCIA-xx/NN, with the xx designating the cable length in meters. CI bus cables come in various lengths including 10-, 20-, and 45-meter lengths. **The minimum bend radius for any CI bus cable is four inches.**

Table 2-4 CI Bus Cable Part Numbers

Description	Digital Part Number
CI cable set, 33 ft. (10m)	BNCIA-10/NN
CI cable set, 66 ft. (20m)	BNCIA-20/NN
CI cable set, 148 ft. (45m)	BNCIA-45/NN

NOTE

The CI bus cable set connects the CI adapter with the star coupler. Each set consists of four CI bus cables (two transmit and two receive). One set is required to connect a CI adapter or HSC controller to a star coupler.

To install the CI bus cables:

1. Locate the four CI bus cable connectors inside the rear of the HSC controller.
 - a. In the HSC50 controller, CI bus cable connectors are located in the X area of the I/O bulkhead as shown in Figure 2-15.
 - b. In the HSC50 (modified) controller and all other HSC controller models, the CI bus cable connectors are located in the panel just above the I/O bulkhead panel as shown in Figure 2-16. Remember that the top I/O bulkhead panel on HSC50 (modified) controllers is a blank shield.

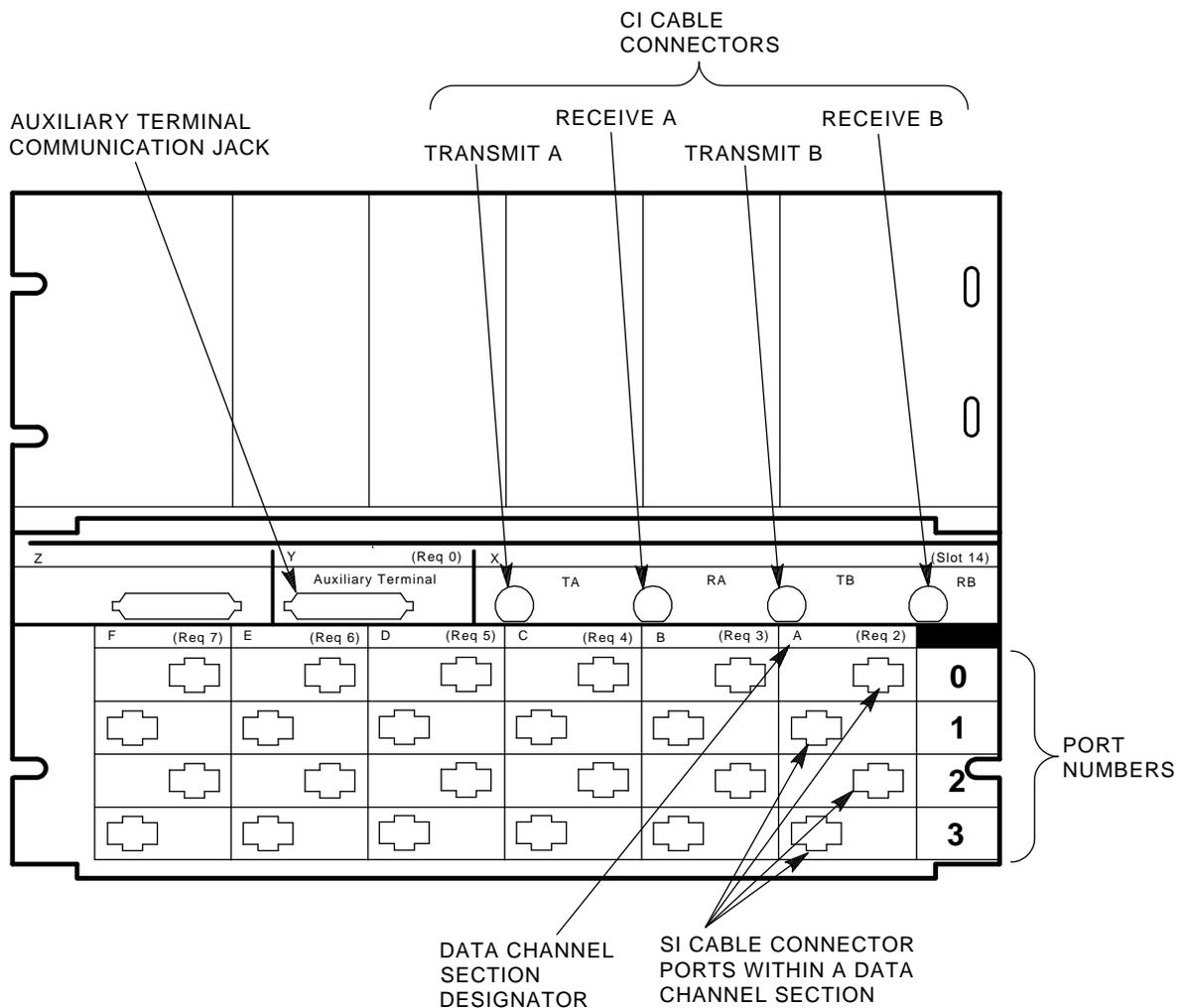
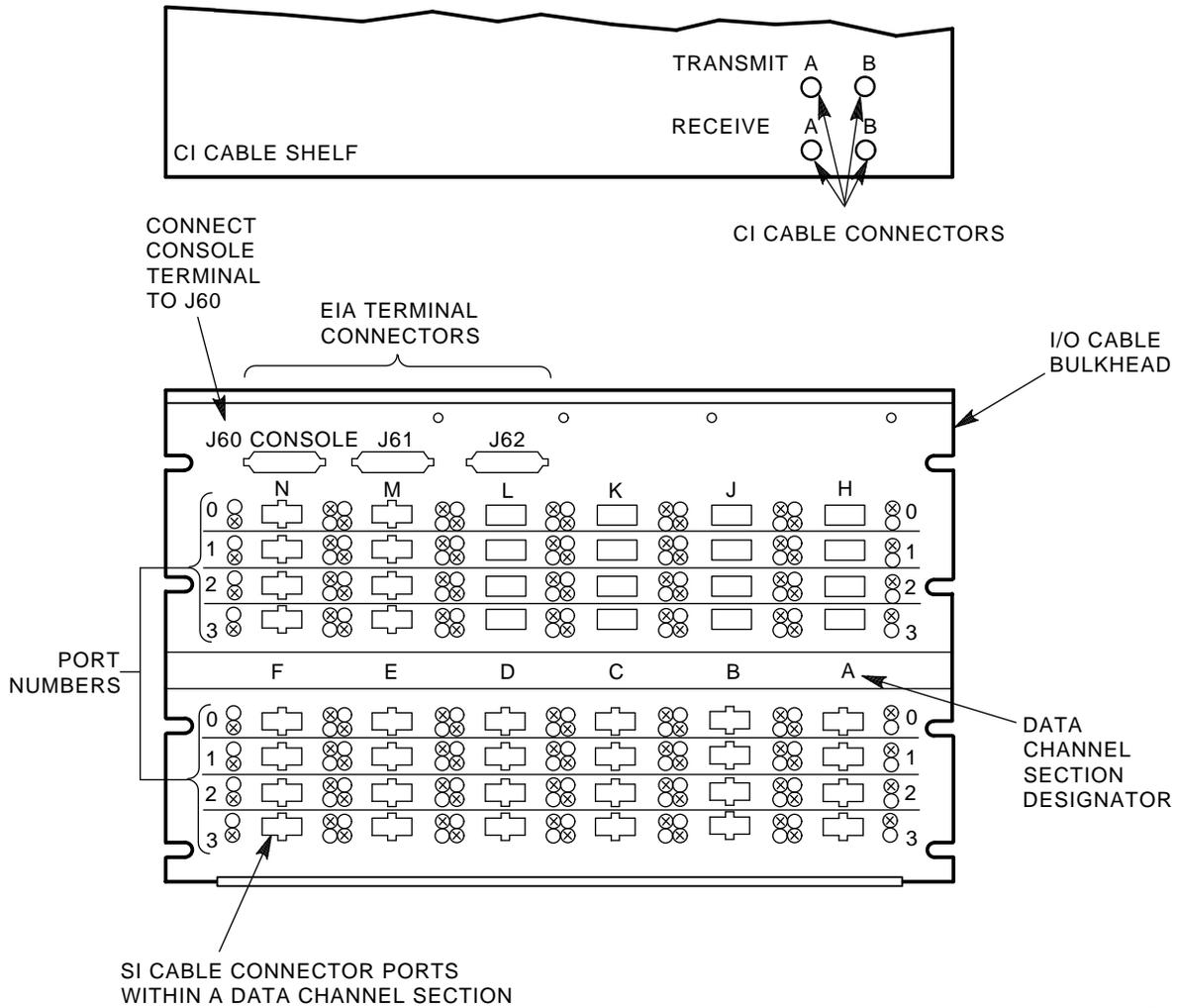


Figure 2-15 Locating the CI Bus Cable Connectors for HSC50 Controllers (Excluding HSC50 (Modified) Controllers)

2. Manually mark the cables labeled receive (R) and transmit (T) with an “A” or “B” on each cable tag. The A or B marking must correspond to the path that cable uses. Also mark the previously set node address (from LINK module switches) on each CI bus cable tag.

NOTE

The CI bus cable connectors are marked corresponding to the receive and transmit paths. Both CI bus paths must be used to connect the HSC controller. The A path contains Transmit A (TA) and Receive A (RA). The B path contains Transmit B (TB) and Receive B (RB). Connector TA on the HSC controller connects to TA on the star coupler; TB on the HSC controller connects to TB on the star coupler. Remember to mark both ends of each CI bus cable before installation to aid in tracking cable destinations for future maintenance and troubleshooting.



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Figure 2-16 Locating the CI Bus Cable Connectors on HSC Controllers (Except HSC50 Controllers)

3. Screw each CI bus cable into the appropriate CI bus cable connector on the CI shelf at the rear of the HSC controller.
4. Screw the star coupler end of each CI bus cable into the star coupler bulkhead panel as described in the installation chapter of the *Star Coupler User Guide*.

2.7 Installing the Power Control Bus Cables and Setting Power Controller Switches

The HSC controller contains two types of power controller units. The HSC power controller is a general-purpose, single-phase ac power controller that controls and distributes ac power to various ac input devices in the HSC cabinet. This power controller is installed in the HSC60 and HSC90 controllers.

The 881 power controller is similar to the HSC power controller, except that it uses three-phase ac input power. This model power controller is used in the HSC40 and HSC70, as well as the HSC50 (modified) controller.

The main external difference between the two power controllers is that the HSC power controller has a round grommet hole for the power cords, while the same hole on the 881 power controller is rectangular. The illustrations in this manual show the HSC power controller.

Use the same procedures except where indicated for both models of power controller.

To avoid an initial power surge in multidevice computer systems, a power control bus is used. This bus permits a single point of control and allows each device on the computer system to power up sequentially. However, if power sequence (power control bus) cabling is used, the feature for connecting and disconnecting nodes during operation without affecting the rest of the VAXcluster system is lost. You may choose not to use the power sequence cabling feature for this reason. If so, set the Bus/On switch located on the HSC power controller (this switch is labeled Bus/Off/On on the 881 power controller) in the ON position, and do not install the power control bus cables.

2.7.1 Installing Power Control Bus Cables in an HSC50 Controller

To install power control bus cables in an HSC50 controller:

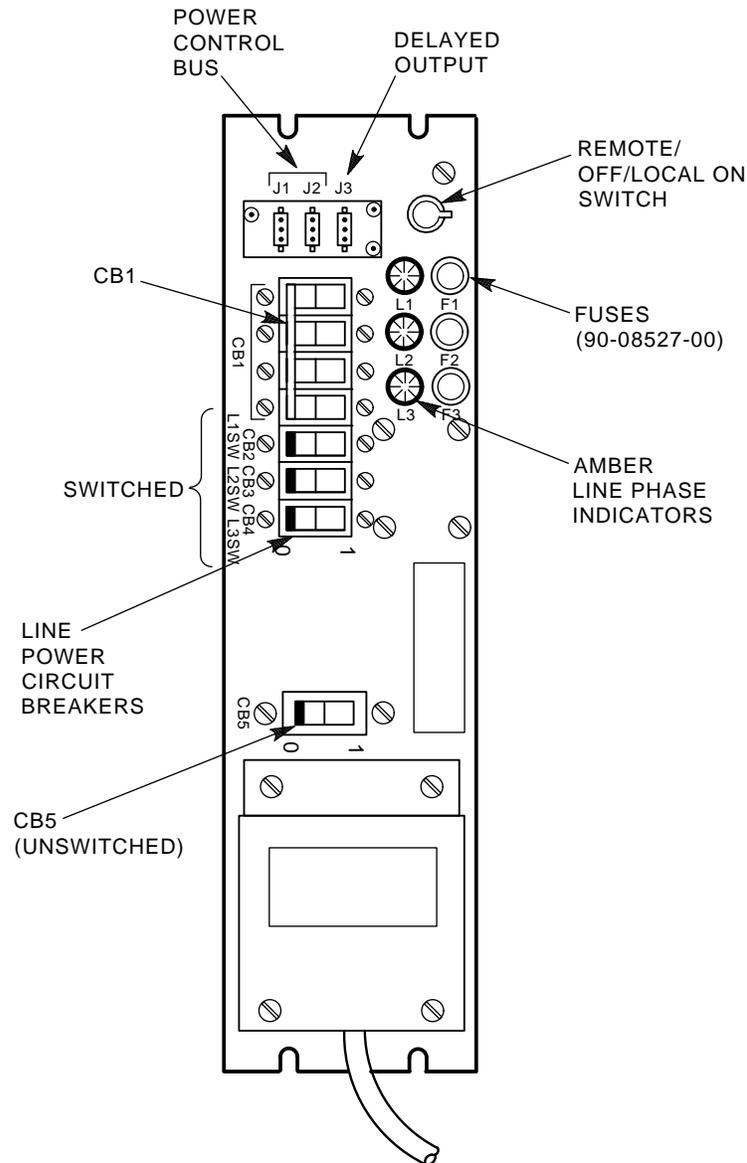
1. Open the HSC50 rear door using a 5/32-inch hex wrench.
2. Find the power control bus connectors J1, J2, and J3 on the power controller front panel as shown in Figure 2–17. The power controller is located in the rear of the HSC50 under the leftmost airflow duct as shown in Figure 2–18.
3. Connect the power control bus cable from the previous computer system's device-delayed output to the J2 connector on the HSC50 power controller front panel in the area labeled Power Control Bus.
4. If another device is in the same computer cluster, connect its power control bus cable to connector J3 on the HSC50 power controller front panel labeled Delayed Output.
5. Close the HSC50 controller rear door taking care not to disturb any of the cables exiting the rear of the controller.

2.7.2 Setting the HSC50 Power Controller Remote/Off/Local On Switch

The following procedure applies to the HSC50–AA 60 HZ controllers up to and including serial number 7769, and the HSC50–AB 50 HZ. controllers up to and including serial number 53017. These controllers use a different model power controller than later model HSC50 controllers.

The Remote/Off/Local On switch on the HSC50 power controller has three positions as shown in Figure 2–19. The three positions are:

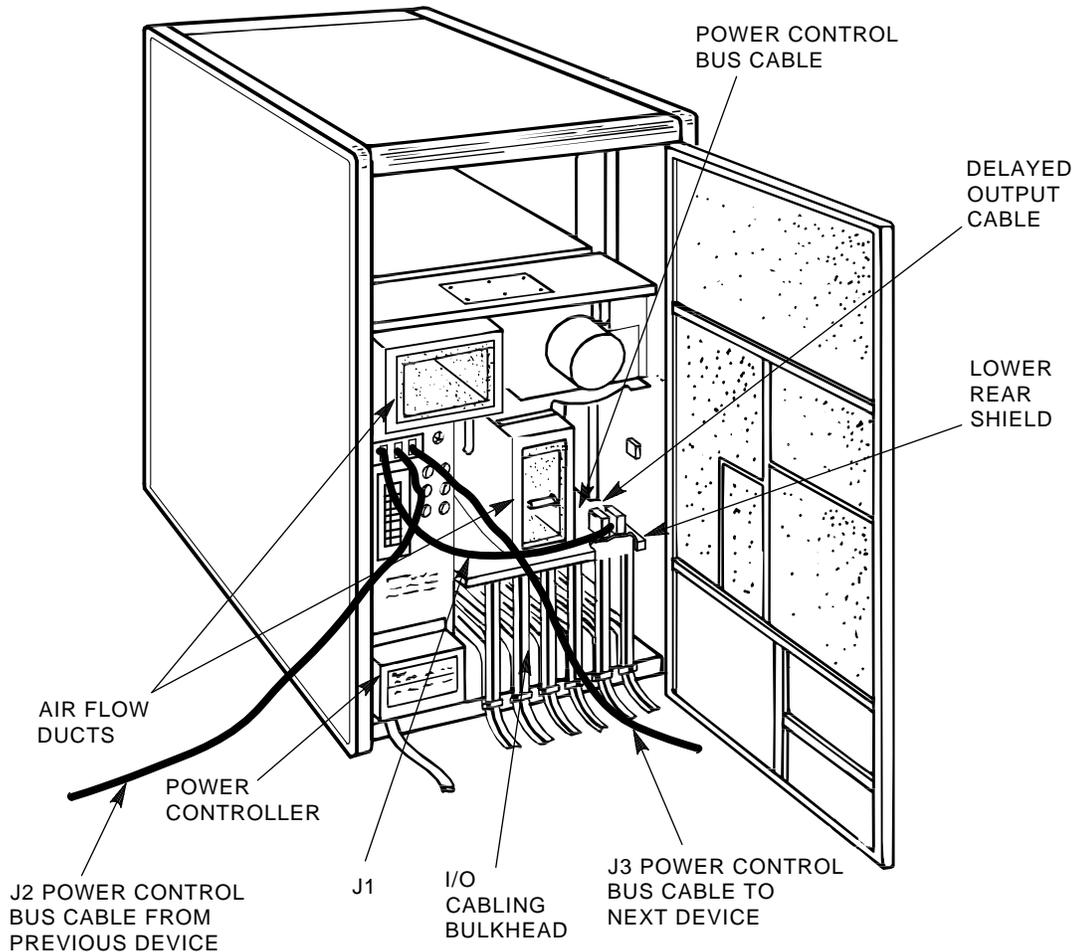
- REMOTE (top position)
- OFF (center position)
- LOCAL ON (lower position)



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Figure 2-17 Locating the Power Control Bus Connectors on the HSC50 Controller Power Controller

If a power control bus is being used, set this switch to the REMOTE position. If a power control bus is **not** being used, set this switch to the LOCAL ON position. The OFF position shuts off power to the switched outlets on the power controller.



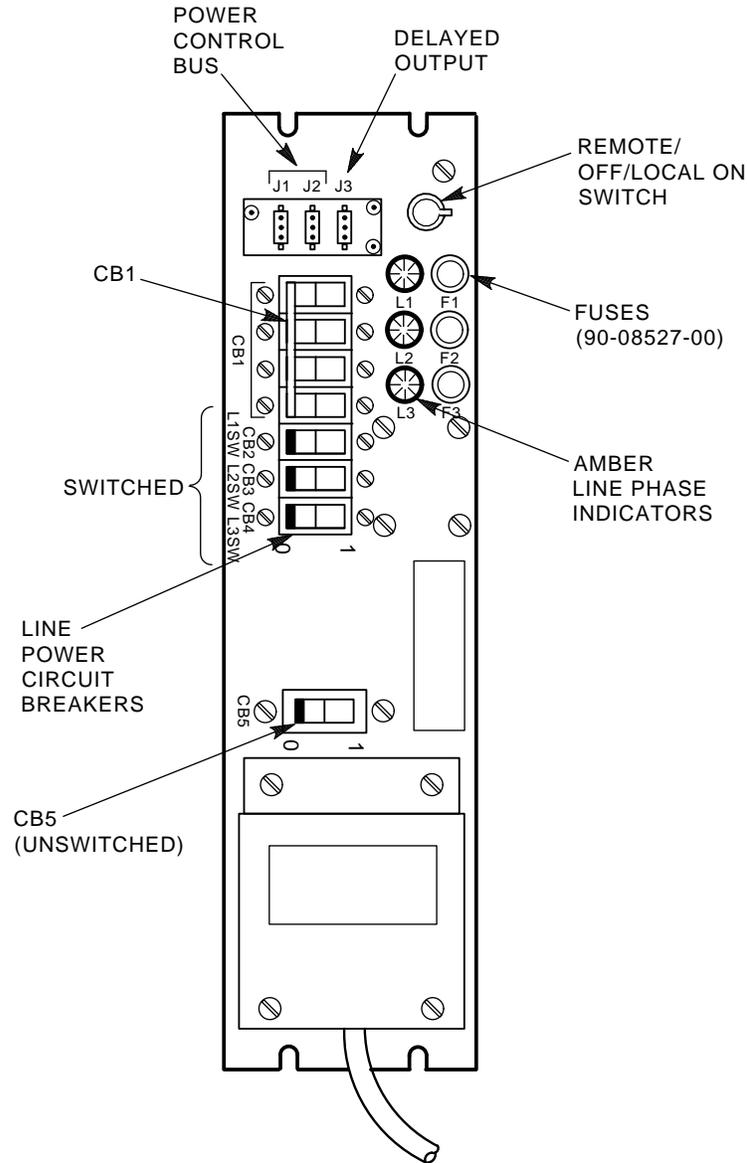
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Figure 2-18 HSC50 Controller Rear Inside View

2.7.3 Installing Power Control Bus Cables to the HSC Power Controller

Use the following procedure to attach power control bus cables to the HSC power controller. See Section 2.7.2 for information on HSC50 controllers.

1. Open the HSC controller rear door using a 5/32-inch hex wrench.
2. Locate power control bus connectors J10, J11, J12, and J13 on the front panel of the HSC power controller as shown in Figure 2-20. Connectors J10 and J11 are the undelayed connectors (used to connect the HSC controller to the next device), and J12 and J13 are the delayed connectors (used to connect power control bus cables from the previous device).
3. Connect one end of the power control bus cable to the delayed output connector of the previous computer system device (J13 if the previous device was an HSC controller other than the HSC50 controller).
4. Connect the other end of that power control bus cable to the undelayed J10 connector on the power controller of the HSC controller being installed.



CXO-1895B

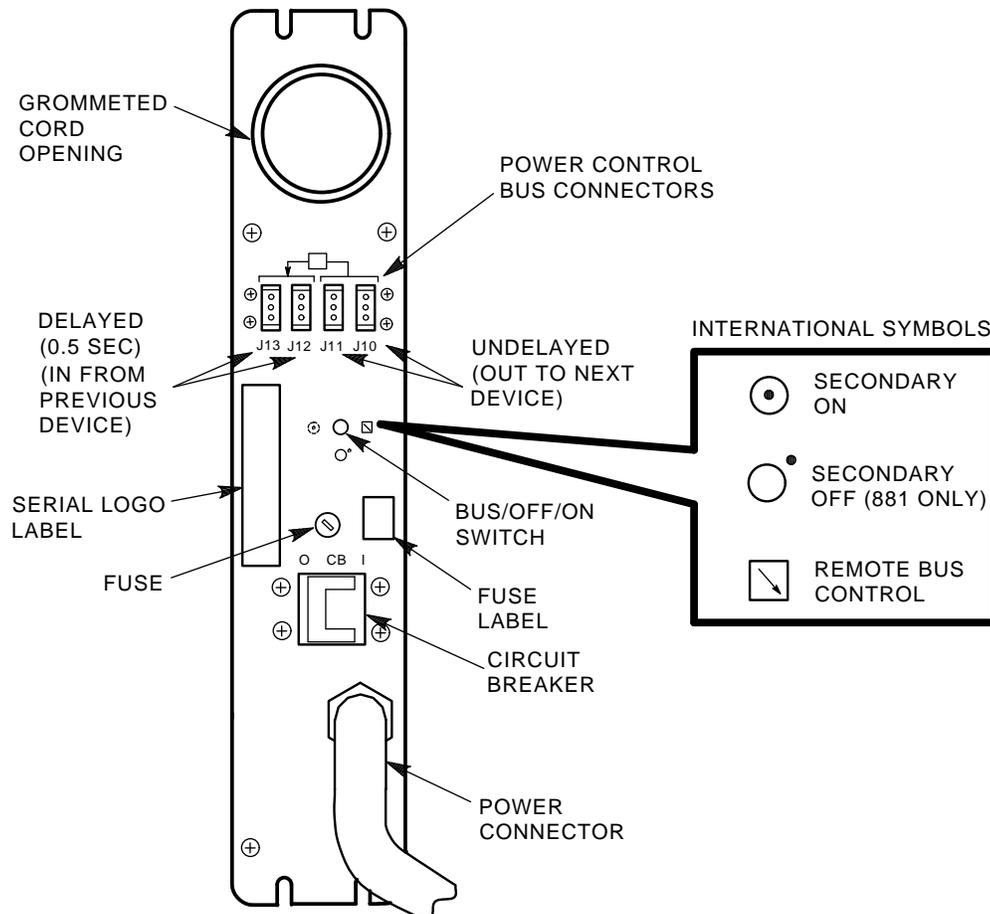
Figure 2-19 Locating the Remote/Off/Local On Switch for HSC50 Controllers

5. Connect any other device's power control bus cable to the J13 connector on the power controller of the HSC controller being installed.

2.7.4 Setting the HSC Power Controller Bus/On Switch

The following applies to the HSC power controllers used in all HSC controller models except the HSC50 controller.

The BUS/ON switch on the HSC power controller has two positions depicted by international symbols as shown in Figure 2-20. If a power control bus is being used, set this switch to the REMOTE BUS CONTROL position. If a power control bus is not being used, set this switch to the SECONDARY ON position. The 881 power controller has a center SECONDARY OFF position that shuts off power to the switched outlets on the power controller.



CXO-893B

Figure 2-20 HSC Power Controller Bus/On Switch

2.8 Installing SDI/STI Cables

The HSC controller I/O bulkhead is divided into data channel cabling sections.

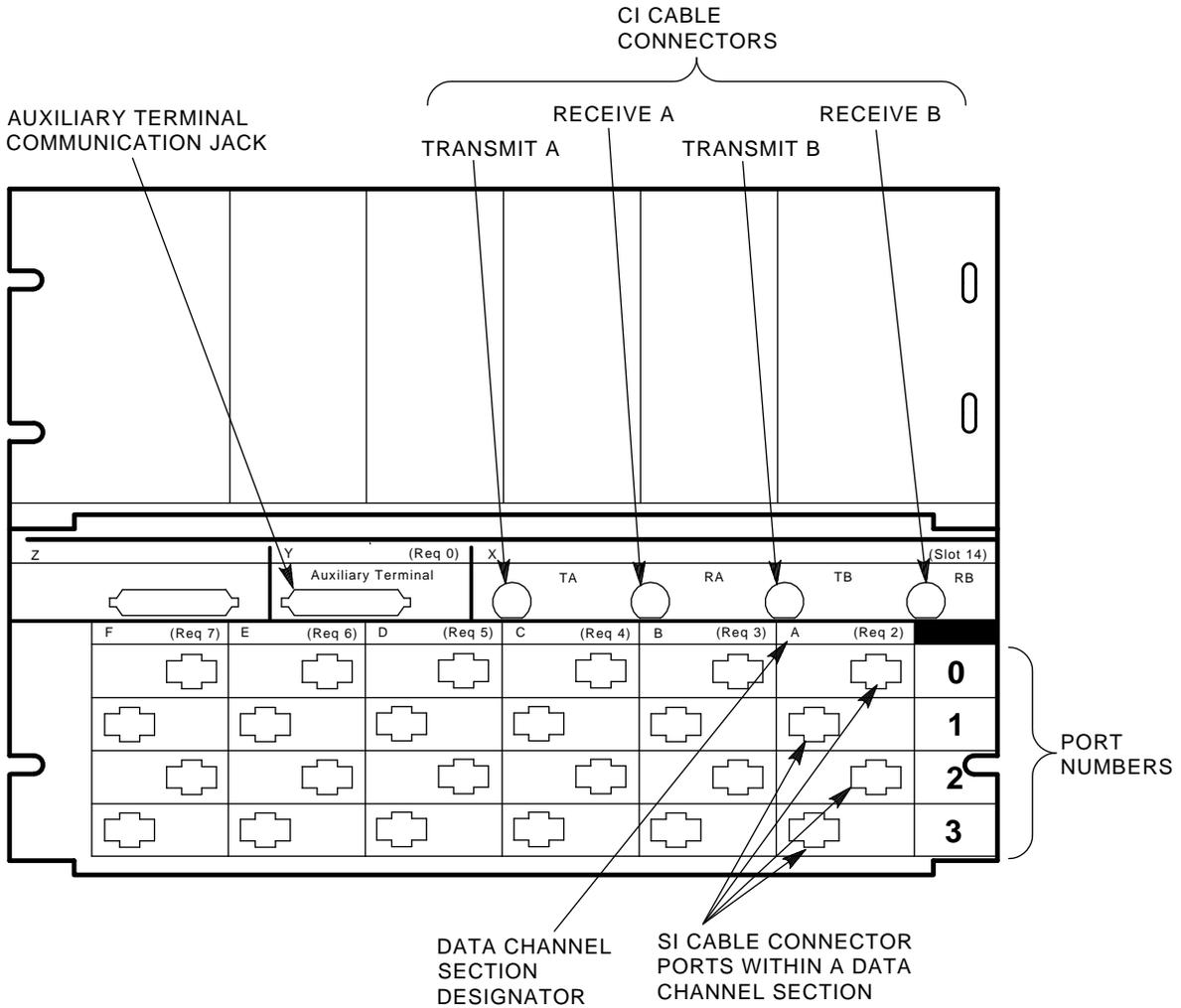
- There are six data channel cabling sections, labeled A through F, on HSC50 controller I/O bulkhead panels.
- There are 12 data channel cabling sections on the other HSC controller model I/O bulkhead panels. However, not every section is used by every model. The sections are labeled A through F on the lower panel, and H, J, K, L, M, N on the upper panel. The HSC70 controllers use sections M and N on the upper bulkhead panel. The higher performance HSC controllers, HSC60 and HSC90 controllers, also utilize upper panel data channel sections.

The HSC50 I/O bulkhead sections are labeled with requestor (REQ) numbers. A requestor refers to a module that accesses HSC memory. Requestors are assigned requestor numbers. The value of the requestor number is related to internal bus priority.

Each of these data channel sections (A through F or H through N) contains four cable connector port slots. Each port slot (labeled 0, 1, 2, or 3) has the same performance characteristics.

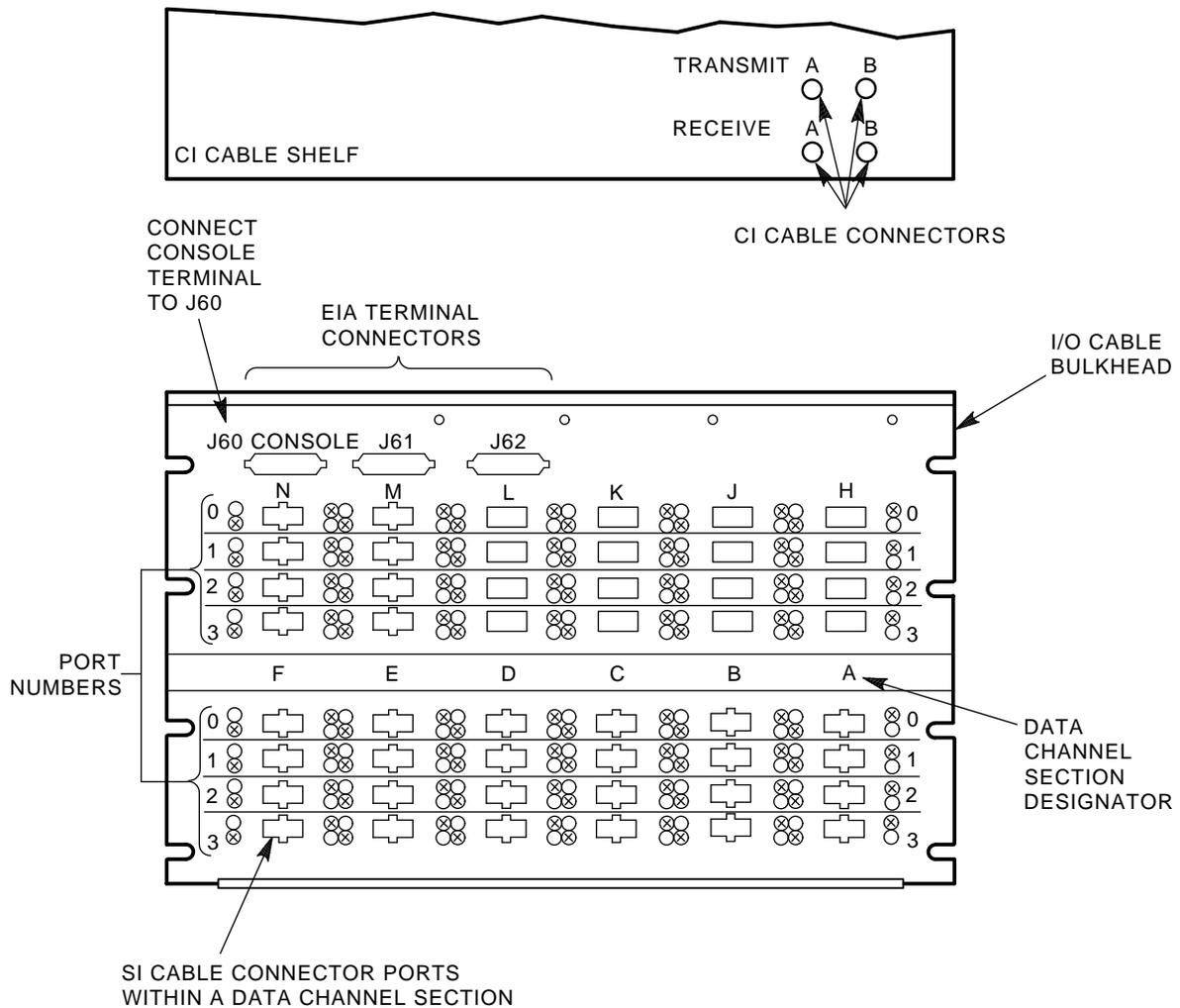
Connect the internal SI cable connector to any one of the four port slots from the same requestor.

Refer to Figure 2-21, Figure 2-22, and Figure 2-23 respectively for illustrations of the HSC controller model I/O bulkheads. These figures show the data section designators and the SI cable port numbering schemes.



CXO-1890B

Figure 2-21 HSC50 Controller I/O Bulkhead



CXO-3079A

Figure 2-22 HSC40 HSC70, and HSC50 (Modified) Controller I/O Bulkhead

The external SDI and STI cables are identical. Use the following procedure to connect SDI/STI cables from the outside of the HSC I/O bulkhead panel to the disk or tape device:

NOTE

Ensure the disk drives are connected to disk channel modules (L0108-YA) and that tape formatters or tape drives are connected to tape channel modules (L0108-YB). Either disk drives or tape drives can be connected to L0119-YA 4-port disk/tape data channel modules. Only disk drives are supported by the L0119-YB 8-port disk data channel modules.

1. Start cabling at either the bottom left or bottom right side of the I/O bulkhead. (This will allow connection to the top row of cables without interference.)
2. Locate the requestor slot of the first data channel module that you installed.
3. Install each SDI/STI cable shield terminator for that requestor slot working from left to right (or right to left). Ensure the SDI/STI cables are grounded to the I/O bulkhead by securing their shield terminators to the I/O bulkhead panel with captive screws.

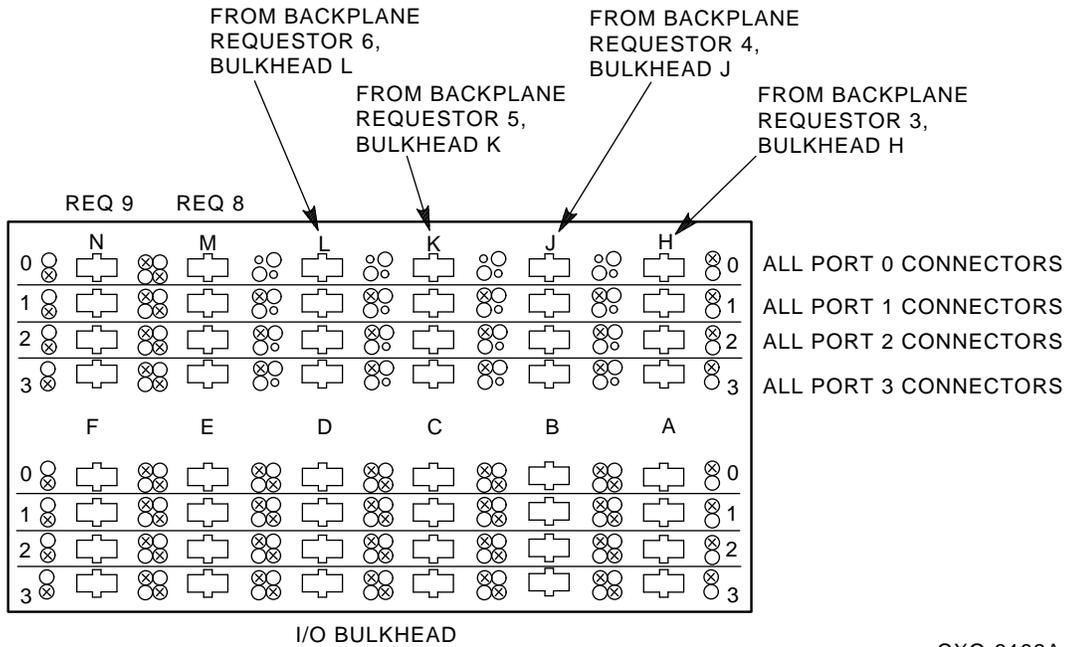


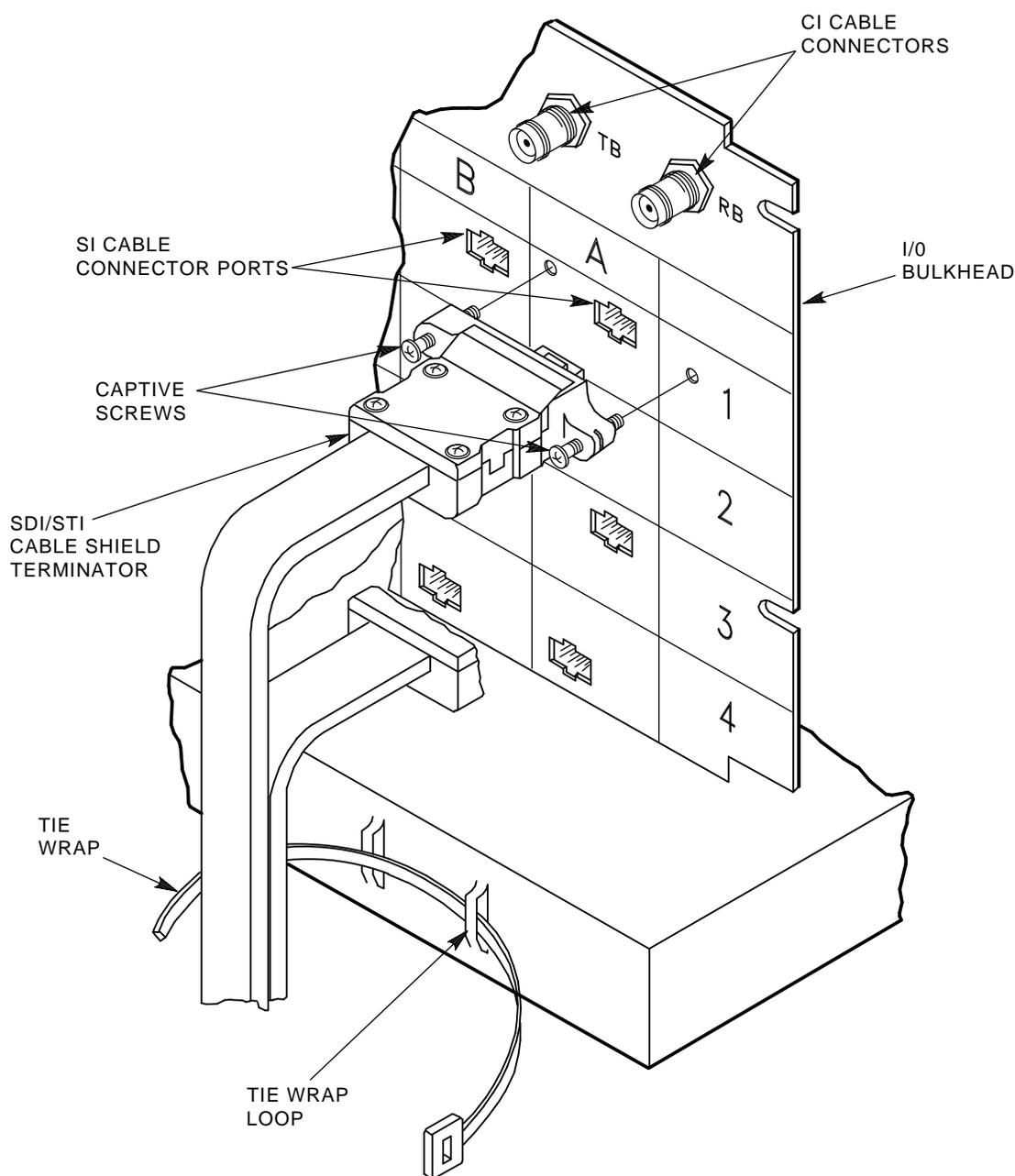
Figure 2-23 HSC60 and HSC90 Controller I/O Bulkhead

4. Group the SDI/STI cables using the following guidelines:

NOTE

Do not secure the SDI/STI cables to the I/O bulkhead panel with tie wraps or cable management clips until every port of each requestor has been tested with the ILDISK or ILTAPE device integrity tests and a known good disk or tape drive. This will eliminate having to remove tie wraps or cable clamps should you find a failed cable during your testing.

5. See Figure 2-24, which shows cable grouping and the securing of tie wraps for the HSC50 controller.
 - a. Place a tie wrap around the group of odd-numbered port SDI/STI cables in each data channel section.
 - b. Place another tie wrap around the group of even-numbered port SDI/STI cables in each data channel section.
 - c. Secure both cable bundles to the bulkhead base with the tie wrap looped through the bulkhead loop and then around both groups of cables.
6. For other HSC models, see Figure 2-25 and use the following procedure:
 - a. Loop the cable management clips within a data channel section around all of the cables in that section.
 - b. Next, push the cable management clips into the slots in the sheet metal as shown in Figure 2-25.



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Figure 2-24 HSC50 Controller SDI/STI Cable Shield Terminator and Tie Wrap Installation

7. 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.

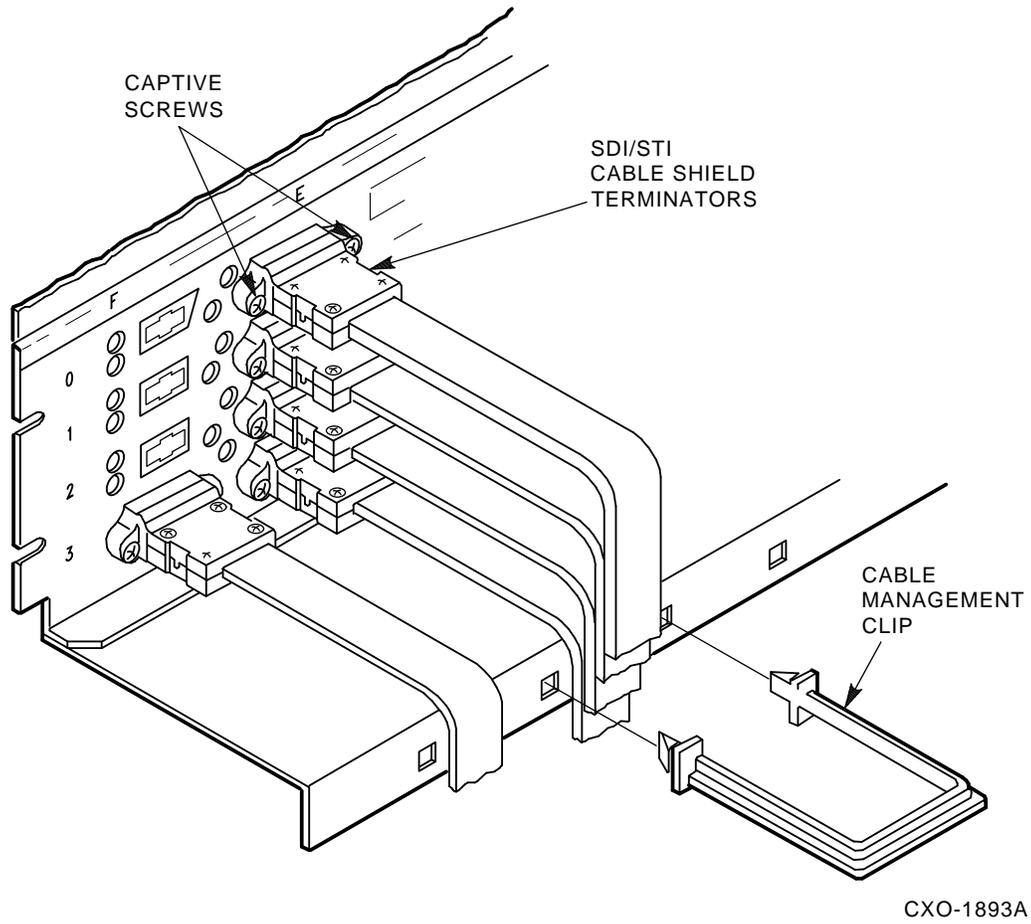


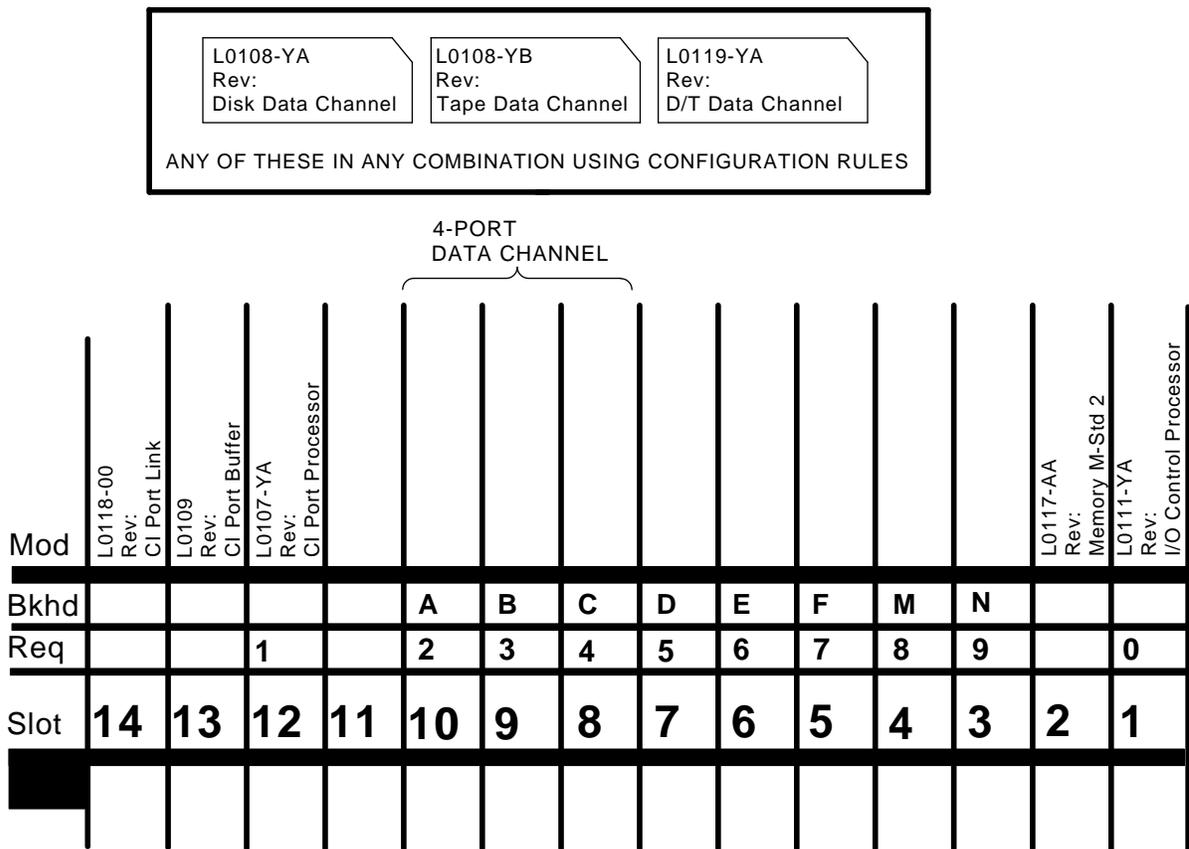
Figure 2-25 HSC SDI/STI Cable Shield Terminator and Management Clip Installation

2.9 Using HSC Controller Module Utilization Labels

At the front of the HSC controller, above the card cage, is a module utilization label that shows the location of each HSC module. Refer to the module utilization label illustrations in:

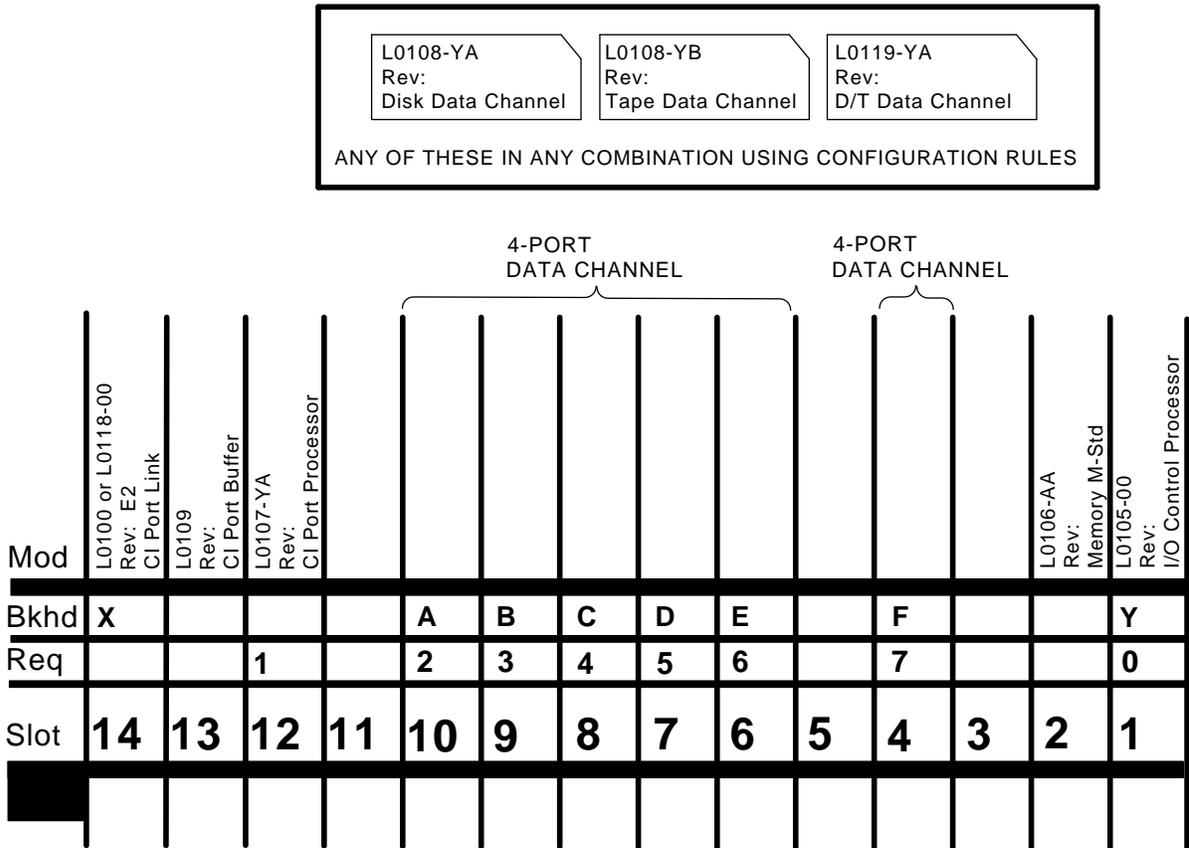
- Figure 2-26 for HSC40 controllers,
- Figure 2-27 for HSC50 controllers,
- Figure 2-28 for HSC60 controllers,
- Figure 2-29 for HSC70 controllers, and
- Figure 2-30 for HSC90 controllers.

Each module utilization label shows the module part number and name, I/O bulkhead data channel section designators, requestor number, and module slot number.



CXO-2458B

Figure 2-26 HSC40 Module Utilization Label



CXO-283C

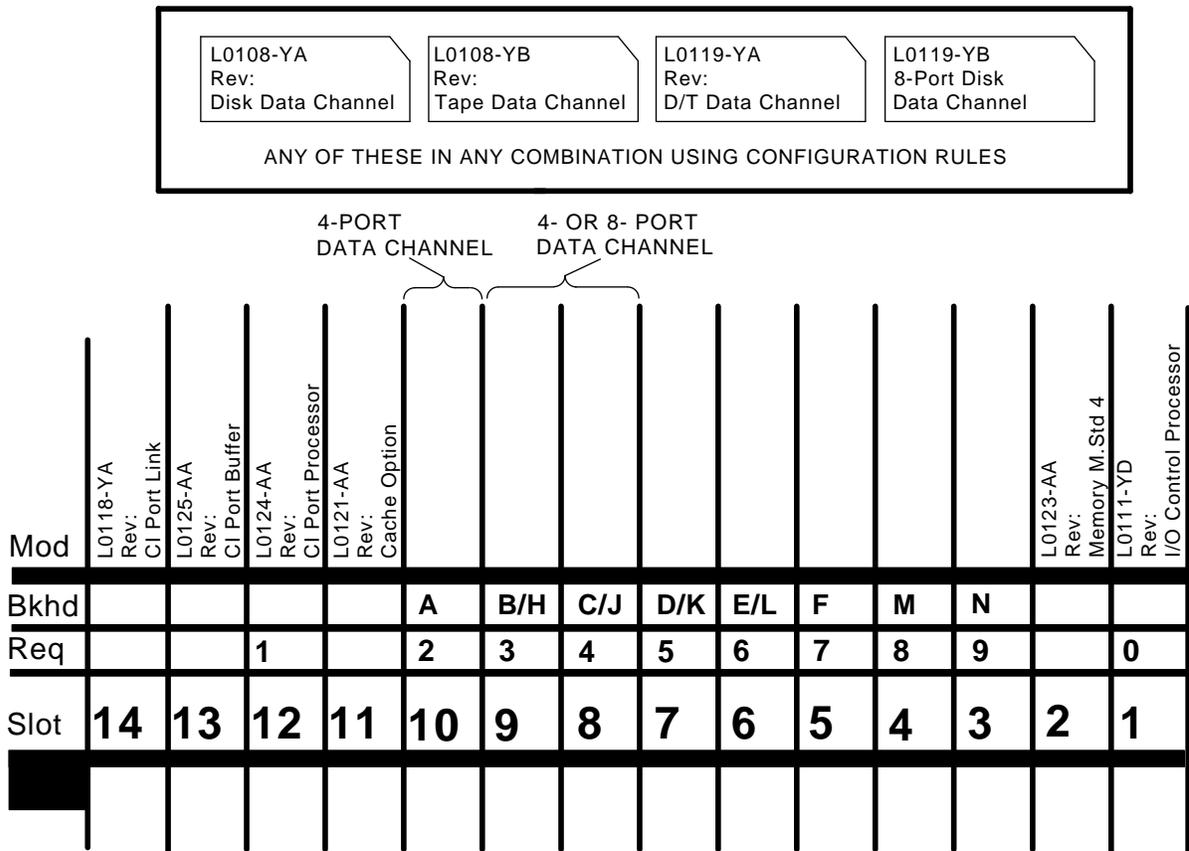
Figure 2-27 HSC50 Module Utilization Label

2.10 HSC Controller Console Video Terminal and Printer Configurations

Various combinations of video terminals and printers have been distributed with HSC controllers. Therefore, rather than listing the setup differences of each video terminal and each printer, this section will only discuss the parameters that need to be set for each device. Model-specific setup instructions can be found within each video terminal's and printer's owner and/or installation manuals.

The following procedures generically explain how to cable and set up the video terminal and line printer:

1. Remove the video terminal and the printer from their shipping cartons.
2. Using the standard EIA cable provided, screw one end to the video terminal EIA port and the other end to the EIA port on the HSC controller I/O bulkhead. On the HSC50 controller, the EIA port is located in area Y on the I/O bulkhead. On the other HSC controller models, the EIA port is designated J60 and is located at the upper left corner of the I/O bulkhead panel.
3. Plug the printer system cable (provided with the printer) into the system port on the back of the printer.
4. Plug the adapter (part number H8571-B) into the back of the video terminal.



CXO-2998B

Figure 2-28 HSC60 Module Utilization Label

5. Plug the other end of the printer system cable into the adapter.
6. Plug the video terminal and printer power cables into a standard grounded wall socket. Apply power to both terminals.

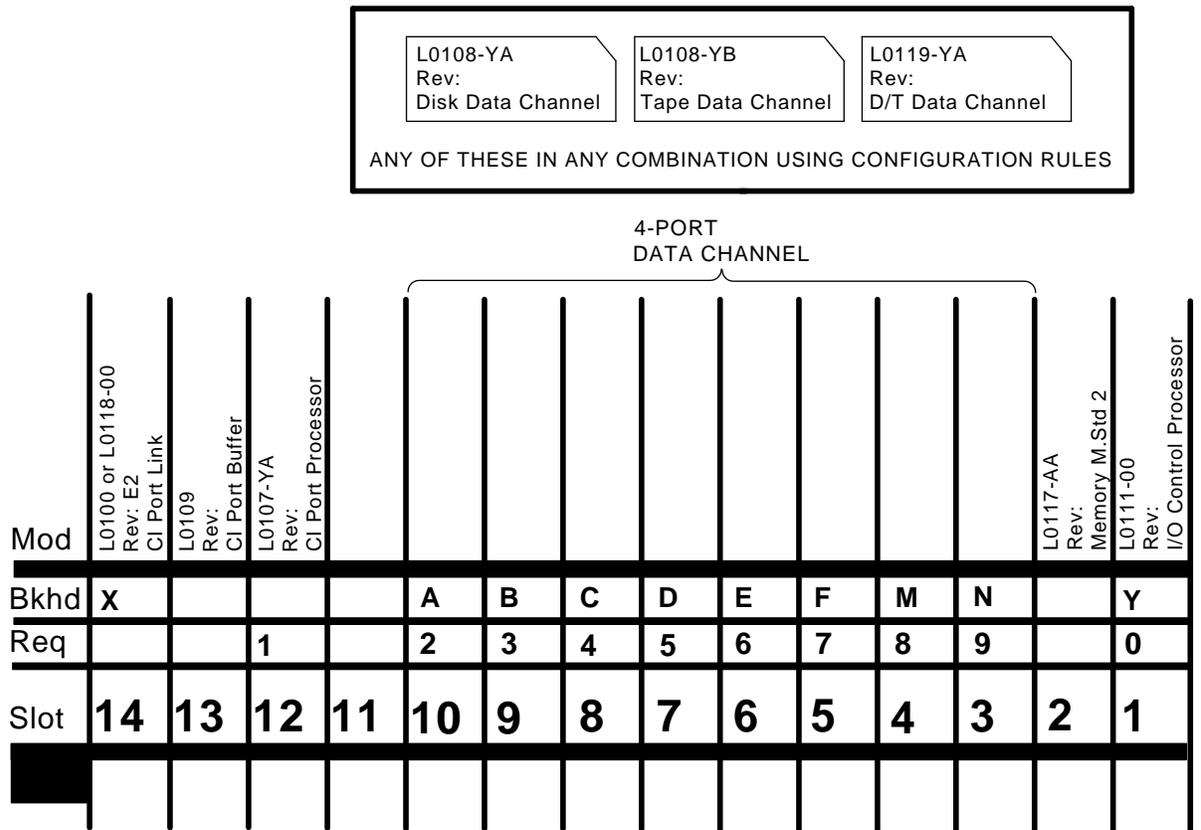
NOTE

Do not use the HSC power controller as a power source for the console terminals.

Set up the transmit speed for your video terminal and the baud rate for your printer. Use the model-specific video terminal and printer manuals for instructions on how to perform these tasks.

2.10.1 Video Terminal Set-up Mode

Your video terminal has several set-up screens that must be displayed and parameters that must be changed at the various set-up screens. Set up your video terminal screens using your terminal's owner and installation manuals.



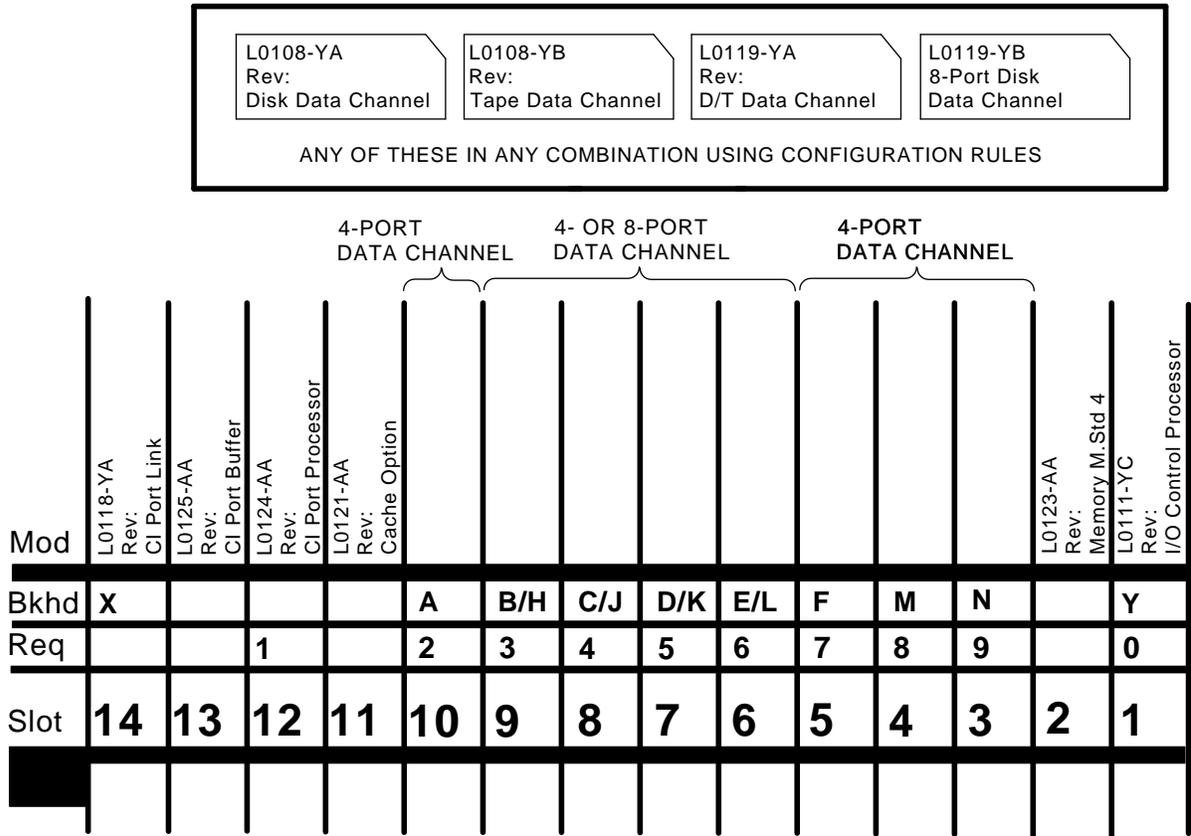
CXO-889B

Figure 2-29 HSC70 Module Utilization Label

2.10.2 Installing the LA12 Dot-matrix Printer

The LA12 printer was distributed with earlier revisions of the HSC50 controller and is only used with HSC50 controllers. When using an LA12 printer with an HSC50 controller, ensure the jumper W3 is properly set.

Using the standard EIA cable provided, connect one end to the LA12 EIA port, and the other end to the EIA port on the HSC50 I/O bulkhead. On the HSC50 I/O bulkhead, the EIA port is located in section Y.



CXO-2999A

Figure 2-30 HSC90 Module Utilization Label

3.1 Applying Power to the HSC Controller Before Online Testing

This section explains the procedures for applying power to the HSC40, HSC50, HSC50 (modified), HSC60, HSC70, and HSC90 controllers. Because the HSC50 controller contains a different power controller than the other HSC controller models, two procedures are listed. The first procedure applies to the HSC50 controller. The second procedure applies to all other HSC controller models.

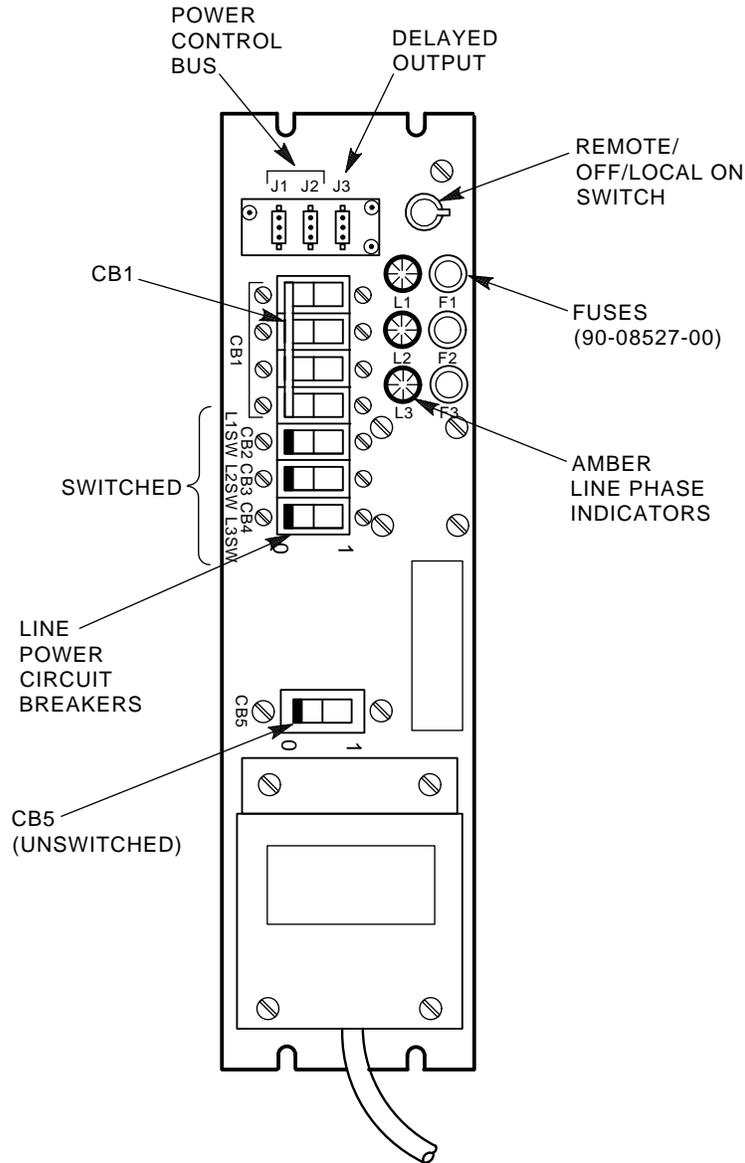
NOTE

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

3.1.1 Powering Up the HSC50 Controller

Use the following procedure for applying power to an HSC50 controller:

1. Open the HSC50 rear door with a 5/32-inch hex wrench.
2. Verify that the circuit breaker (CB) on the HSC50 power controller is in the 0 (OFF) position (see Figure 3–1 for the location of CB).
3. Verify that the Remote/Off/Local On switch on the power controller is in the OFF position.
4. Open the front door of the HSC50 controller.
5. Locate the DC power switch behind the maintenance access panel and ensure it is in the 0 (OFF) position. Figure 3–2 shows the location of the DC power switch.
6. Verify that the wall receptacle to be used for the HSC50 controller is wired for proper voltage output.
7. Plug the ac power cord from the HSC50 power controller into the appropriate ac wall receptacle.
8. Ensure the Online switch on the HSC50 OCP is out (in the OFFLINE position). See Figure 3–3 for location of the Online switch.
9. At the rear of the HSC50 controller, ensure the Remote/Off/Local On switch on the power controller is in the proper position. If the HSC50 controller is connected using the power control bus sequence cable, turn the Remote/Off/Local On switch to REMOTE; otherwise, turn the switch to the LOCAL ON position (see Figure 3–1).



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Figure 3-1 HSC50 Power Controller Front Panel

10. Set circuit breaker CB on the HSC50 power controller to 1 (ON). Ensure the three amber line phase indicators light. (The three Line Phase indicators display the status of incoming line power. If any phase drops, the indicator for that phase goes off.) If one or more indicators do not light, turn CB to 0 (OFF). Check fuses F1, F2, and F3. If none of the three indicators light, check the site power source.
11. Sequentially turn circuit breakers CB2 through CB5 to 1 (ON).
12. Ensure the blower and power supply fans are working by checking the air flow from the exhaust ducts and by checking fan movement within the power supplies themselves. If airflow or fan movement is absent, check to make sure the blower cord and power supply cords are plugged into the power controller.

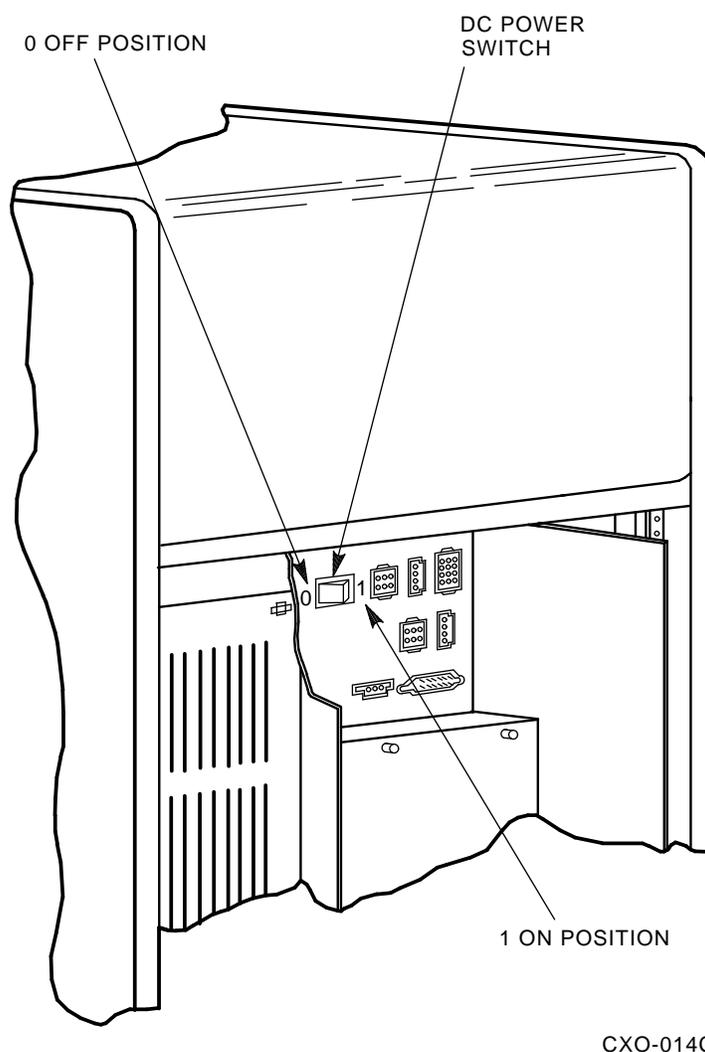


Figure 3-2 Locating the HSC50 DC Power Switch

13. Close the HSC50 controller rear door.
14. Return to the front inside of the HSC50 controller and set the dc power switch to the 1 (ON) position.

NOTE

The HSC50 controller boot procedure starts each time power is applied. The HSC50 Fault indicator on the OCP lights because a TU58 tape cartridge is not inserted.

15. Ensure the Power indicator on the OCP is lit.

NOTE

The Power indicator on the OCP indicates the presence of all three voltages required for HSC controller operation. If this 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).

16. Continue acceptance and checkout by proceeding with the UART echo test in Section 3.2.

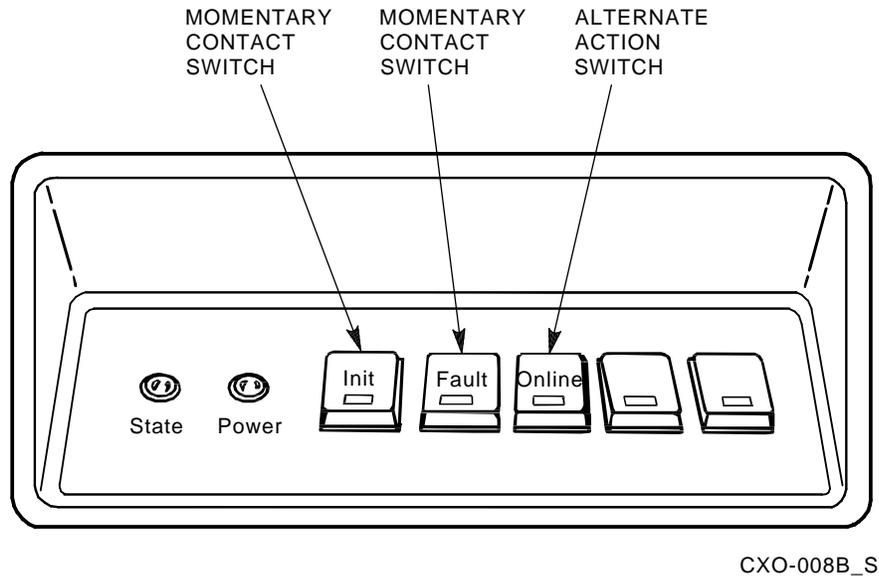


Figure 3-3 HSC Operator Control Panel (OCP) Switches and Indicators

17. Install the Systems and Utilities diskette and run the device integrity tests.

3.1.2 Powering Up HSC Controllers (Except HSC50)

Use the following procedure for applying power to all HSC controllers except the HSC50 controller:

1. Open the HSC controller rear door with a 5/32-inch hex wrench.
2. Verify that the ac circuit breaker on the HSC power controller is in the 0 (OFF) position (refer to Figure 3-4).

NOTE

The Bus/On switch on the HSC power controller panel is labeled with international symbols that represent REMOTE BUS CONTROL and SECONDARY ON positions. The 881 power controller has an additional SECONDARY OFF center position. Refer to Figure 3-5 for the translation of these international symbols.

3. Open the front door of the HSC controller.
4. Locate the DC power switch at the front of the HSC controller and ensure that it is in the OFF position. Refer to Figure 3-6.

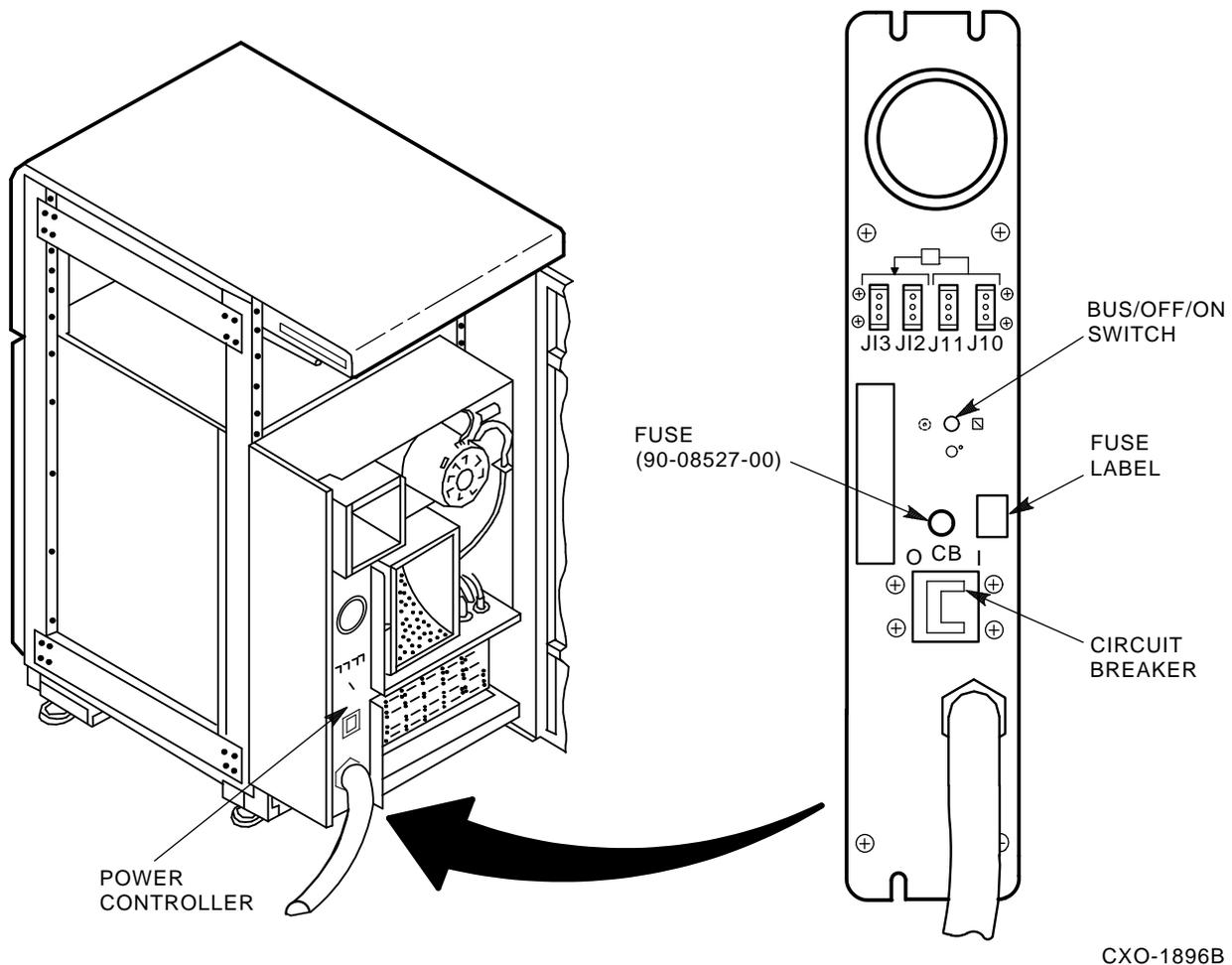
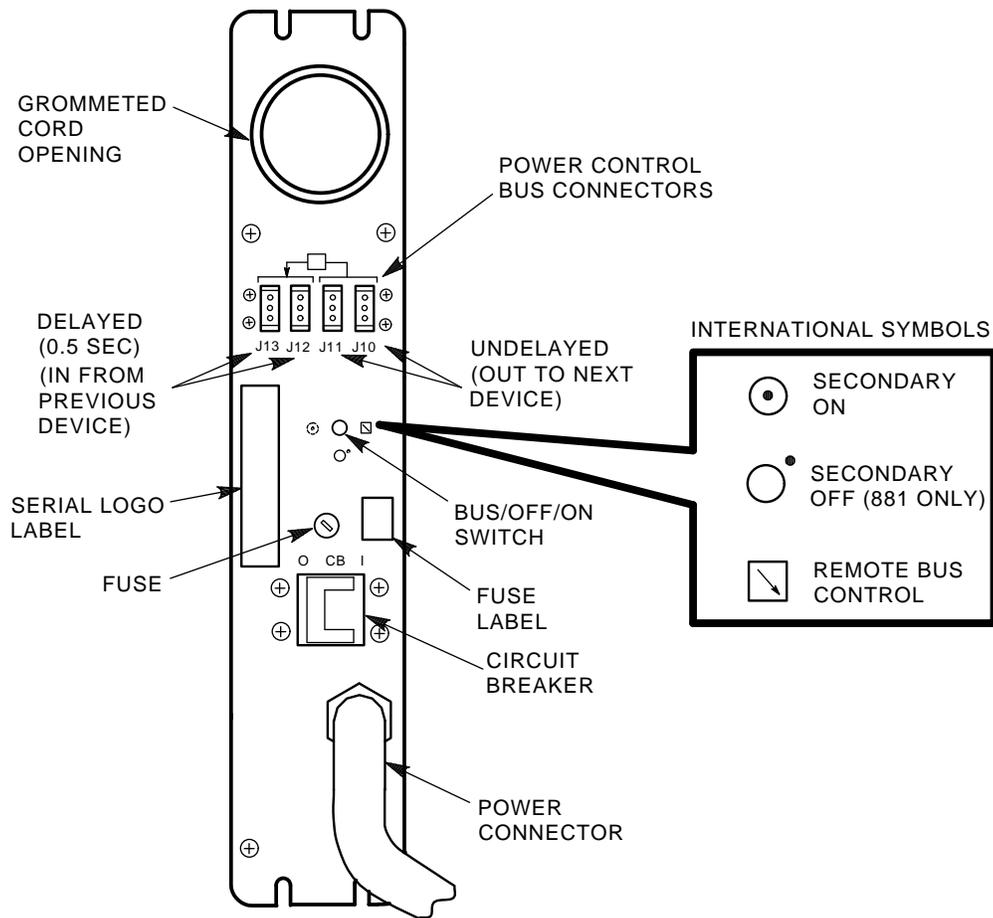
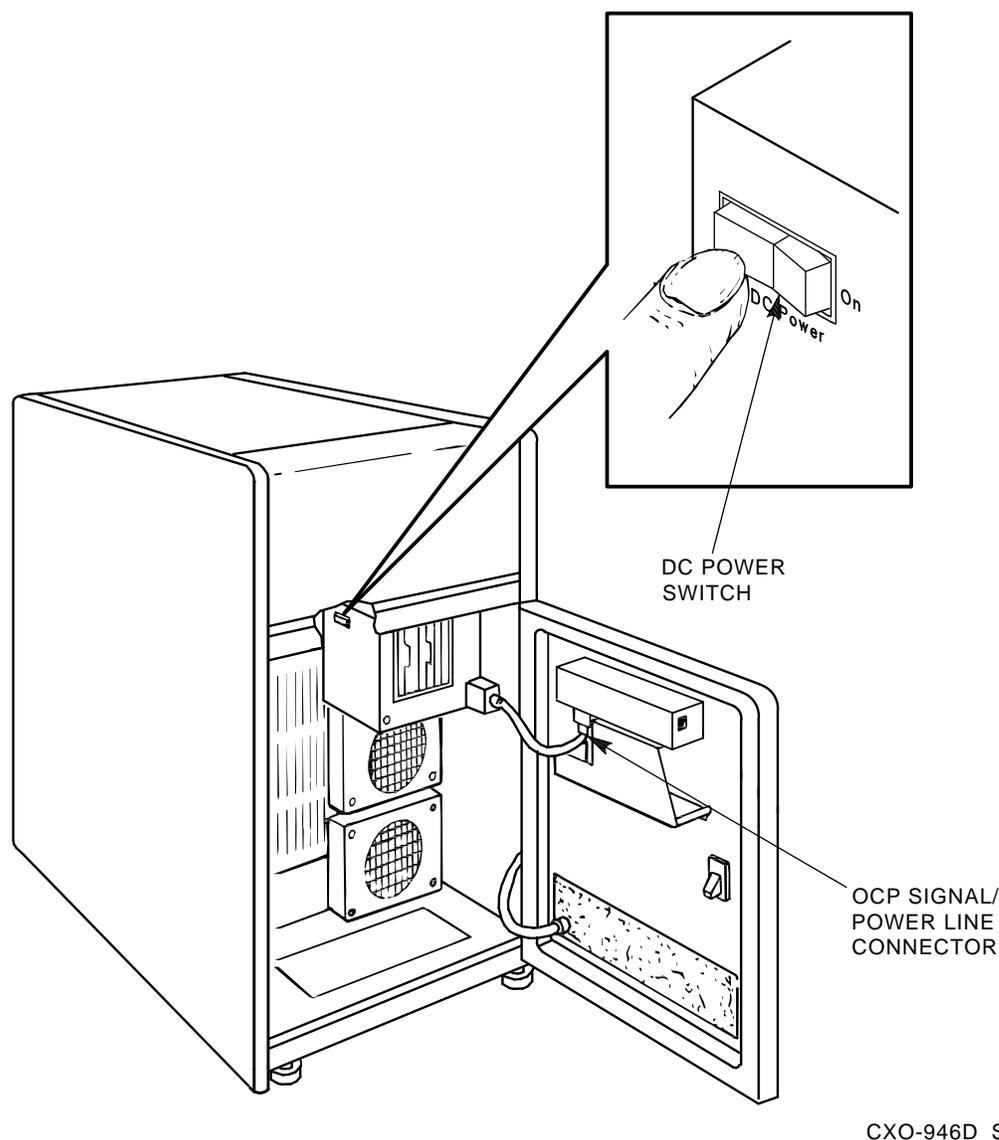


Figure 3-4 Locating the HSC Power Controller Circuit Breaker



CXO-893B

Figure 3-5 HSC Power Controller International Symbols



CXO-946D_S

Figure 3-6 Locating the HSC DC Power Switch (Except HSC50)

5. Perform this step if not done previously when grounding the HSC controller frame for ESD protection. Verify that the wall receptacle to be used for the HSC controller is wired for proper output. Plug the HSC power controller into the appropriate ac wall receptacle. If the HSC controller is intended for 240 Vac operation, unpack the power cord and connect it to the power controller, and then to the ac source.
6. Set the circuit breaker on the HSC power controller to the 1 (ON) position.
7. Turn the Bus/On switch on the HSC power controller to the proper position. If the HSC controller is connected to the remote bus, set the switch to the symbol depicting REMOTE BUS CONTROL; otherwise, set it to the symbol depicting SECONDARY ON.

8. Ensure that the blower and power supply fans are working by checking the air flow from the exhaust ducts and by checking for fan movement within the power supplies themselves. If airflow or fan movement is absent, turn off the ac power to the HSC controller by setting the circuit breaker on the power controller to the OFF position. Check to make sure the blower cord and power supply cords are plugged into the power controller.
9. Turn the ac power on by setting the circuit breaker on the power controller to the ON position.
10. Close the HSC controller rear door.
11. Install the system load media to prepare for running the device integrity tests.
12. Turn the dc power switch to the ON position. The dc power switch is located on the left side of the RX33 load device, at the front of the HSC controller.
13. Ensure the power indicator on the OCP is lit.

NOTE

The Power indicator on the OCP indicates the presence of all three voltages required for HSC 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

To test the serial path between the local console terminal and the UART chip on the HSC I/O control processor (P.ioj/c) module, the HSC controller echoes characters typed on the console terminal as if the terminal were in local mode. Prior to booting the HSC controller, perform the UART Echo test to ensure proper operation of the I/O control processor module, console terminal, and the path between. Perform the UART echo test procedure as follows:

NOTE

The UART Echo test can be performed by one person if the console terminal has been installed on top of the HSC controller. If for some reason the console terminal is located in a remote location away from the HSC controller, two people will be needed to run this test.

1. Make sure the Secure/Enable switch on the HSC load device panel is in the ENABLE position. Refer to Figure 3-7 for the location of the Secure/Enable switch.
2. With power on, push in and hold the OCP Init switch.
3. Type any series of characters on the console terminal keyboard while holding in the OCP Init switch.
4. Ensure the string of characters typed are echoed on the console terminal's screen.
5. Refer to the *HSC Controller Service Manual* or video terminal installation manual for information on troubleshooting communication problems between the HSC controller and local console terminal.

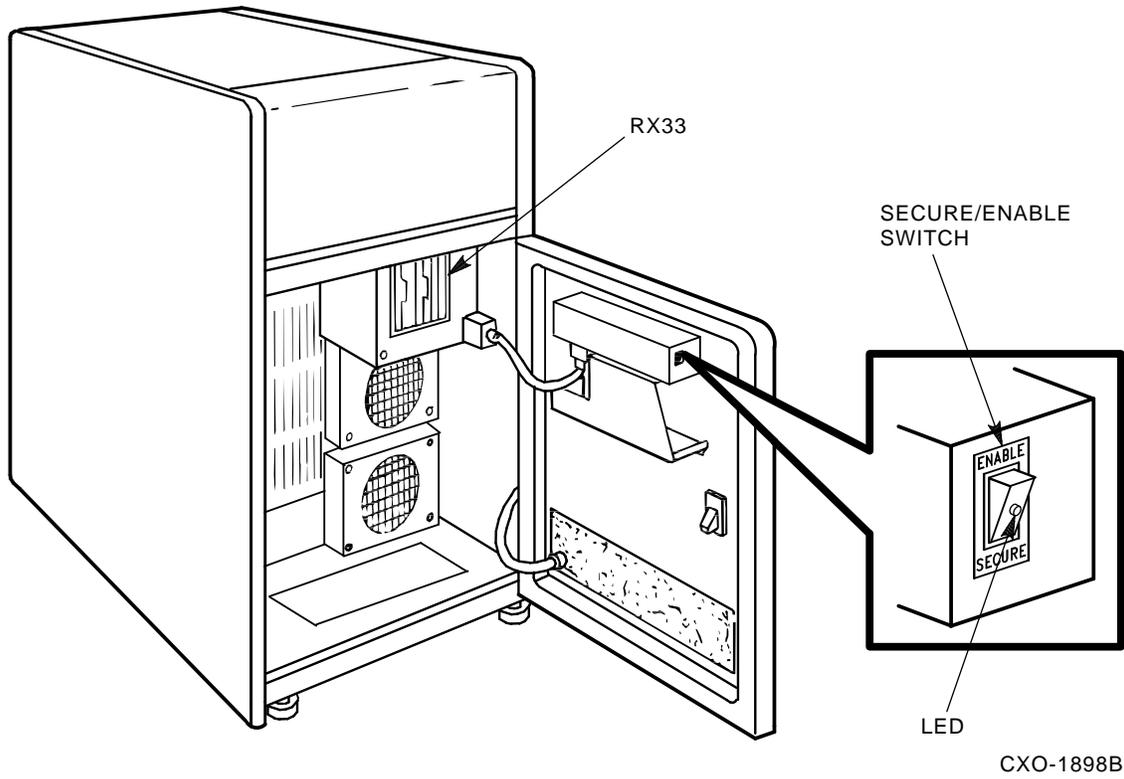


Figure 3-7 Locating the Secure/Enable Switch

4.1 Introduction

Device integrity tests executing in the HSC controller do not interfere with normal operation other than with the device being tested, though some performance degradation may be experienced by the HSC controller. The device integrity tests reside on the HSC controller system media disk or HSC50 controller utilities media tape.

The tests described in this chapter are:

- ILRX33—RX33 disk drive integrity tests
- ILTU58—TU58 tape drive integrity tests
- ILMEMY—Memory integrity tests
- ILCACH—Cache memory integrity tests
- ILDISK—Disk drive integrity tests
- ILTAPE—Tape device integrity tests
- ILTCOM—Tape compatibility tests
- ILEXER—Multidrive exerciser

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 the response should be in decimal.
- Square brackets enclose the prompt default or, if empty, indicate 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.

eeeeee is the octal number denoting offset within the block.

yyyyyy is the octal number denoting data expected.

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 Tests

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 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 a drive or controller is not operating correctly, replace the drive and/or controller.

4.2.1 System Requirements

Hardware and software requirements include:

- P.ioj (processor) module with boot ROMs
- M.std2/M.std4 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 get the HSCxx> prompt. Then, enter either RUN ILRX33 or RUN DXn:ILRX33 to initiate the tests.

NOTE

The term DXn: 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 DXn:ILRX33.

4.2.3 Test Termination

ILRX33 can be terminated by entering Ctrl/y. The test automatically terminates after reporting an error with one exception: 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 the RX33 disk drive 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

The ILRX33 test summary is contained in the following paragraph.

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 different 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 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-bbbbbbb
ACT-ccccccc
```

In this example:

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 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 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 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 ILTU58–TU58 Tape Drive Device Integrity Test

ILTU58 tests either of the TU58 tape drives attached to the HSC50 controller. This test runs concurrently with other HSC controller processes and uses the services of the control program and the diagnostic execution monitor (DEMON). The test can be initiated with only the system tape installed.

Because the operating system tests the TU58 tape drive every time it is used, ILTU58 performs only minimal testing. Several read and write operations are performed to test the internal data paths and the read/write circuitry of the TU58 tape drive.

A scratch tape is not required. This test does not destroy any data on the HSC software cassette.

ILTU58 tests only the TU58 tape drive and the data path between the P.ioc module and the TU58 tape drive. All other system hardware is assumed to be working properly.

ILTU58 verifies that only a particular TU58 tape drive and controller combination is working or failing. Therefore, the test should not be used as a 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.

4.3.1 System Requirements

Hardware and software requirements include:

- P.ioc module
- M.std memory/disk controller module
- TU58 tape drive controller with at least one working drive
- HSC system media

4.3.2 Operating Instructions

Enter Ctrl/y to get the HSCxx> prompt. Then enter RUN ILTU58 or RUN DDn::ILTU58 to initiate the tests.

4.3.3 Test Termination

ILTU58 can be terminated by entering Ctrl/y.

4.3.4 Error Messages

This section describes the error messages issued by ILTU58.

- **Bad Opcode**—Indicates the program encountered an illegal opcode.
- **Bad Record**—Indicates the program encountered a bad record while attempting to read or write the cassette tape.
- **Bad Unit #**—Indicates the diagnostic interface could not find the unit number specified. The drive may have been offline.
- **Data Compare Error**—Indicates that data subsequently read back did not match data written. The test writes a pattern to block 1, then reads block 1 and checks that the pattern read is the same as the pattern written. If the patterns differ, this error message is displayed. Because this test only reads and writes block 1 of the cassette tape, all failures occur while trying to access physical block 1.
- **End of Medium**—Indicates the end of the cassette tape.
- **Failed Self-Test**—Indicates the TU58 internal diagnostic test failed.
- **Hard I/O Error**—Indicates the program encountered a hard error while attempting to read or write the cassette tape.
- **Illegal Device Name**—Indicates the user specified an illegal device name when prompted for the name of the drive to be tested. After displaying this error, the program again prompts for a device name. Enter a legal device name to continue the test.
- **No Cassette Mounted**—Indicates the drive does not have a cassette. Insert a cassette tape then repeat the test. Otherwise, the drive or the controller is faulty.
- **Operation Aborted**—Reported if the test is interrupted by Ctrl/y.
- **Retries Required**—Indicates a read or write operation failed in the first attempt but succeeded on one of the retries. This message may also mean that the tape media is degrading and should be replaced.
- **Seek Error**—Indicates a seek error status was set after a SEEK command.
- **Unknown Status**—Indicates ILTU58 received a status code it did not recognize. This status code is displayed to help determine the cause of the problem.
- **Write Protected**—Indicates the drive being tested contains a write-protected tape. Try again with a write-enabled tape. If the tape is not write protected, then the drive or controller is faulty.

4.4 ILMEMY—Memory Integrity Tests

The memory integrity test 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. They are 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 this 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 PRMEMORY, which indicates the failure occurred during the periodic tests.

4.4.1 System Requirements

Hardware requirements include:

- P.ioj/c (processor) module
- At least one M.std2/4 memory module (HSC controller) or the M.std memory module (HSC50 controller)
- RX33 disk drive controller with one working drive (HSC controller) or TU58 tape drive controller with one working drive (HSC50 controller)
- 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.

Software requirements include:

- Control program (system diskette or tape)
- Diagnostic execution monitor (DEMON)

4.4.2 Operating Instructions

Enter Ctrl/y to get the HSCxx> prompt. The keyboard monitor responds with the prompt:

```
HSCxx>
```

Enter RUN dev:ILMEMORY 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.

4.4.3 Test Termination

ILMEMORY can be terminated at any time by entering Ctrl/y.

4.4.4 Progress Reports

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

```
ILMEMORY>D>tt:tt Execution Complete
```

where:

tt:tt is the current time.

4.4.5 Test Summary

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

When the control program detects a parity or nonexistent memory (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 periodically checks the suspect buffer queue to see if it contains any buffers. If buffers are found on the queue, they are removed and ILMEMORY is automatically initiated to test those buffers.

If the ILMEMORY test is initiated on demand, it retests only buffers already known as 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.

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

4.4.6 Error Message Example

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

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

4.4.7 Error Messages

This section describes the error messages issued by ILMEMY.

- **Can't Allocate Timer, Test Aborted**—Indicates 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 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.

4.5 ILCACH—Cache Memory Integrity Tests

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

- It is always initiated at HSC controller power-up if the boot code determines that an M.cache module is available and properly connected to the M.std4 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. First, it determines if the M.cache module is usable. Second, 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 a fatal error or if just portions of the on-board 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.

4.5.1 System Requirements

Hardware requirements include:

- P.ioj-18 (18-Mhz processor) module
- M.std4 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:

- 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.

4.5.2 Operating Instructions

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

```
HSC>
```

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

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
```

4.5.3 Test Termination

ILCACH cannot be terminated while running.

4.5.4 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

4.5.5 Test Summaries

Test summaries for ILCACH follow:

- **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.

4.5.6 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
```

4.5.7 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 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 online 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:

```

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 = xxxxxxxxxx
Actual Address   = xxxxxxxxxx

```

- **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 one-fourth of it is marked bad.

4.6 ILDISK—Disk Drive Integrity Tests

ILDISK isolates disk drive-related problems to a disk drive, including the Enhanced Mode ESE20 storage element, or to the SDI cable, or to a disk data channel module

ILDISK runs in parallel with disk I/O from a host CPU. However, the drive being diagnosed cannot be online 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, with one exception: if 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 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 is either unable to communicate with the HSC controller or was declared inoperative when it failed while communicating with the HSC controller.

In this case, because the drive cannot be identified by unit number, the user must supply the requestor number and port number of the drive. Then the SDI verification tests can execute. The SDI verification tests check the path between the K.sdi/K.si and the disk drive and command the drive to run its integrity tests. If the SDI verification tests fail, the most probable field replaceable unit (FRU) is identified in the error report. If the SDI verification tests pass, presume 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, presume 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.

4.6.1 System Requirements

Hardware requirements include:

- Disk drive
- Disk data channel, connected by an SDI cable

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

- HSC controller executive (CRONIC)
- ILDISK.DIA program
- Diagnostic Execution Monitor (DEMON)
- K.sdi/K.si microcode (installed with the K.sdi/K.si module)

The test assumes 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.

4.6.2 Operating Instructions

The following steps are used 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.

Enter Ctrl/y to get the HSCxx> prompt. The keyboard monitor responds with the prompt:

```
HSCxx>
```

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.

Enter parameters after ILDISK is started. Refer to Section 4.6.5 for the parameter entries.

4.6.3 Availability

If the software media containing ILDISK is not loaded when the RUN ILDISK command is entered, an error message is displayed. Insert the software media containing ILDISK and repeat Section 4.6.2.

4.6.4 Test Termination

ILDISK is terminated 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 two minutes before aborting.

When ILDISK is aborted, it sends the message:

```
Execution Aborted
```

4.6.5 Parameter Entry

When run on demand, ILDISK first prompts:

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

Enter the unit number of the disk drive being tested. Unit numbers are in the form Dnnnn, 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 the drive is connected to the HSC controller, but is currently online 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, and 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. Refer to Section 4.6.6.

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

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

Answering N causes the drive to execute its entire integrity test set. Answering Y executes a single drive integrity test. If a single drive integrity test is selected, the test prompts:

```
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 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.

4.6.6 Specifying Requestor and Port

To test drives unknown to the disk functional software, specify the requestor number and port number. The requestor number is any number 2 through 9 (HSC controller) or 2 through 7 (HSC50 controller) 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 entering 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 a requestor number and port number are supplied 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 4.6.5. If the requestor and port do match a known drive, ILDISK reports an error.

4.6.7 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.

4.6.8 Test Summaries

Test summaries for ILDISK are as follows.

- **Test 00, Parameter Fetching**—This test 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. If the revision level of the disk data channel microcode is not up to date, the microdiagnostics are not executed. 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 the drive is supplying clocks and 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 the disk data channel microcode supports the ECHO command. If not, a warning message is issued 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 prompt:

Run a Single Drive Diagnostic ?

Before commanding the drive to run its integrity tests, the drive is brought online 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 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 a 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 the drive is in the Available state. The test also expects Receiver Ready and Attention are set in drive status and 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 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 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 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 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 drive's real-time status is checked to ensure Available, Attention, and Receiver Ready are true, and 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 online.

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 (FCT) and replacement control block (RCT) of the drive also are 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 sector is checked to ensure it 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 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. 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, go to step 5 of this test.
 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.

4.6.9 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
```

4.6.10 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 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 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 given when ILDISK was initiated. This indicates 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. (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

- **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. 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, refer to Section 4.6.11.

- **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 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. Error 01 is not recoverable and is caused by:
 - Insufficient memory to allocate buffers and control structures required by the diagnostic interface, and
 - 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 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 online. 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 online.
- **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 online in enhanced mode for ILDISK tests.
- **Drive online in normal mode.**—An ESE20 storage element, capable of running in enhanced mode, has been brought online in normal mode for ILDISK tests.
- **Drive online in normal mode. HSC variants not currently enabled.**—ILDISK attempted to bring an ESE20 storage element online 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 online 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 online 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 online 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 4.6.6 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 the drive spontaneously went offline or stopped sending clocks and is now unknown. The test should be restarted using the requestor and port numbers instead of 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 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 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**—As part of Test 13, ILDISK alternates between reading DBNs and LBNs. This tests the drive's ability to seek properly. The error indicates 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 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 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 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 an Software Performance Report (SPR). See the *HSC Controller Service Manual* for detailed information on SPR submission.

- **Insufficient Resources to Perform Test**—This error indicates further testing cannot complete due to 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 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 (HSC controller) or 2 through 7 (HSC50 controller), 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 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 which 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 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 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 DRAT for the read operation was not returned indicating a problem with the K.sdi/K.si module.

- **Read Operation Timed Out**—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 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 HSC disk software tables. The drive may have changed state and disappeared while ILDISK was running. This error also can be caused by inconsistencies in software structures.
- **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 front door 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 and should be reported through 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 indicating 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 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 Dnnnn. Refer to Section 4.6.5 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 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.

4.6.11 MSCP Status Codes—ILDISK Error Reports

This section lists some of the MSCP (Mass Storage control Protocol) 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* for detailed information on SPR submission.

- 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

4.7 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 following are the three types of tape transport tests (see Section 4.7.6 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 4.7.3 for information on initiating a full test. Detected failures result in fault isolation to the FRU level.

Hardware required to run ILTAPE includes:

- HSC controller with K.sti/K.si
- STI-compatible tape formatter
- TA78, TA81, or other DSA tape drive (for transfer commands only)
- Console terminal
- RX33 disk drive or equivalent (HSC controller)
- TU58 tape device or equivalent (HSC50 controller)

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

Software required to run ILTAPE includes:

- HSC controller executive (CHRONIC)
- Diagnostic execution monitor (DEMON)
- K.sti/K.si microcode (installed with the K.sti/K.si module)

4.7.1 Operating Instructions

The following steps outline the procedure for running ILTAPE. The test assumes 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.

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 get the HSCxx> prompt. The keyboard monitor responds with the prompt:

```
HSCxx>
```

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

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

4.7.2 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 up to several minutes. Certain errors that occur during execution will cause ILTAPE to terminate automatically.

4.7.3 User Dialog

The following paragraphs describe ILTAPE/user dialog during execution of ILTAPE. Note that the default values for input parameters appear within the brackets of the prompt. The absence of a value within the brackets indicates 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 Tnnn, where *nnn* is the MSCP unit number (such as T316).

For a full interface test, enter Xm, where *m* is any number. Entering 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 Tnnn at the Drive Unit Number prompt, ILTAPE issues the following prompt:

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

Enter Y or press Return 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 with a 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, you will get the following prompt:

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

To test the tape transport, enter Y. If you enter N or Return 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 4.7.4 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 get an error message and be reprompted 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 get an error message and be re-prompted for density. Selecting ALL tests the drive at normal and compacted densities in separate passes. Since 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 prompts 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]?
```

The supported speed in inches per second is shown as ssss. The maximum number of supported speeds is 4. Thus, n cannot be greater than 4.

To select a fixed speed, enter a digit (n) corresponding to one of the above 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:

```
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 prompts appear:

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

Enter the number of unique words in the data pattern. Up to 16 words are permitted.

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

Enter the data pattern word (in hex), for example, ABCD (hexadecimal). 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. Errors encountered during execution cause the display of appropriate messages.

4.7.4 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
 Cnnn —Counter set to *nnn* (0 = 1000.)
 Dnnn —Delay *nnn* ticks (0 = 1000.)
 BRnn—Branch unconditionally to step *nn*
 DBnn—Decrement counter and branch if nonzero to step *nn*
 TMnn—Branch on Tape Mark to step *nn*
 NTnn—Branch on NO Tape Mark to step *nn*
 ETnn—Branch on EOT to step *nn*
 NEnn—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 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. 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, type 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 indicates the user sequence just entered should not be stored. In this case, the sequence cannot be run at a later time.

An example of entering 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 end-of-tape (EOT) is encountered prior to writing 950 records, the tape is rewound and the sequence terminates. Note, 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 reprompted 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.

4.7.5 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:

```
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 appropriate error message is printed on the terminal.

4.7.6 Test Summaries

The following sections summarize the tests run by ILTAPE.

4.7.6.1 Interface Test Summary

The interface test summary of ILTAPE tests the STI (standard tape interface) 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 probabilities of the STI set are:

- 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 indicated in the preceding list.

4.7.6.2 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.

4.7.6.3 User Sequence Test Summary

User sequences are used to exercise the tape transport. The particular sequence is totally user-defined. Refer to Section 4.7.4.

4.7.6.4 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.

4.7.6.5 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.

4.7.7 Error Message Example

All error messages issued by ILTAPE conforms to the generic error message format described in Section 4.1.2. 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 is executing when an error occurs. This number does not indicate a separate test that can be called. Table 4-1 defines the ILTAPE test levels.

Table 4-1 ILTAPE Test Levels

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

The optional text is dependent upon the type of error.

4.7.8 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. Information in 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. Information in 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 number or port number is out of range or 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, it was determined that the revision level 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 load device media is properly installed. The program reprompts for a user sequence number. To break the loop of reprompts, enter Ctrl/y.
- **Load Device Read Error**—While attempting to read a user sequence from the load device, a read error was encountered. Ensure a sequence has been stored on the load device as identified by the user sequence number. The program reprompts for a user sequence number. To break the loop of reprompts, 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 reprompts, enter Ctrl/y.
- **PATTERN WORD ERROR** — During the execution of a user or canned sequence, the pattern word was compared to the data on tape and 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. Information in 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**—Selected device is online to another controller or host.
- **Requested Device Unknown**—Device requested is not known to the tape subsystem.
- **Requestor Not A K.sti**—Selected requestor is not known to the system as a tape data channel.
- **Selected Unit Not a Tape**—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, 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 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 it is online to another controller. Verify 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 offline. Check the drive and assure that it remains online for the duration of the test.
- **Unknown Status from TDUSUB**—An unknown status was returned from the tape diagnostic interface.

4.8 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

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

The data records are arranged as follows:

- Sixty-six 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 containing pattern 33.

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

4.8.1 System Requirements

The hardware requirements necessary to run ILTCOM include:

- An HSC controller with K.sti/K.si
- 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:

- CHRONIC
- DEMON
- K.sti/K.si microcode
- TFUNCT
- TDUSUB

4.8.2 Operating Instructions

The following steps outline the procedure for running ILTCOM. ILTCOM assumes 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 get the HSCxx> prompt. The keyboard monitor responds with the prompt:

```
HSCxx>
```

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

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

4.8.3 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.

4.8.4 Parameter Entry

ILTCOM allows the writing, reading, listing, or modifying 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, with or without the optional data compaction board installed, ILTCOM 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 get an error message.

If the device under test is not a TA90 tape drive, ILTCOM prompts for density as follows:

```
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 entering 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 beginning of tape (BOT). If the read function is selected, the following prompt appears:

```
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 have 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 appears at the terminal:

```
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.

4.8.5 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 merely reports incompatibilities and other errors as they occur.

4.8.6 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
```

where:

E *nnn* is an error number.

U-Txxxxx indicates the TMSCP (Tape Mass Storage Control Protocol) unit number.

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 tape position (in objects) from BOT.

4.8.7 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**—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 offline, online to another controller, or is not available.
- **TDUSUB Initialization Failure**—Tape path cannot be established due to insufficient resources.
- **Unknown Status from TDUSUB**—An unknown error condition returned from the software interface TDUSUB.

4.9 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.

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

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 runs with other processes on the HSC controller. It is loaded from the RX33 disk drive or TU58 tape drive, and uses the services of the DEMON and the control software.

4.9.1 System Requirements

In order for the ILEXER program to run, the following hardware and software items must be available.

Hardware requirements include:

- Console terminal
- P.ioj/c (processor) module with boot ROMs
- K.sdi, K.sti, and/or K.si data channel module
- Memory module
- RX33 disk drive (HSC controller) or TU58 tape drive (HSC50 controller)
- SDI compatible disk drive and/or STI compatible tape drive

Software requirements include:

- Control program (system diskette or tape)
- Diagnostic execution monitor (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).

4.9.2 Operating Instructions

Enter Ctrl/y to get the HSCxx> prompt. The keyboard monitor responds with the prompt:

```
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
```

4.9.3 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 the Ctrl/y may have no effect for a brief moment and may need repetition. Whenever ILEXER is terminated, whether normally or by operator abort, ILEXER always completes any outstanding I/O requests and prints a final performance summary.

4.9.4 Parameter Entry

The parameters in ILEXER follow the format:

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

where:

PROMPT DESCRIPTION explains the type of information ILEXER needs from the operator. The 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 entered 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:

```
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 Dnnnn or Tnnnn, 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 Return. 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 online 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: either all disk drives, all tape drives, or a combination of the two.

4.9.5 Disk Drive Prompts

The following prompts are presented if the drive selected for test is a disk drive:

```
ACCESS USER DATA AREA (Y/N) [N]?
```

If this prompt is answered with an N or Return, testing is confined to the disk area reserved for diagnostics or integrity tests (DBN area). The multidrive exerciser continues with the TERMINATE TEST ON THIS DRIVE FOLLOWING INITIAL WRITE prompt.

Answering Y to this and the next prompt directs ILEXER to perform testing in the user data area.

NOTE

It is the operator's responsibility to see that the data contained there is either backed up or of no value.

ARE YOU SURE (Y/N) [N]?

Answering N 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 (Y/N) [Y]?

Answer N if you suspect the drive is bad. If you are positive the drive is good, answer Y 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 (Y/N) [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 a Return, the prompt immediately following is omitted.

TERMINATE TEST ON THIS DRIVE FOLLOWING INITIAL WRITE (Y/N) [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 that part of the test following the initial write portion. Even if the operator requests read-only mode, the drive will not be write protected until after any initial write has been completed.

SEQUENTIAL ACCESS (Y/N) [N]?

The operator has the option of requesting all disk data access be performed in a sequential manner.

READ ONLY (Y/N) [N]?

If answered N, the operator is asked 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]?

The operator has the option of selecting one of 16 disk data patterns. Selecting data pattern 0 allows the user to specify a pattern with a maximum of 16 words. The default data pattern (15) is the factory format data pattern.

WRITE ONLY (Y/N) [N]?

This option permits only write operations on a disk. This prompt is not displayed if read-only mode is selected.

DATA COMPARE (Y/N) [N]?

If this prompt is answered with an N or a Return, data read from the disk is not checked; for example, disk data is not compared to the expected pattern. If the prompt is answered with 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 (Y/N) [N]?
```

Answering Y causes ILEXER to check the data returned by every disk read operation. Answering with an N or a Return 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 do data compares unless absolutely necessary.

```
ANOTHER DRIVE (Y/N) []?
```

Answering Y permits selection of another drive for exercising. This prompt has no default. Answering N causes ILEXER to prompt:

```
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.

Once the preceding parameters are entered, ILEXER continues with the global user prompts listed in Section 4.9.7.

4.9.6 Tape Drive Prompts

ILEXER displays the following prompts if the drive selected is a tape drive:

```
Do you wish to enable enhanced protocol (Y/N) [Y]?
```

This prompt is displayed if you have selected a tape drive that supports enhanced protocol. If you answer Y or a Return, your test is run in the default enhanced protocol. Answering N runs the test in normal protocol.

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

Answering N results in a reprompt for the drive unit number. Answering Y displays the next prompt.

```
ARE YOU SURE (Y/N) [N]?
```

If the answer is N, the operator is reprompted for the drive unit number. If answered with 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 4.9.8.

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 get an error message.

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

```
SELECT AUTOMATIC SPEED MANAGEMENT (Y/N) [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 the operator to select a speed. See the tape drive user documentation for available speeds.

```
SELECT FIXED [VARIABLE] SPEED (D) [1]?
```

This prompt allows selection of variable speed for the tape drive selected. See the tape drive user documentation for available speeds.

```
RECORD LENGTH IN BYTES (1 to 12288) (D) [8192]?
```

Response to this prompt specifies the size in bytes of a tape record. Maximum size is 12 KB. 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 KB.

```
DATA COMPARE (Y/N) [N]?
```

Answering N results in no data compares performed during a read from tape. Answering Y causes the following prompt:

```
DATA COMPARE ALWAYS (Y/N) [N]?
```

Answering Y selects data compares to be performed on every tape read operation. Answering N causes data compares to be performed on 15 percent of the tape reads.

```
ANOTHER DRIVE (Y/N) []?
```

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 4.9.7 are presented. This prompt has no default, allowing the operator to default all other prompts and set up another drive for this pass of ILEXER.

4.9.7 Global Prompts

The following prompts are presented to the operator 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]?
```

The number of hard errors allowed for the drives being exercised can be specified. 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 of errors:

- 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 prompt next calls for:

NARROW REPORT (Y/N) [N]?

Answering Y presents a narrow report which displays the performance summaries in 32 columns. The default display, selected by answering N or pressing the Return key, is 80 columns. The format of this display is described in further detail in Section 4.9.12. This report format is intended for use by small hand-held terminals.

ENABLE SOFT ERROR REPORTS (Y/N) [N]?

Answering Y enables soft error reports. By default, the operator does not see any soft error reports specific to the number of retries required on a tape I/O operation.

Answering N results in no soft error report. Soft errors are classified as those errors that eventually complete successfully after explicit controller-managed retry operations. They include read, write, and read reverse requested retries.

4.9.8 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 User Defined	Pattern 1 105613	Pattern 2 031463	Pattern 3 030221
Pattern 4 Shifting 1s	Pattern 5 Shifting 0s	Pattern 6 Alter 1s,0s	Pattern 7 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 B0101../B1010..	Pattern 9 B110... 155554	Pattern 10 26455/151322	Pattern 11 066666
052525		026455	
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 Ripple 1	Pattern 13 Ripple 0	Pattern 14	Pattern 15
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 Alternating one and zero bits 125252 125252	Pattern 17 All ones	Pattern 18 Alternating bytes of all ones	Pattern 19 Alternating bytes of all ones and all zeros
Pattern 20 Alternating two bytes ones and two bytes zeros	Pattern 21 Alternating four bytes ones and four bytes zeros	Pattern 22 Alternating three bytes of ones and one byte zeros	Pattern 23 Alternating bytes of ones and zeros with high byte in pattern number also zero*

*Pattern 23 is used with odd record sizes.

4.9.9 Setting/Clearing Flags

The ENABLE SOFT ERROR REPORT display prompt in Section 4.9.7 allows the operator to inhibit the display of soft error reports. No other error reports can be inhibited.

4.9.10 Progress Reports

ILEXER has three basic forms of progress reports: the data transfer error report, the performance summary, and the communication error report.

- 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 a 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.

4.9.11 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.

4.9.12 Performance Summary

The performance summary is printed on the terminal at the end of a manually terminated testing session, or after the specified number of minutes for the periodic performance summary. This report provides statistical data which 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 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 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  HHHHHHHHHH ddddddddd dddddddd dddddddd dddd  dddd  dddd
Tddd  HHHHHHHHHH ddddddddd dddddddd dddddddd dddd  dddd  dddd

```

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.
- **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 KBs read by ILEXER on each drive.
- **Kbyte Written**—The number of KBs 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 dddd  dddd   dddd  dddd  dddd  dddd  dddd  dddd

```

An explanation of the summary columns 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 HHHHHHHHHHHH
P ddddd
R dddddddddd
W dddddddddd
HE dddd
SE dddd
SC dddd

```

This report 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 dddd
ILEXER>D>DF dddd
ILEXER>D>DR dddd
ILEXER>D>SF dddd
ILEXER>D>SR dddd
ILEXER>D>OA dddd
ILEXER>D>OB dddd
ILEXER>D>OC dddd

```

4.9.13 Communications Error Report

Whenever ILEXER encounters an error that prevents it from communicating with one of the drives to be exercised, ILEXER issues a standard error report. This report gives details enabling the operator to identify the problem. For further isolation of the problem, the operator should run another test specifically designed to isolate the failure (ILDISK or ILTAPE).

4.9.14 Test Summaries

The test numbers in ILEXER correspond to the module being executed within ILEXER itself. The main module is called the multidrive exerciser (MDE), and it calls all other modules.

- **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 gets 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 online 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 the drives are at the beginning of tape (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:
 - a. If the drive is read only and data compare is not requested, a read operation is queued to the drive.
 - b. If read only and data compare (occasional) are requested, a read operation is queued along with a random choice of compare/no-compare.
 - c. If read only and data compare (always) are requested by the operator, a READ-COMPARE command is queued to the drive.
 - d. If write only is requested, and data compare is not, then a write request is queued to the disk drive.
 - e. If write only and data compare (occasional) are requested, a write operation is queued along with a random choice of compare/no-compare.
 - f. If write only and data compare (always) are requested, a WRITE-COMPARE command is queued to the drive.
 - g. If only data compare (occasional) is requested, then a random selection of read/write and compare/no-compare is done.
 - h. 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:
 - a. No reads when no records exist before or after the current position.
 - b. No writes when records exist after the current position.
 - c. No position of record when no records exist before or after the current position.

- d. 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:

1. READ FORWARD
2. WRITE FORWARD
3. POSITION FORWARD
4. READ REVERSE
5. REWIND
6. 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 a 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.

4.9.15 Error Message Format

ILEXER outputs four types of error formats:

- 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.

4.9.15.1 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:

```
ILEXER>D>error message
```

The error message is an ASCII string describing the type of error discovered.

4.9.15.2 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:

```

ILEXER>D>hh:mm T#ddd E#ddd 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.

4.9.15.3 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:

```

ILEXER>D>hh:mm T#ddd E#ddd U-dddd
ILEXER>D>Error Description
ILEXER>D>MA -- HHHHHHHHHH
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.

4.9.15.4 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.

4.9.16 Error Messages

This section lists the informational and error messages and explains the cause of each error. A typical error message is:

```
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.

4.9.16.1 Informational Messages

Informational messages are not fatal to the exerciser and are intended only to:

- 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 online 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 online 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 online 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 online 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 online 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 online 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 x/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**—Reprompts for the correct values. The operator selected a starting block number for the test that is greater than the ending block number selected, or it 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 reprompted for the value.

4.9.16.2 Generic Errors

The following list indicates the error text and cause of errors displayed by ILEXER. ILEXER generic errors have error 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 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 offline 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 online.
 - 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 online. 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 online.
- **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 online 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 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 entry of parameters and also check the write protection on the drive to make sure they are consistent.

4.9.16.3 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 offline 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 messages 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 Customer 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 Xnnnn, 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.

4.9.16.4 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. 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 offline 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 online.
- **Couldn't Get Unit Characteristics**—The drive is not communicating with ILEXER. The unit could be offline.
- **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 online to the available state while being exercised.
- **Drive Went Available...Removing from Test**—During the exercise the drive unexpectedly transitioned from the online to the available state.
- **Drive Went Off Line...Removing from Test**—The drive went offline during the exercise. This is caused by the operator taking the drive offline or a hard failure forcing the drive offline.
- **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 4.9.7). 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 due to this error.

Setting System Parameters

5.1 Introduction

The procedure described in this chapter will complete the online portion of the HSC controller installation. This procedure describes how to set system parameters from the HSC controller console terminal.

Do **not** push in the Online switch on the HSC controller 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.

5.2 Setting System Parameters

After the HSC boot process has loaded the software, an initialization process reads a System Configuration Table (SCT) from the load media. The 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 top of 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 following procedures to reset the SCT to the default.

NOTE

Before performing either procedure, print a hardcopy of all the system parameters and save them for Digital Customer Services personnel.

Perform the following steps to reboot the HSC controller:

1. Verify that the OCP Online switch is out (HSC controller is offline).
2. Hold the Fault switch in and press and release the INIT switch. Continue holding the Fault switch in until the "INIPIO-I Booting..." portion of the boot message is displayed:

```
INIPIO-I Booting...
      HSCxx Version Vx.xx day-month-year 17:00:41      System HSC009
      Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific.

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 controller OCP will display 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.

The second method of booting is to:

Enter SET SCT CLEAR at the SETSHO> prompt. This command is equivalent to holding in the Fault switch during the initial phase of boot.

Both booting actions return the SCT to factory settings. After the HSC controller boots, it prints a message indicating the factory SCT is in use.

NOTE

Both of these 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 (set at installation time for a node address unique to the cluster).

The default SCT is installed at the manufacturing site. The system identification, system name, and allocation are changed with the SETSHO utility.

After completion of the boot process, as indicated by the system version on the console terminal, enter a Ctrl/y to get the following prompt:

```
HSC>
```

NOTE

Load media must be write enabled for the SET commands to work.

Enter RUN SETSHO at the HSC> prompt. The following prompt is displayed:

```
SETSHO>
```

NOTE

The SETSHO utility is a tool used to examine and change the internal state of the HSC controller relative to hosts and devices. SETSHO thereby controls portions of the HSC decision-making process. More information on the SETSHO utility is contained in the *HSC Controller User Guide*.

To obtain basic information about SETSHO, enter HELP at the SETSHO> prompt.

Before setting the system parameters, enter SHOW SYSTEM at the SETSHO> prompt. The terminal displays the current system parameters. Print a hardcopy of the system parameters for reference should you wish to reset the system parameters to these settings. Refer to Section 5.2.4 for an example of a SHOW SYSTEM display.

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 TABLE 1-1 AND CHECK PROPER MODULE CONFIGURATION.

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Figure 5-1 Operator Control Panel Fault Codes

5.2.1 Setting the System Identification Number

To set the system identification number, enter the following at the SETSHO> prompt:

```
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 7FFFFFFFFFFFF.

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 at the HSC> prompt:

```
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. A subsequent reboot sets the system name.

Press the Return key.

5.2.3 Setting the Storage Allocation Class

To set the storage allocation class, enter the following at the HSC> prompt:

```
SET ALLOCATE DISK N and/or 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. 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.

After the reboot, enter a Ctrl/y to return to the HSC> prompt. Enter SHOW SYSTEM at the HSC> prompt. The following is a sample printout from a SHOW SYSTEM command:

CTRL/C

```
HSC> SHOW SYSTEM Return
 3-Nov-1989 13:08:33.84 Boot: 2-Nov-1989 16:47:17.84 Up: 20:21
Version: V600 System ID: %X00000000FA05 Name: HSC005
Front Panel: Enabled HSC Type: HSC70
Console Dump: Enabled
Automatic DITs: Enabled
Periodic DITs: Enabled, Interval = 1
Disk Allocation Class: 0 Tape Allocation Class: 0
Start-up Command File: Disabled
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 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.

6

Upgrading Your HSC40 Controller to an HSC60 Controller

6.1 Introduction

This chapter describes the steps necessary to upgrade your HSC40 controller to the higher performance model HSC60 controller. After installing your upgrade kit, the upgraded HSC controller will be the higher level model in all respects.

To upgrade your existing HSC40 controller to an HSC60 controller, refer to Table 6–1 for the upgrade kit order number. This table also contains additional HSC controller upgrade kit order numbers to upgrade other HSC controller models.

Table 6–1 HSC Controllers Upgrade Kits Order Numbers and Descriptions

Order Number	Description
HSC6X-AA	HSC40 controller to HSC60 controller
HSC7X-AA	HSC40 controller to HSC70 controller, 60 HZ
HSC7X-AB	HSC40 controller to HSC70 controller, 50 HZ
HSC9X-CA	HSC60 controller to HSC90 controller, 60 HZ
HSC9X-CB	HSC60 controller to HSC90 controller, 50 HZ
HSC9X-AA	HSC70 controller to HSC90 controller

6.2 Preparing for the Upgrade

Perform the following steps to prepare for the upgrade:

1. Use the packing slip to verify that all the components of the upgrade kit are included and are not damaged. If there is a discrepancy between Table 6–2 and the packing slip, the packing slip takes priority.

Table 6-2 HSC6X-AA Upgrade Kit Contents

Digital Part Number	Component Description	Quantity
L0111-YD	P.ioj-18 I/O Control Processor module	1
L0123-AA	M.std4 Memory Standard module	1
L0124-AA	K.pli2 Port Processor module	1
L0125-AA	PILA2 Port Buffer module	1
L0118-YA	Port LINK module	1
17-00958-01	SI cables	4
74-38607-04	HSC60 medallion	1
36-15946-01	HSC60 product conversion label	1
36-21684-01-01	HSC60 module placement label	1
EK-H4060-IN-001	<i>HSC40 to HSC60 Controller Upgrade Procedure</i>	1

- At the HSC> prompt on your console terminal screen display, enter a SHOW ALL command to extract the system parameters. The SHOW ALL command displays information and parameters of the following SHOW commands:

SHOW CI	SHOW MEMORY
SHOW CONNECTIONS	SHOW ODT
SHOW DISK	SHOW REQUESTORS
SHOW ERROR	SHOW SERVER CACHE
SHOW EXCEPTION	SHOW SERVER DISK
SHOW HOST	SHOW SYSTEM
SHOW LINES	SHOW TAPE
SHOW LOAD	SHOW VIRTUAL_CIRCUITS

- Print a hardcopy of these system parameters if your system does not automatically produce a copy. You will use this copy to reset the HSC software parameters after installing your upgrade components.
- If your cluster does not have failover capabilities, shut down the cluster and go to step 6.
- Fail over all disk and tape drives to the alternate HSC controller.

6. Enter the `SHOW TAPES` and `SHOW DISKS` commands to verify that no tape or disk drives are on line to the HSC controller being upgraded:

```
HSC>SHOW DISKS [Return]

Unit   Req   Port   Type   State           Cached Access  Version
   8     5     2     RA70   Not Available   Yes-A  Host    MC-79, iHV-7

Units in NOHOST_ACCESS Table:

Units in NOCACHE Table:

SETSHO-I Program Exit

[Ctrl Y]

HSC> SHOW TAPES [Return]

Unit   Req   Port   Type   State           Version
  196   2     1     TA81   Not Available

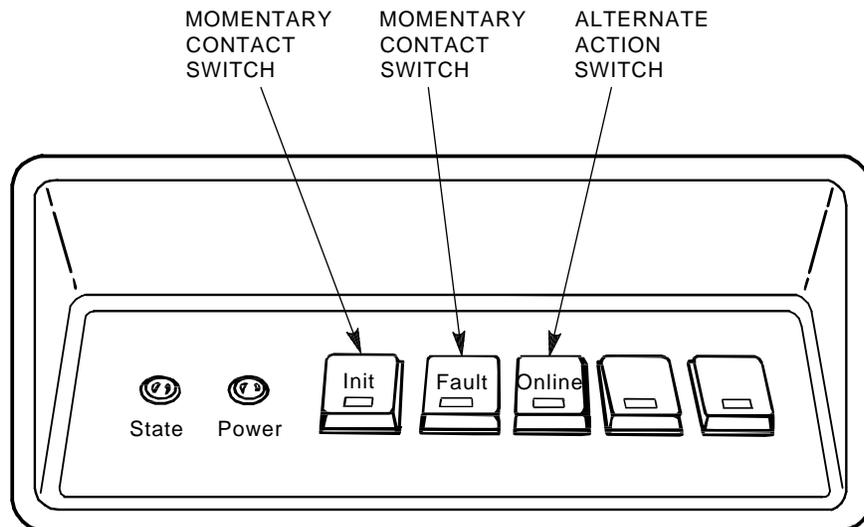
The Tape NOHOST_ACCESS Table is empty.

SETSHO-I Program Exit
```

6.3 Installing Upgrade Kit Modules

Install the new modules from the upgrade kit using the following procedure:

1. Set the Online switch on the HSC controller operator control panel (OCP) to the out position. Refer to Figure 6-1 for the location of the Online switch.
2. Open the front door of the HSC controller cabinet.

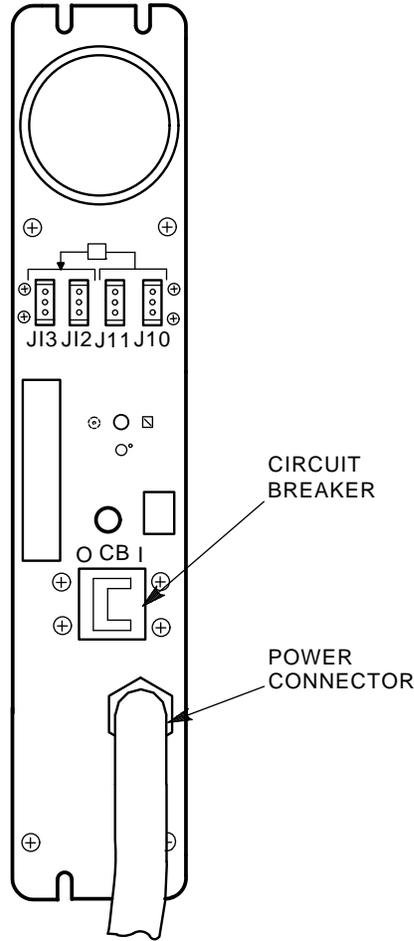


CXO-008B_S

Figure 6-1 Locating the OCP Online Switch

3. Turn the dc power off by setting the DC power switch to the 0 position. The DC power switch is located on the left side of the RX33 disk drive housing at the front of the HSC controller.
4. Open the rear door of the HSC controller cabinet.

5. Refer to Figure 6-2 and turn off ac power by setting the HSC power controller circuit breaker (CB) to the 0 position. Verify that power is off by checking that no LEDs are lit on the installed modules.



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Figure 6-2 HSC Power Controller Front Panel

CAUTION

If the power control bus is connected to another device, use caution when removing the power control bus cable. This bus could be daisy chained to other equipment that is not related to the HSC controller.

6. At the front of your HSC controller, turn the nylon latches on the card cage cover plate one-quarter turn clockwise or counterclockwise. Pull the card cage cover up and out and set it aside.

CAUTION

Do not attempt to upgrade the HSC controller 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.

7. Remove selected HSC40 modules and replace them with the upgrade modules listed in Table 6-3.

Table 6-3 Upgrade Modules for HSC40 to HSC60 Controller Upgrade

Card Cage Slot Number	HSC40 to HSC60 Module Changes
Slot 1:	
Remove module	L0111-YA
Replace with module	L0111-YD
Slot 2:	
Remove module	L0117-AA ¹
Replace with module	L0123-AA
Slot 12:	
Remove module	L0107-YA
Replace with module	L0124-AA
Slot 13:	
Remove module	L0109-00
Replace with module	L0125-AA
Slot 14:	
Remove module	L0118-00
Replace with module	L0118-YA

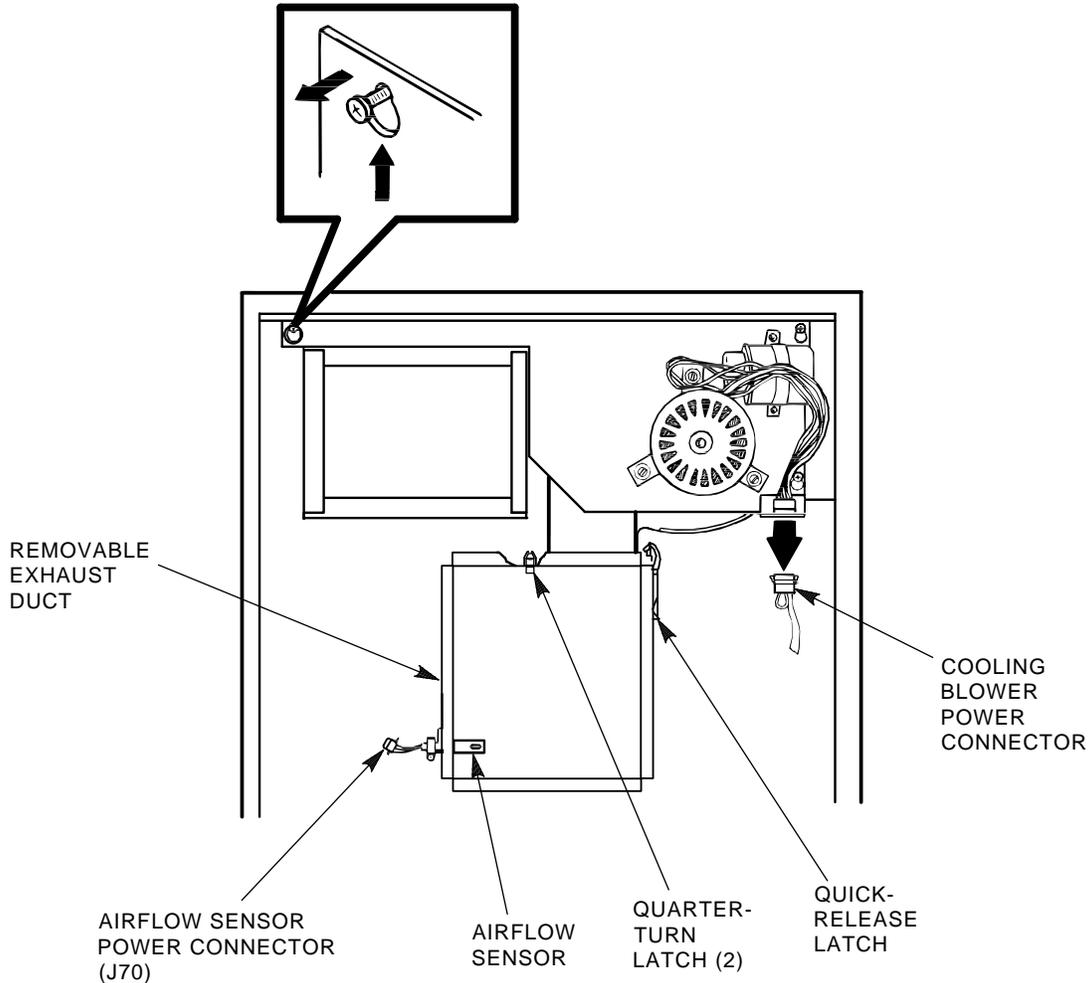
¹May already have L0123-AA installed.

8. Attach the labels accompanying the new modules to the appropriate slot position on the module utilization label. The utilization label is located directly above the module card cage.

6.4 Installing 8-Port K.si Module SDI Cables

Use the following procedure to install the necessary SDI cables for 8-port K.si disk data channel modules:

1. Refer to Figure 6-3 and disconnect the airflow sensor power connector (J70) from the side of the exhaust duct.
2. Remove the exhaust duct from the bottom of the blower duct by lifting up the quick release latch on the right side of the exhaust duct, and turning the two quarter-turn latches on the inside left side of the exhaust duct clockwise or counterclockwise. This hardware is shown in Figure 6-3.



CXO-939C_S

Figure 6-3 Removing the Exhaust Duct and Airflow Sensor

3. Refer to Figure 6-4 and install SDI cables to the HSC controller backplane at sections H/J/K/L. The SDI cable connectors are keyed to be installed only one way. Do not use excessive force; if a connector does not seat easily, be sure you have correctly aligned the connector key with the backplane connector key.

- Connect the I/O bulkhead end of each SDI cable using Figure 6-4 and Table 6-4 as your guide. These cable connectors are also keyed to be installed only one way. Do not use excessive force; if a connector does not seat easily, be sure you have correctly aligned the key.

Table 6-4 Locations for SDI Cable Connectors

Backplane Requestor	Backplane Section	Port Connector	Position In I/O Bulkhead
3	H	0	H0
3	H	1	H1
3	H	2	H2
3	H	3	H3
4	J	0	J0
4	J	1	J1
4	J	2	J2
4	J	3	J3
5	K	0	K0
5	K	1	K1
5	K	2	K2
5	K	3	K3
6	L	0	L0
6	L	1	L1
6	L	2	L2
6	L	3	L3

- Install the right-hand screws to all connectors on the I/O bulkhead. Then install the left-hand screws. Recheck the screws for tightness, being careful to not disturb the other I/O bulkhead connectors.
- Verify that all connectors on the backplane and I/O bulkhead are seated. Verify that you have not disturbed any of the connectors on the CI shelf during installation.
- Replace the exhaust duct and the airflow sensor power connector.

6.5 Post-Upgrade Tests

Use the following procedure to test the upgrade:

- Add new requestors (disk or tape data channel modules) to the HSC controller as required. If you are installing new K.si 4-port or 8-port data channel modules, refer to the *Installation Procedure For HSC5X-DA And HSC9X-FA K.si Data Channel Modules*, included with your K.si module option kit.

The K.si modules are by default disk data channels after initial installation or on first boot of the HSC software. If the attached devices are tape drives, perform initialization and reconfigure procedures, as described in the *Installation Procedure For HSC5X-DA And HSC9X-FA K.si Data Channel Modules*.

- Replace the card cage cover after all new modules have been installed.

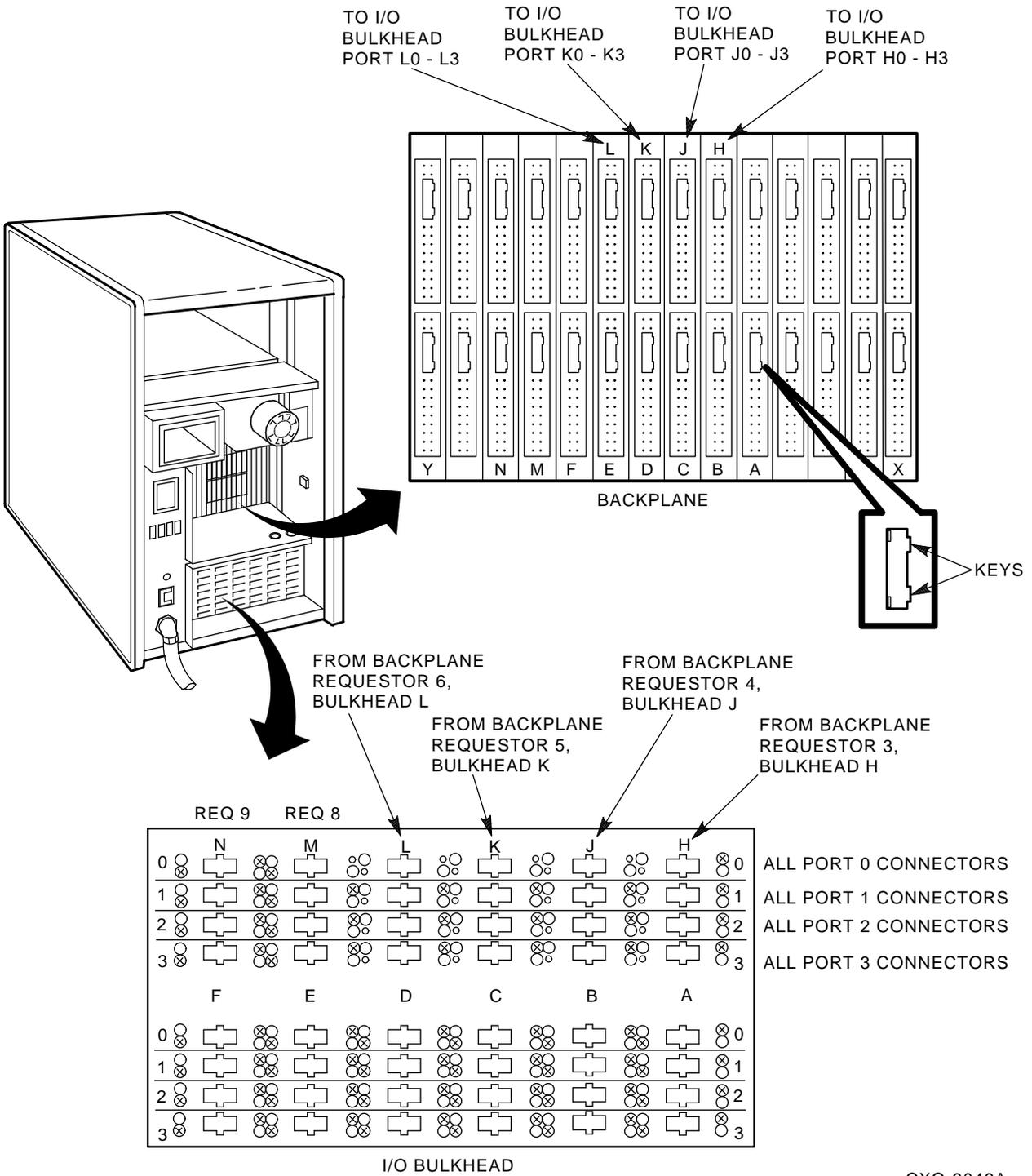


Figure 6-4 Installing SDI Interconnect Cables to the I/O Bulkhead Panel

3. Reconnect the HSC controller power cord to the power source.
4. Turn on the HSC controller by setting the circuit breaker (CB) on the HSC power controller to 1 (ON).

5. Ensure the Secure/Enable switch is in the ENABLE position.
6. Verify that the Online switch is in the out position.
7. Ensure that the System and Utilities diskette is installed and the RX33 drive release handle is closed.
8. At the front of the HSC controller, set the DC power switch to ON.
9. Ensure that the Power indicator on the OCP is on.

NOTE

If the OCP Power indicator is not on, reset the circuit breaker to 0 (OFF), remove the requestors from the backplane, and set the circuit breaker to 1 again. This check determines if any of the new requestors are causing a problem.

10. All HSC controller module green status LEDs should be on.
11. The HSC automatic reboot begins. Verify that the HSC controller console terminal displays the following boot message:

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

```
    HSCxx Version X.XX day-month-year 17:00:41    System HSC009
```

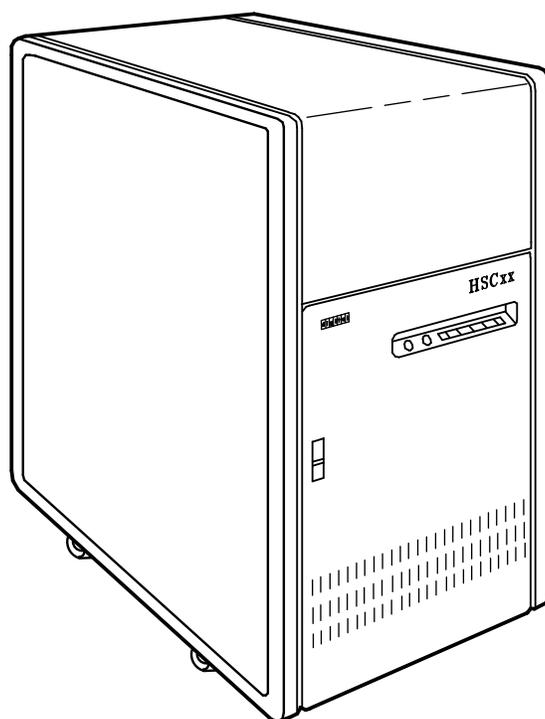
```
    Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific. If you do not get this message, 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 re-apply power.

6.6 Completing the Upgrade

Perform the following steps to complete the upgrade procedure.

1. Replace the HSC40 controller serial number label on the rear door of the HSC controller with the new HSC60 controller serial number label included with your upgrade kit.
2. Change the logo on the front door of your HSC40 controller to reflect the new HSC60 controller model number. Figure 6-5 shows the location of the HSC model decal.



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Figure 6-5 Locating the HSCxx Controller Model Number Decal

3. Attach the new Digital HSC60 medallion as follows:
 - a. On the inside of the HSC controller front door, remove the old logo by snipping off the pins behind their securing clips.
 - b. Push the new Digital HSC60 medallion through the holes in the front door and secure by twisting the new wing clips onto the medallion's pins.
4. Close and latch the front and rear doors of the HSC controller.
5. Hold the Fault switch in and switch 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...
```

```
HSCxx Version Vx.xx day-month-year 17:00:41    System HSC009  
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific.

6. Enter the SHOW ALL command at the HSC> prompt and compare the display to the hard copy you made in step 2 of Section 6.2.

- Set the system name, ID, disk allocation, and tape allocation using the appropriate SET commands. Reset other parameters as required by the site.

NOTE

Only reset the SET REQUESTOR parameters if the software has been upgraded, 4-port K.si modules are added and configured with tape drives, or tape-to-disk drive/disk drive-to-tape data channel module changes are made.

- Enter the SHOW REQUESTORS command to identify the requestors. In the following example for an HSC90, a 4-port K.si module is in Requestor 2 and an 8-port K.si module is in Requestor 6. Note that the 8-port K.si module is identified by **8disk** in the Microcode Loaded column and **K.si/8** in the Status column. The Req column also lists both bulkhead connectors for the 8-port K.si module.

```

[Ctrl/y]
HSC> SHOW REQUESTORS [Return]
Req      Status      Type           Version      Microcode Loaded
0        Enabled      P.ioj
1        Enabled      K.ci          MC- 45 DS- 2 Pila-65 K.pli-5  N/A
2/A      Enabled      K.si          MC- 9  DS- 4      disk
3/B      Enabled      K.sdi         MC- 40 DS- 3      N/A
4/C      Enabled      K.sdi         MC- 42 DS- 3      N/A
5/D      Enabled      K.sdi         MC- 40 DS- 3      N/A
6/EL     Enabled      K.si/8        MC- 9  DS- 4      8disk
7/F      Enabled      K.sdi         MC- 42 DS- 3      N/A
8/M      Enabled      K.sdi         MC- 39 DS- 3      N/A
9/N      Enabled      K.sdi         MC- 42 DS- 3      N/A

SETSHO-I Program Exit


```

For each requestor, the following information is displayed:

- Requestor number and bulkhead
 - Status (enabled or disabled)
 - Type of requestor (P.ioj/c, K.ci, K.si, K.sdi, K.sti, or Empty)
 - Microcode version
 - If the requestor is a K.si, the microcode loaded is also displayed. In the example, Requestor 2 is a K.si that is configured as a disk data channel. By default, disk microcode is loaded into a K.si.
- Enter reconfiguring commands as follows, then reboot the HSC controller.

```

[Ctrl/y]
HSC>RUN SETSHO [Return]
SETSHO>SET REQUESTOR 2/TYPE=TAPE [Return]
SETSHO-I Your settings require an IMMEDIATE reboot on exit.
SETSHO>EXIT [Return]
SETSHO-Q Rebooting HSC, type Y to continue, CTRL/Y to abort:Y [Return]
INIPIO-I Booting...

HSCxx Version Vx.xx day-month-year 17:00:41      System HSC009
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.


```

10. Check to see if any red status indicators are lit on any modules in the card cage. Follow standard troubleshooting procedures and replace any failed modules. (If a module is replaced, you may have to reset all of your system parameters.)
11. Set the Online switch to the in position. Check that the Online indicator on the OCP lights within 15 seconds. Enter Ctrl/y, then reconcile any error messages.
12. Ensure that VMS can access the disks for that HSC controller by mounting and performing failover on the disks, if applicable. Verify that at least one disk or tape per requestor is functional on the upgraded HSC controller.
13. Connect any additional cables and install any disks as required to complete the subsystem installation.

To ensure that the upgrade modules are fully functional, run ILDISK, ILTAPE (as required), ILEXER, and ILMEMY device integrity tests. Refer to Chapter 4 for instructions when running these tests.

6.7 Returning The Removed Modules

Digital Customer Services personnel and customers who install their own upgrades should use the following instructions for repackaging and returning the removed HSC controller modules. Use the following procedure in the in U.S. area only.

1. Package the HSC module removed from the HSC controller in the same container(s) in which the HSC6X-AA upgrade option kit was shipped. Be sure the return address label has been removed from inside the box prior to packing.

CAUTION

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.

2. Seal the container securely with packing tape.
3. Affix the return address label from the upgrade kit on the outside of the package. Be sure to cover up all previous shipping information with the label or with packing tape. If the label is lost or missing from the kit, refer to Figure 6-6 and make a suitable label.

RETURN TO
Returns Sort Center
D001

DEC # _____ RA # _____

Ship to:
Digital Equipment Corp.
Rt 127 Dock Area D001
Contoocook, NH 03229-9210
ATTN: Returns Sort Center

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Figure 6-6 Sample Return Mailing Label

4. Contact your district CAS representative for a Return Authorization Number (RA#). CAS will also need the Digital sales order number (DEC#) and the customer name. CAS will arrange for pickup of this material.

NOTE

If you don't know the appropriate CAS representative, contact the district sales office for instructions.

5. Write the DEC# and the RA# on the return address label. Please be sure this number is legible.
6. Digital Customer Services Engineers should advise the customer that they will be billed for these modules if they are not returned to Digital Equipment Corporation. If there are any questions, customer should contact his sales representative.
7. Ensure that the package is sent to the customer shipping area for pickup.
8. Digital Customer Services Engineers: Fill out LARS form, ensuring that the fields listed in Table 6-5 are filled out as indicated.

Table 6-5 LARS Form Fields

Field	Required Entry
System Processor Type:	HSC
Activity:	N
Call Type:	I
Module/Fail Area:	HSC6X-AA RA#_ _ _ The HSC controller upgrade kit order number (HSC6X-AA) is as listed in the shipping paperwork. Ensure that the RA number (RA#) is also as listed.

7

Upgrading Your HSC40 Controller to an HSC70 Controller

7.1 Introduction

This chapter describes the steps necessary to upgrade your present HSC40 controller to the model HSC70 controller. After installing your upgrade kit, the upgraded HSC controller will be the higher level model in all respects.

To upgrade your existing HSC40 controller to an HSC70 controller, refer to Table 7–1 for the upgrade kit order number. This table also contains additional HSC controller upgrade kit order numbers to upgrade other HSC controller models.

Table 7–1 HSC Controllers Upgrade Kits Order Numbers and Descriptions

Order Number	Description
HSC6X-AA	HSC40 controller to HSC60 controller
HSC7X-AA	HSC40 controller to HSC70 controller, 60 HZ
HSC7X-AB	HSC40 controller to HSC70 controller, 50 HZ
HSC9X-CA	HSC60 controller to HSC90 controller, 60 HZ
HSC9X-CB	HSC60 controller to HSC90 controller, 50 HZ
HSC9X-AA	HSC70 controller to HSC90 controller

7.2 Preparing for the Upgrade

Perform the following steps to prepare for the upgrade:

1. Use the packing slip to verify that all the components of the upgrade kit are included and are not damaged. Table 7–2 lists the components found in your upgrade kit. If there is a discrepancy between this table and the packing slip, the packing slip takes priority.

Table 7-2 HSC7X-AA or HSC7X-AB Upgrade Kit Contents

Digital Part Number	Component Description	Quantity
L0111-00	P.ioj I/O Control Processor module	1
HSC5X-EA or -EB	60 HZ or 50 HZ auxiliary power supply	1
17-00958-01	SI cables	4
74-38607-07	Digital HSC70 medallion	1
36-15946-01	Label, product conversion	1
EK-H4070-IN-001	<i>HSC40 to HSC70 Controller Upgrade Procedure</i>	1

- At the HSC> prompt on your console terminal, enter the SHOW ALL command to extract the system parameters. The SHOW ALL command displays information and parameters of the following SHOW commands:

SHOW CI	SHOW MEMORY
SHOW CONNECTIONS	SHOW ODT
SHOW DISK	SHOW REQUESTORS
SHOW ERROR	SHOW SERVER CACHE
SHOW EXCEPTION	SHOW SERVER DISK
SHOW HOST	SHOW SYSTEM
SHOW LINES	SHOW TAPE
SHOW LOAD	SHOW VIRTUAL_CIRCUITS

- Print a hardcopy of these system parameters if your system does not automatically produce a copy. You will use this copy to reset the HSC software parameters after installing your upgrade components.
- If your cluster does not have failover capabilities, shut down the cluster and go to step 6.
- Fail over all disk and tape drives to the alternate HSC controller.

6. Enter the `SHOW DISKS` and `SHOW TAPES` commands to verify that no tape or disk drives are on line to the HSC controller being upgraded:

```
HSC>SHOW DISKS [Return]

Unit   Req   Port   Type   State   Cached Access  Version
   8     5     2     RA70   Available Yes-A  Host   MC-79, HV-7

Units in NOHOST_ACCESS Table:

Units in NOCACHE Table:

SETSHO-I Program Exit

[Ctrl/Y]

HSC> SHOW TAPES [Return]

Unit   Req   Port   Type   State   Version
  196   2     1     TA81   Not Available

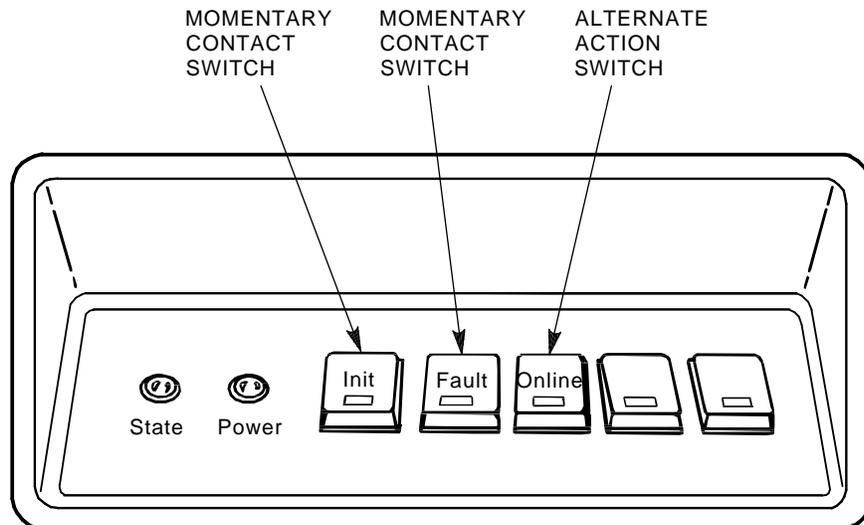
The Tape NOHOST_ACCESS Table is empty.

SETSHO-I Program Exit
```

7.3 Installing Upgrade Kit Modules

Install the new module(s) from the upgrade kit using the following procedure:

1. Set the Online switch on your HSC40 controller operator control panel (OCP) to the out position. Refer to Figure 7-1 for the location of the Online switch.

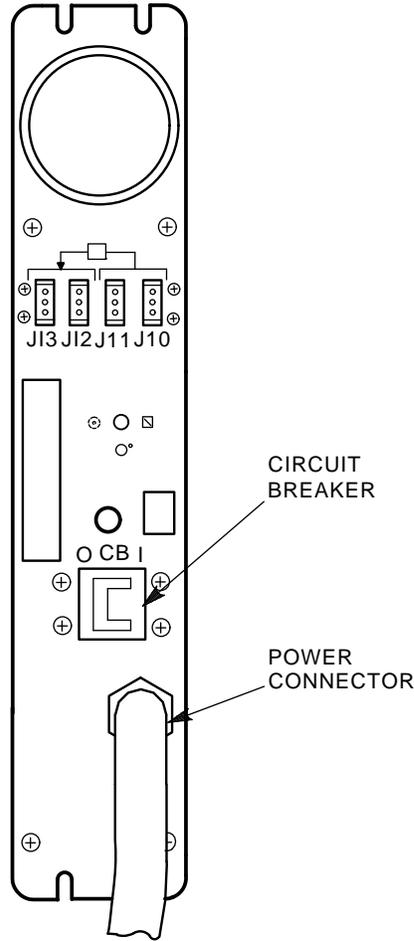


CXO-008B_S

Figure 7-1 Locating the OCP Online Switch

2. Open the front door of the HSC controller cabinet.
3. Turn the dc power off by setting the DC power switch to the 0 position. The DC power switch is located on the left side of the RX33 disk controller housing at the front of the HSC controller.
4. Open the rear door of the HSC controller cabinet.

5. Refer to Figure 7-2 and turn off ac power by setting the HSC power controller circuit breaker (CB) to the 0 position. Verify that power is off by checking that no LEDs are lit on any of the installed modules.



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Figure 7-2 Locating the HSC Power Controller Circuit Breaker

CAUTION

If the power control bus is connected to another device, use caution when removing the power control bus cable. This bus could be daisy-chained to other equipment that is not related to this HSC controller.

6. Disconnect the HSC power cord from the power source.

CAUTION

Do not attempt to upgrade the HSC controller 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.

7. At the front of your HSC controller, turn the nylon latches on the card cage cover plate one-quarter turn clockwise, or counterclockwise. Pull the card cage cover up and out and set it aside.
8. Remove selected HSC40 modules and replace them with the upgrade modules as listed in Table 7-3.

Table 7-3 Upgrade Module(s) for HSC40 to HSC70 Controller Upgrade

Card Cage Slot Number	HSC40 to HSC70 Module Changes
Slot 1:	
Remove module	L0111-YA
Replace with module	L0111-00

9. Attach the module labels accompanying the new modules to the appropriate slot position on the module utilization label. The utilization label is located directly above the module card cage.

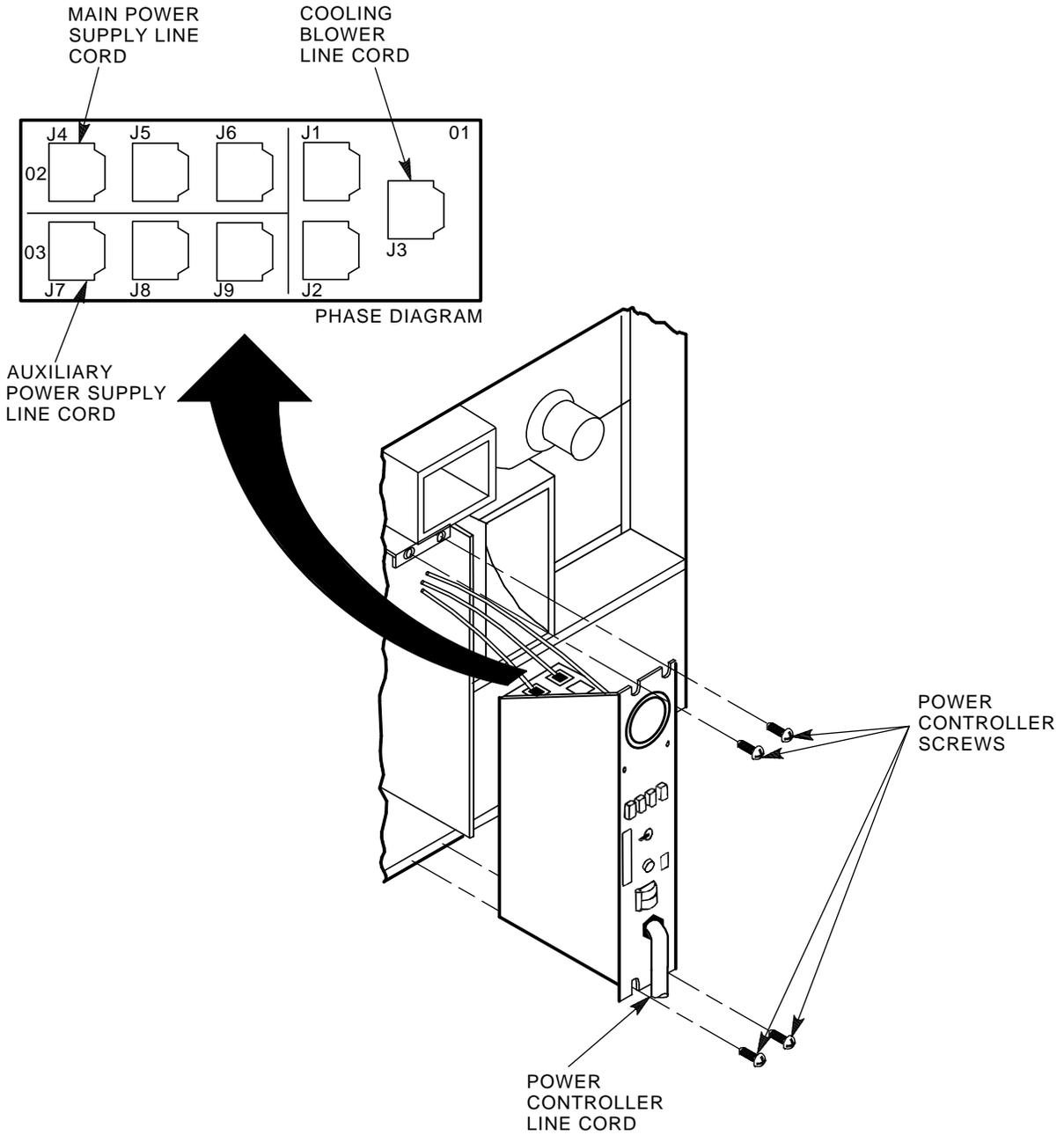
7.4 Installing An Auxiliary Power Supply (HSC5X-EA/EB)

Use the following procedure to install the auxiliary power supply in your HSC40 controller.

CAUTION

Use care when removing the cabinet doors so you do not damage the OCP cable at the front door and the I/O cables at the rear door of the HSC controller cabinet.

1. At the front door of the HSC controller cabinet, disconnect P40 on the OCP and the green grounding wire near the bottom of the door.
2. Remove both doors of the cabinet by pulling down on the spring-loaded rod on the top hinge inside the door. Lift the doors off their bottom pins.
3. Remove the rear door latch, by removing its screws, to provide the needed clearance to remove the HSC power controller. It is necessary to remove the HSC power controller to access the rear of the auxiliary power supply and its cables.
4. Refer to Figure 7-3. Remove the two top screws and then the two bottom screws that secure the HSC power controller to the cabinet. While removing the two bottom screws, push up on the HSC power controller to take the weight off the screws.
5. Pull the HSC power controller out only enough to allow removal of the power control bus cables. Refer to Figure 7-3 and remove the power control bus cables from connectors J10, J11, J12, and J13 on the front panel of the HSC power controller. Label these cables as you remove them for reference when reinstalling the power controller.
6. Pull the HSC power controller completely out of the cabinet and set it on the floor next to the HSC controller. *Be careful to not stress the cables that remain attached to top panel of the power controller.*
7. At the front of the HSC cabinet, remove the baffle plate over the auxiliary power supply space. Figure 7-4 shows the auxiliary power supply housing that will replace the baffle plate.
8. Refer to Figure 7-4. Slide the auxiliary power supply into its housing in the cabinet. Make sure that the power cord is not pinched between the auxiliary power supply and the cabinet while performing this step.

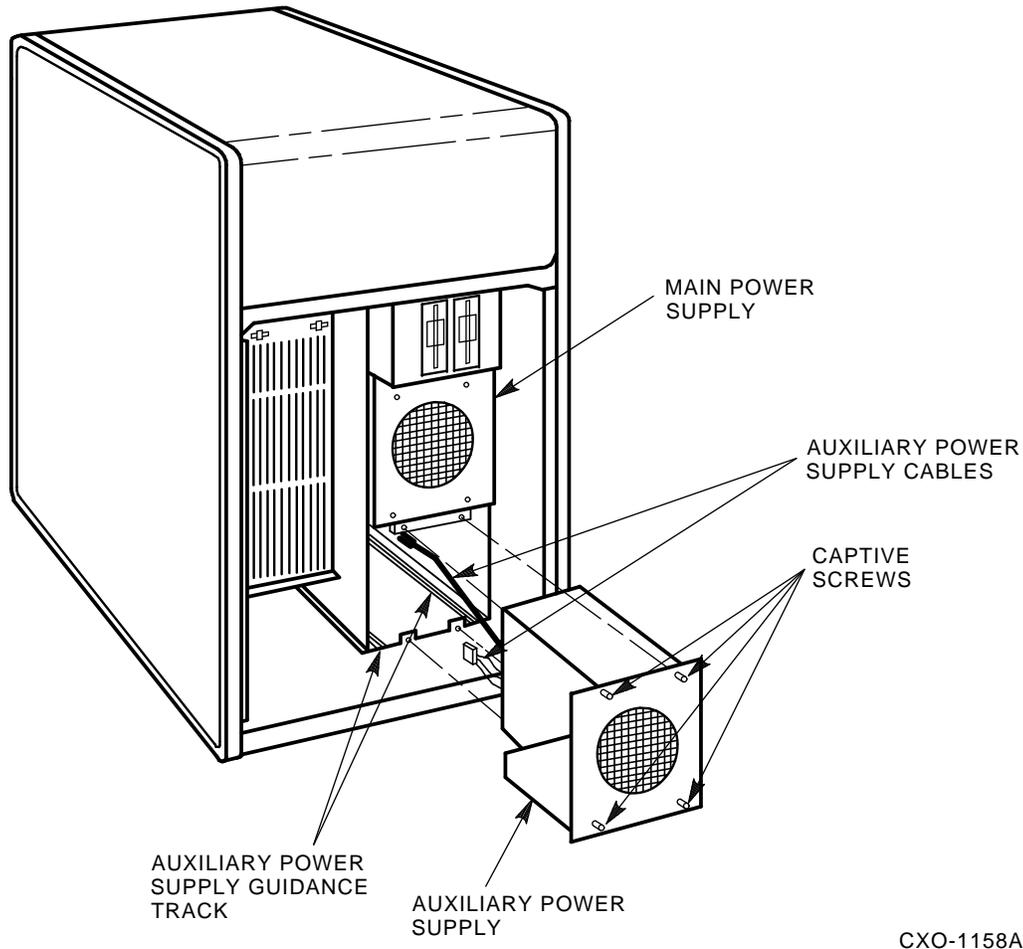


CXO-941D

Figure 7-3 Removing the HSC Power Controller

9. Secure the four captive screws on the front of the auxiliary power supply to the power supply cabinet bracket. These screws are shown in Figure 7-4.
10. Refer to Figure 7-5. Connect the following cables to the rear of the auxiliary power supply. The terminals on auxiliary power supply terminal board TB1 are numbered from left to right.
 - a. Connect J50 to the 3-pin connector, P50.

- b. Connect J51 to the 2-pin connector, P51.
- c. Install the flexbus from the HSC controller backplane to the two studs on the lower righthand edge of TB1.
- d. Route the power cord of the auxiliary power supply through the auxiliary power supply space and around into the HSC power controller space.



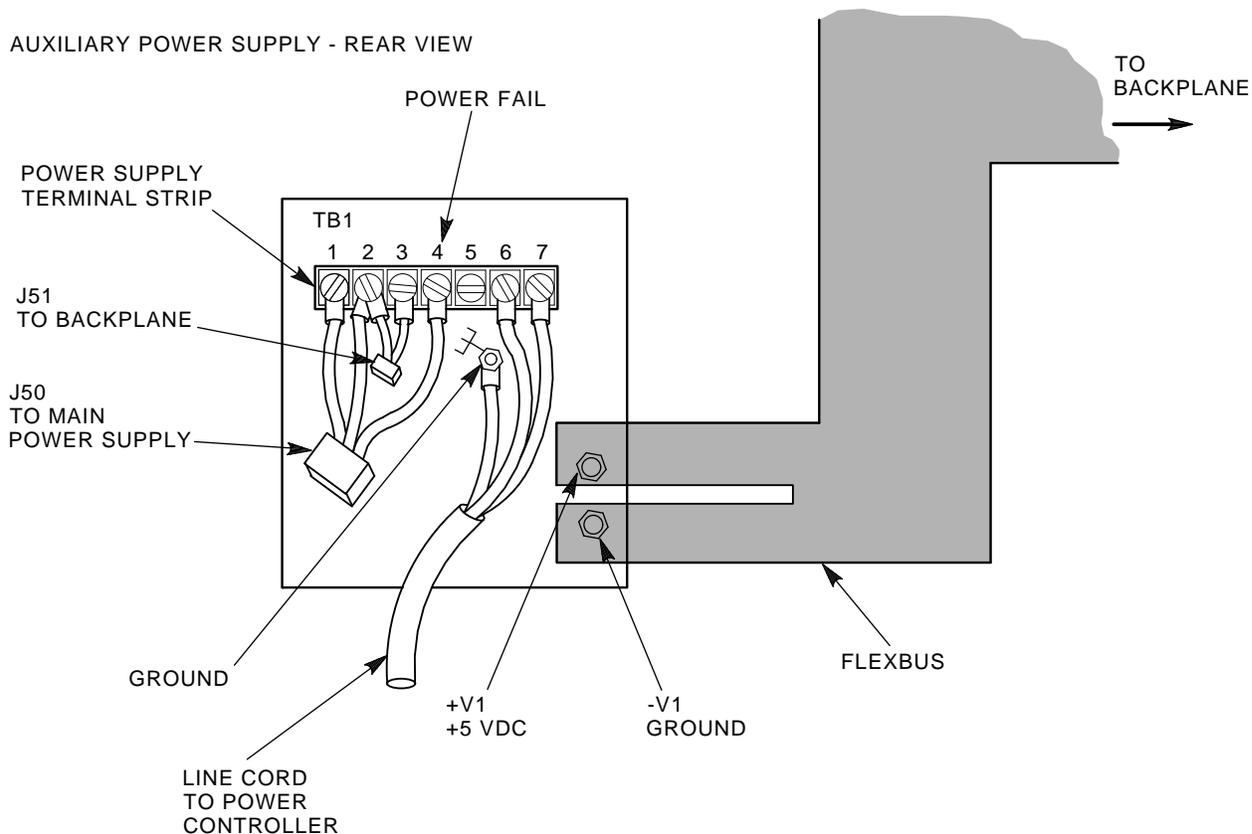
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Figure 7-4 Installing the Auxiliary Power Supply

11. Connect the auxiliary power supply line cord to J7 on the power controller. To ensure proper phase distribution of the source voltage, verify that the main power supply (J4) and cooling blower (J3) line cords as shown in Figure 7-3 are still attached to the top panel of the HSC power controller.
12. Reinstall the power controller in the reverse order that it was removed. You should have labeled all cables in previous steps.

WIRE LIST		
COLOR	POSITION	SIGNAL
BLACK	TBI-2	GROUND (5 V SENSE)
RED	TBI-1	5 V SENSE
BROWN	TBI-4	POWER FAIL
BLUE	TBI-7	ACC
BROWN	TBI-6	AC
GRN/YEL	TBI-5	CHASSIS GROUND
BLUE	TBI-3	ON/OFF
BLACK	TBI-2	GROUND (5 V SENSE)

AUXILIARY POWER SUPPLY - REAR VIEW



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Figure 7-5 Auxiliary Power Supply TB1 Connections

13. Reinstall the front and rear doors of the HSC cabinet. Reconnect P40 on the OCP and the green grounding wire at the bottom of the front door.
14. Reconnect the power cord to the power source and set the HSC power controller circuit breaker to the 1 (ON) position.

7.4.1 Auxiliary Power Supply Voltage Check Points

After you have completed the installation of your auxiliary power supply, check the voltages for the supply at the following points:

Voltage	Test Point	Check
+5.0 Vdc	Connector P40 on the OCP	Voltage between the red wire, pin 15, and the black wire, pin 14, should read between +4.95 and +5.15 Vdc. If this voltage is not within tolerance, remove power from the HSC controller immediately.
-5.2 Vdc	Connector P70 on the airflow sensor	Voltage between the orange wire, pin 3, and ground should read between -4.96 and -5.46 Vdc.
+12 Vdc	Connector P70 on the airflow sensor	Voltage between the purple wire, pin 1, and ground should read between 11.4 and 12.6 Vdc.

If the +5.0 Vdc output is not at least +4.95 Vdc, verify that the auxiliary power supply fan is running. If the fan is not running, verify that the power cord is correctly installed. If the fan is NOT running, recheck all connections. If all connections are good, replace the auxiliary power supply.

7.5 Post-Upgrade Tests

Use the following procedure to test the upgrade:

1. Add new requestors (disk or tape data channel modules) to the HSC controller as required. If you are installing new K.si 4-port data channel modules, refer to the *Installation Procedure For HSC5X-DA And HSC9X-FA K.si Data Channel Modules*, included with your K.si module option kit.

The K.si modules are by default disk data channels after initial installation or on first boot of the HSC software. If the attached devices are tape drives, perform initialization and reconfigure procedures, as described in the *Installation Procedure For HSC5X-DA And HSC9X-FA K.si Data Channel Modules*.
2. Replace the card cage cover after all new modules have been installed.
3. Reconnect the HSC controller power cord to the power source.
4. Turn on the HSC controller by setting the circuit breaker (CB) on the HSC power controller to 1 (ON).
5. Verify that the Online switch is in the out position.
6. Ensure that the System and Utilities diskette is installed and the RX33 drive release handle is closed.
7. At the front of the HSC controller, set the DC power switch to ON.

8. Ensure that the Power indicator on the OCP is on.

NOTE

If this indicator is not on, reset the circuit breaker to 0 (OFF), remove the new requestors from the backplane and set the CB to 1 (ON) again. This check determines if any of the new requestors are causing a problem.

9. All HSC controller module green status LEDs should be on.
10. The HSC automatic reboot begins. Verify that the HSC controller console terminal displays the following boot message:

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

```
HSCxx Version X.XX day-month-year 17:00:41 System HSC009
```

```
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific. If you do not get this message, 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 reapply power.

7.6 Completing the Upgrade

Perform the following steps to complete the upgrade procedure.

1. Replace the HSC40 controller serial number label on the rear door of the HSC controller with the new HSC70 controller serial number label included with your upgrade kit.
2. Change the logo on the front door of your HSC40 controller to reflect the new HSC70 controller model number. If the old logo is a decal, attach the new HSC70 controller logo medallion (from the upgrade kit) as follows:
 - a. Using the cardboard logo medallion template provided with your upgrade kit, align the template over the OCP. The fold at the right side of the template should fit between the door and the frame. The HSC40 decal should show through the template cutout above the OCP.
 - b. Remove the paper covering the adhesive-backed Digital HSC70 logo medallion.
 - c. While holding the template in place, stick the new logo medallion through the template cutout and over the top of the old HSC40 decal.
 - d. Press the medallion firmly on to the door.
 - e. Remove and discard the template.
3. If the old HSC40 logo is a medallion instead of a decal, attach the new Digital HSC70 medallion as follows:
4. Attach the new Digital HSC60 medallion as follows:
 - a. On the inside of the HSC controller front door, remove the old logo by snipping off the pins behind their securing clips.
 - b. Push the new Digital HSC60 medallion through the holes in the front door and secure by twisting the new wing clips onto the medallion's pins.
5. Close and latch the front and rear doors of the HSC controller.

6. Hold the Fault switch in and switch 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...
```

```
HSCxx Version Vx.xx day-month-year 17:00:41 System HSC009
```

```
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific.

7. Enter the SHOW ALL command at the HSC> prompt and compare the display to the hard copy you made in step 2 of Section 7.2.
8. Set the system name, ID, disk allocation, tape allocation, using the appropriate SET commands. Reset other parameters as required by the site.
9. Enter the SHOW REQUESTORS command to identify the requestors. In this example, 4-port K.si modules are in Requestors 2 and 6.

```
Ctrl/Y
```

```
HSC> SHOW REQUESTORS Return
```

Req	Status	Type	Version	Microcode	Loaded
0	Enabled	P.ioj			
1	Enabled	K.ci	MC- 45 DS- 2	Pila-65	K.pli-5 N/A
2/A	Enabled	K.si	MC- 9 DS- 4		disk
3/B	Enabled	K.sdi	MC- 40 DS- 3		N/A
4/C	Enabled	K.sdi	MC- 42 DS- 3		N/A
5/D	Enabled	K.sdi	MC- 40 DS- 3		N/A
6/E	Enabled	K.si	MC- 9 DS- 4		disk
7/F	Enabled	K.sdi	MC- 42 DS- 3		N/A
8/M	Enabled	K.sdi	MC- 39 DS- 3		N/A
9/N	Enabled	K.sdi	MC- 42 DS- 3		N/A

```
SETSHO-I Program Exit
```

For each requestor, the following information is displayed:

- Requestor number and bulkhead
- Status (enabled or disabled)
- Type of requestor (P.ioj/c, K.ci, K.si, K.sdi, K.sti, or Empty)
- Microcode version
- If the requestor is a K.si, the microcode loaded is also displayed. In the example, Requestor 2 is a K.si that is configured as a disk data channel. By default, disk microcode is loaded into a K.si.

10. Enter reconfiguring commands as follows, then reboot the HSC controller.

```
Ctrl/Y
```

```
HSC>RUN SETSHO Return
```

```
SETSHO>SET REQUESTOR 2/TYPE=TAPE Return
```

```
SETSHO-I Your settings require an IMMEDIATE reboot on exit.
```

```
SETSHO>EXIT Return
```

7-12 Upgrading Your HSC40 Controller to an HSC70 Controller

```
SETSHO-Q Rebooting HSC, type Y to continue,  
CTRL/Y to abort:Y Return  
INIPIO-I Booting...
```

```
HSCxx Version Vx.xx day-month-year 17:00:41    System HSC009  
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

11. Check to see if any red status indicators are lit on any modules in the card cage. Follow standard troubleshooting procedures and replace any failed modules. If a module is replaced, you may have to reset all of your system parameters.
12. Set the Online switch to the in position. Check that the Online indicator on the OCP lights within 15 seconds. Enter a Ctrl/Y, then reconcile any error messages.
13. Ensure that VMS can access the disks for that HSC controller by mounting and performing failover on the disks, if applicable. Verify that at least one disk or tape per requestor is functional on the upgraded HSC controller.
14. Connect any additional cables and install any disks or tapes as required to complete the subsystem installation.

To ensure the functionality of the upgrade, run ILDISK, ILTAPE (also as required, ILEXER, and ILMEMY). Refer to Chapter 4 for instructions when running these tests.

7.7 Returning The Removed Modules

Digital Customer Services personnel and customers who install their own upgrades should use the following instructions for repackaging and returning the removed HSC controller modules. Use the following procedure in the in U.S. area only.

1. Package the HSC module removed from the HSC controller in the same container(s) in which the HSC7X-AA/AB upgrade option kit was shipped. Be sure the return address label has been removed from inside the box prior to packing.

CAUTION

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.

2. Seal the container securely with packing tape.
3. Affix the return address label from the upgrade kit on the outside of the package. Be sure to cover up all previous shipping information with the label or with packing tape. If the label is lost or missing from the kit, refer to Figure 7-6 and make a suitable label.

RETURN TO
Returns Sort Center
D001

DEC # _____ RA # _____

Ship to:
Digital Equipment Corp.
Rt 127 Dock Area D001
Contoocook, NH 03229-9210
ATTN: Returns Sort Center

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Figure 7-6 Sample Return Mailing Label

4. Contact your district CAS representative for a Return Authorization Number (RA#). CAS will also need the Digital sales order number (DEC#) and the customer name. CAS will arrange for pickup of this material.

NOTE

If you don't know the appropriate CAS representative, contact the district sales office for instructions.

5. Write the DEC# and the RA# on the return address label. Please be sure this number is legible.
6. Digital Customer Services Engineers should advise the customer that they will be billed for these modules if they are not returned to Digital Equipment Corporation. If there are any questions, customer should contact his sales representative.
7. Ensure that the package is sent to the customer shipping area for pickup.
8. Digital Customer Services Engineers: Fill out LARS form, ensuring that the fields listed in Table 7-4 are filled out as indicated.

Table 7-4 LARS Form Fields

Field	Required Entry
System Processor Type:	HSC
Activity:	N
Call Type:	I
Module/Fail Area:	HSC7X-AA/AB RA#_ ___ The HSC controller upgrade kit order number (HSC7X-AA/AB) is as listed in the shipping paperwork. Ensure that the RA number (RA#) is also as listed.

8

Upgrading Your HSC60 Controller to an HSC90 Controller

8.1 Introduction

This chapter describes the steps necessary to upgrade your present HSC60 controller to the model HSC90 controller. After installing your upgrade kit, the upgraded HSC controller will be the higher level model in all respects.

To upgrade your existing HSC60 controller to an HSC90 controller, refer to Table 8–1 for the upgrade kit order number. This table also contains additional HSC controller upgrade kit order numbers to upgrade other HSC controller models.

Table 8–1 HSC Controllers Upgrade Kits Order Numbers and Descriptions

Order Number	Description
HSC6X-AA	HSC40 controller to HSC60 controller
HSC7X-AA	HSC40 controller to HSC70 controller, 60 HZ
HSC7X-AB	HSC40 controller to HSC70 controller, 50 HZ
HSC9X-CA	HSC60 controller to HSC90 controller, 60 HZ
HSC9X-CB	HSC60 controller to HSC90 controller, 50 HZ
HSC9X-AA	HSC70 controller to HSC90 controller

8.2 Preparing for the Upgrade

Perform the following steps to prepare for the upgrade:

1. Use the packing slip to verify that all the components of the upgrade kit are included and are not damaged. Table 8–2 lists the components found in your upgrade kit. If there is a discrepancy between this table and the packing slip, the packing slip takes priority.

Table 8-2 HSC9X-CA or HSC9X-CB Upgrade Kit Contents

Digital Part Number	Component Description	Quantity
L0111-YC	Pioj-18 I/O Control Processor module	1
HSC5X-EA or -EB	60 HZ or 50 HZ auxiliary power supply	1
74-38607-04	HSC90 Medallion	1
TBS	HSC90 serial number label	1
36-21758-02	Label, HSC Controller Module Replacement	1
36-15946-01	Label, Product Conversion	1
EK-H6090-IN-001	<i>HSC60 to HSC90 Controller Upgrade Procedure</i>	1

- At the HSC> prompt on your console terminal, enter the SHOW ALL command to extract the system parameters. The SHOW ALL command displays information and parameters of the following SHOW commands:

SHOW CI	SHOW MEMORY
SHOW CONNECTIONS	SHOW ODT
SHOW DISK	SHOW REQUESTORS
SHOW ERROR	SHOW SERVER CACHE
SHOW EXCEPTION	SHOW SERVER DISK
SHOW HOST	SHOW SYSTEM
SHOW LINES	SHOW TAPE
SHOW LOAD	SHOW VIRTUAL_CIRCUITS

- Print a hardcopy of these system parameters if your system does not automatically produce a copy. You will use this copy to reset the HSC software parameters after installing your upgrade components.
- If your cluster does not have failover capabilities, shut down the cluster and go to step 6.
- Fail over all disk and tape drives to the alternate HSC controller.

- Enter the SHOW TAPES and SHOW DISKS commands to verify that no tape or disk drives are on line to the HSC controller being upgraded:

```
HSC>SHOW DISKS [Return]

Unit   Req   Port   Type   State   Cached Access  Version
   8     5     2     RA70   Not Available   Yes-A  Host   MC-79, HV-7

Units in NOHOST_ACCESS Table:

Units in NOCACHE Table:

SETSHO-I Program Exit

[Ctrl Y]

HSC> SHOW TAPES [Return]

Unit   Req   Port   Type   State   Version
  196   2     1     TA81   Not Available

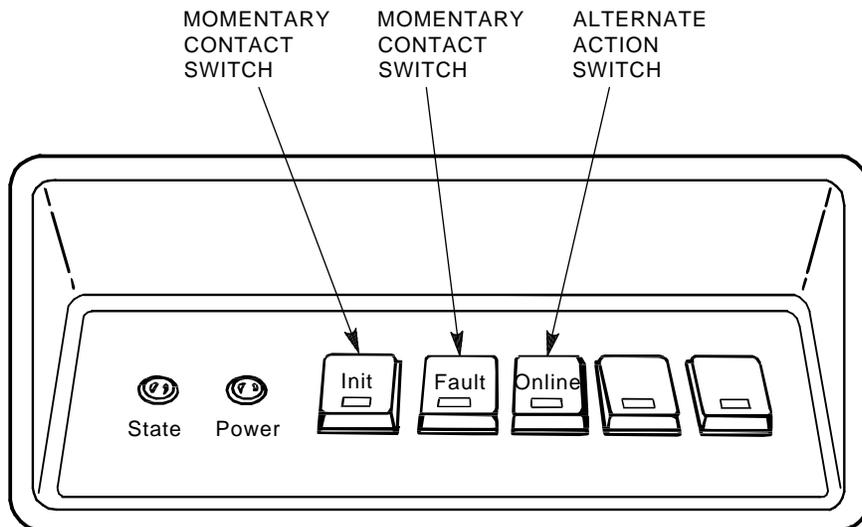
The Tape NOHOST_ACCESS Table is empty.

SETSHO-I Program Exit
```

8.3 Installing Upgrade Kit Modules

Install the new module(s) from the upgrade kit using the following procedure:

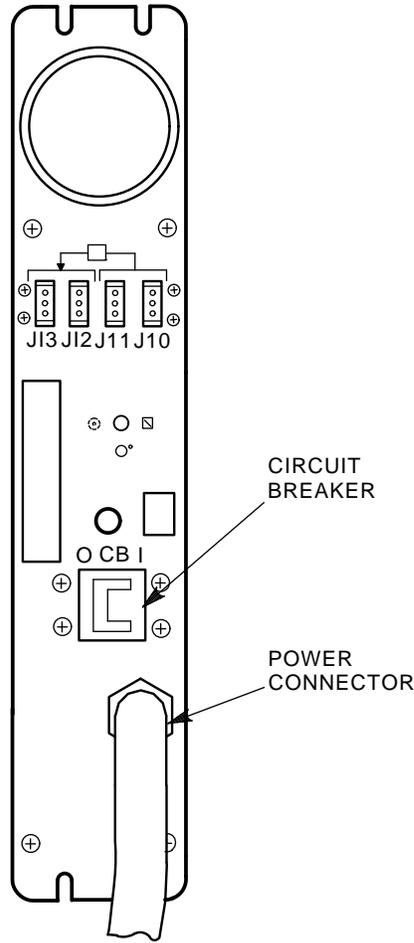
- Set the Online switch on your HSC60 controller operator control panel (OCP) to the out position. Refer to Figure 8-1.
- Open the front and rear doors of the HSC controller cabinet.



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Figure 8-1 Locating the OCP Online Switch

- Turn the dc power off by setting the dc power switch to the 0 position. The dc power switch is located on the left side of the RX33 disk controller housing at the front of the HSC controller.



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Figure 8-2 Locating the HSC Power Controller Circuit Breaker

4. Refer to Figure 8-2. Turn off ac power by setting the HSC power controller circuit breaker (CB) to the 0 position. Verify that power is off by checking that no LEDs are lit on any of the installed modules.

CAUTION

If the power control bus is connected to another device, use caution when removing the power control bus cable. This bus could be daisy-chained to other equipment that is not related to this HSC controller.

5. Disconnect the HSC power cord from the power source.

CAUTION

Do not attempt to upgrade an HSC controller 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.

6. At the front of your HSC controller, turn the nylon latches on the card cage cover plate one-quarter turn clockwise or counterclockwise. Pull the card cage cover up and out and set it aside.
7. Remove selected HSC60 modules and replace them with the upgrade modules as listed in Table 8–3.

Table 8–3 Upgrade Modules for HSC60 to HSC90 Controller Upgrade

Card Cage Slot Number	HSC60 to HSC90 Module Changes
Slot 1:	
Remove module	L0111–YD
Replace with module	L0111–YC

8. Attach the module labels accompanying the new modules to the appropriate slot position on the module utilization label. The utilization label is located directly above the module card cage.

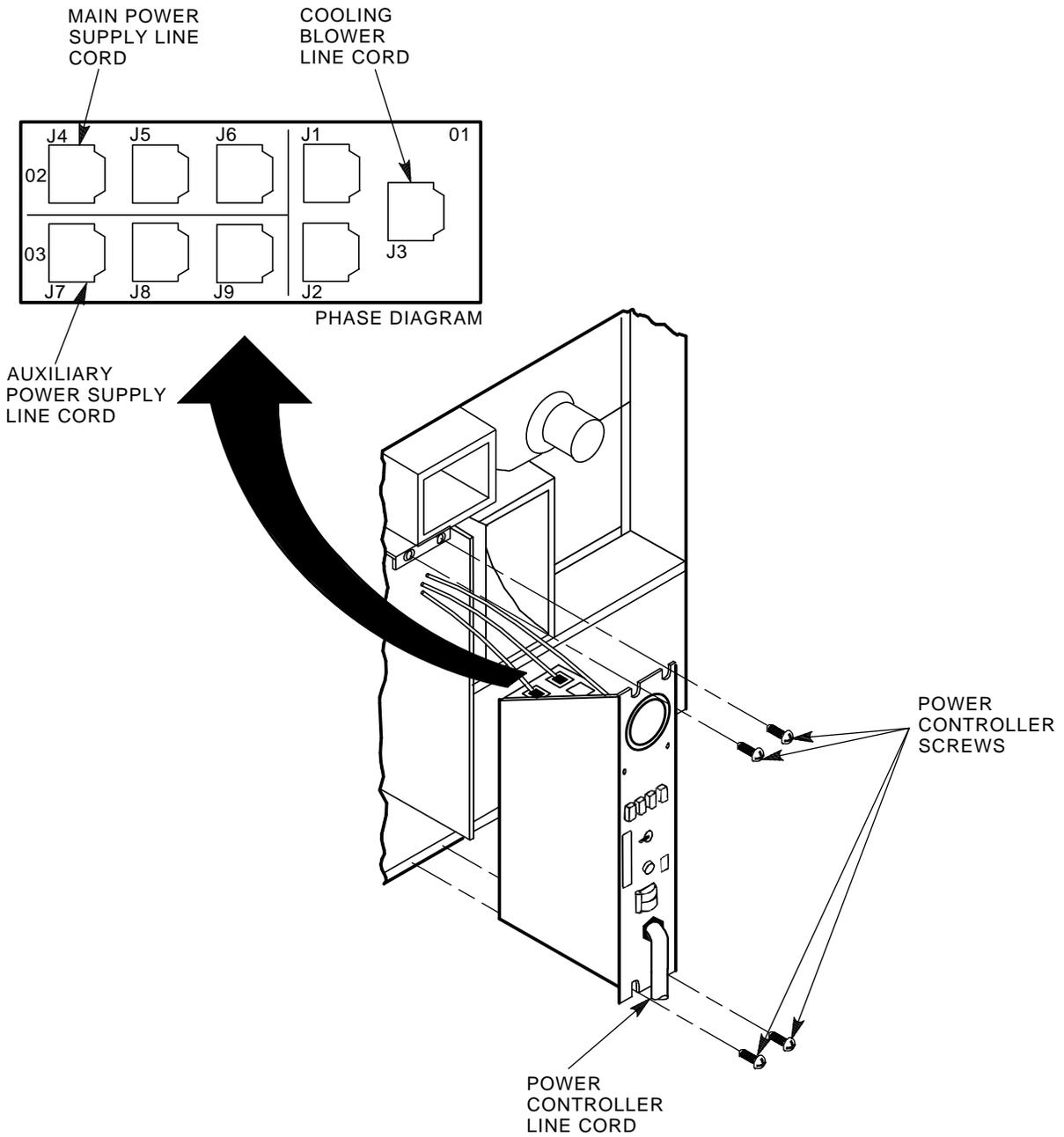
8.4 Installing An Auxiliary Power Supply (HSC5X–EA/EB)

Use the following procedure to install the auxiliary power supply in your HSC60 controller.

CAUTION

Use care when removing the HSC cabinet doors so you do not damage the OCP cable at the front door and the I/O cables at the rear door.

1. At the front door of the HSC controller cabinet, disconnect P40 on the OCP and the green grounding wire near the bottom of the door.
2. Remove both doors of the HSC cabinet by pulling down on the spring-loaded rod on the top hinge inside the door. Lift the doors off their bottom pins.
3. Remove the rear door latch to provide the needed clearance to remove the HSC power controller.
4. Refer to Figure 8–3. Remove the two top screws and then the two bottom screws that secure the HSC power controller to the HSC cabinet. While removing the two bottom screws, push up on the HSC power controller to take the weight off the screws.
5. Pull the power HSC controller out only enough to allow removal of the power control bus cables. Remove the power control bus cables from connectors J10, J11, J12, and J13 on the front panel of the HSC power controller. Label these cables as you remove them for reference when reinstalling.
6. Pull the HSC power controller out of the cabinet and set it on the floor next to the HSC controller. *Be careful to not stress the cables that remain attached to top panel of the power controller.*
7. Remove the baffle plate over the auxiliary power supply space in the front of the HSC cabinet (Figure 8–4).
8. Refer to Figure 8–4. Slide the auxiliary power supply into its housing in the cabinet. Make sure that the power cord is not pinched between the auxiliary power supply and the cabinet while performing this step.

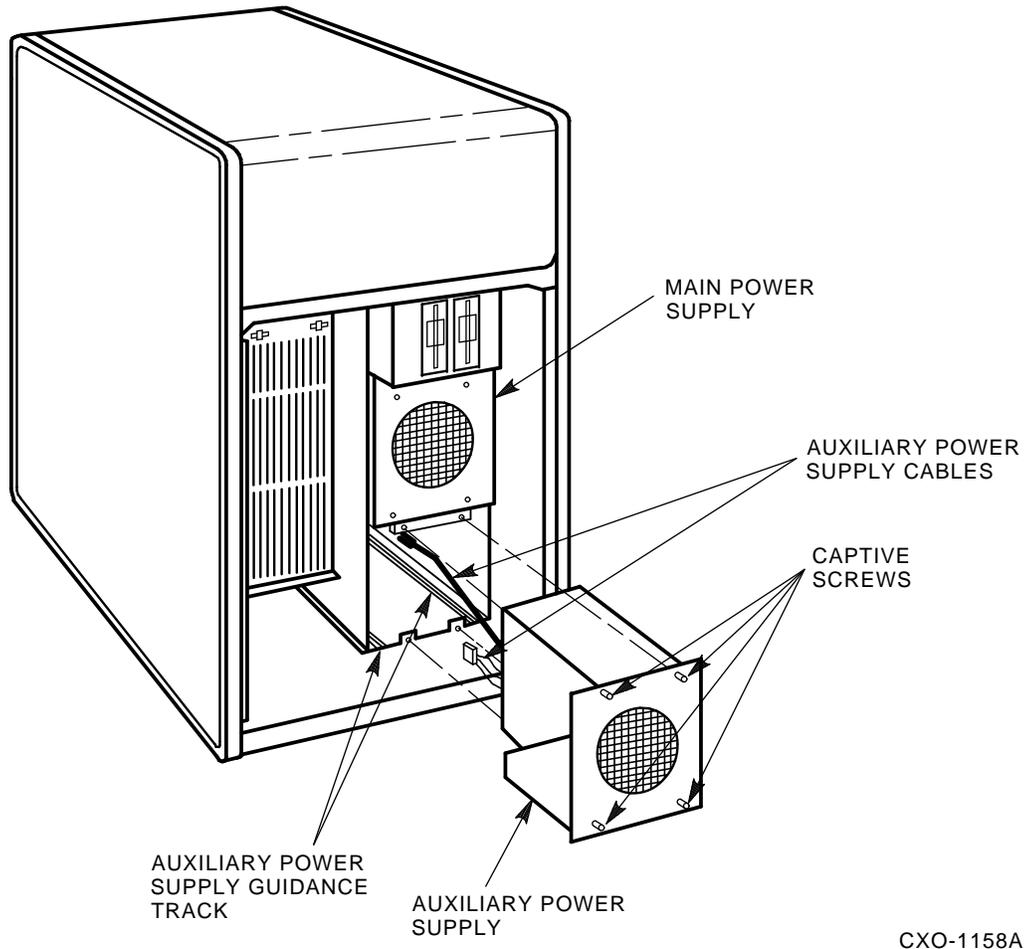


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Figure 8-3 Removing the HSC Power Controller

9. Secure the four captive screws on the auxiliary power supply to the power supply cabinet bracket. These screws are shown in Figure 8-4.
10. Refer to Figure 8-5. Connect the following cables to the back of the auxiliary power supply. The terminals on auxiliary power supply terminal board TB1 are numbered from left to right.
 - a. Connect J50 to the 3-pin connector, P50.

- b. Connect J51 to the 2-pin connector, P51.
- c. Install the flexbus from the HSC controller backplane to the two studs on the lower righthand edge of TB1 (Figure 8-5).
- d. Route the power cord of the auxiliary power supply through the auxiliary power supply space and around into the HSC power controller space.



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Figure 8-4 Installing Auxiliary Power Supply

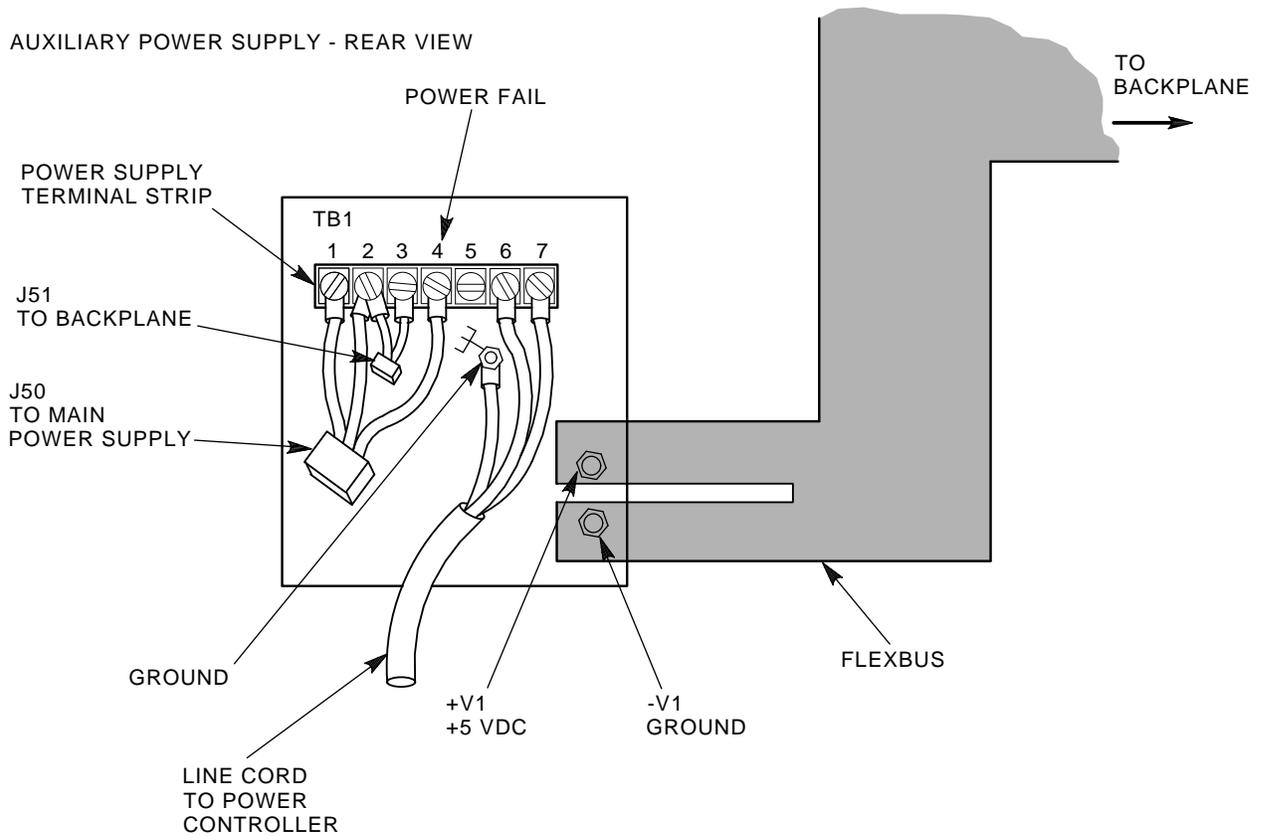
11. Connect the auxiliary power supply line cord to J7 on the HSC power controller. To ensure proper phase distribution of the source voltage, verify that the main power supply (J4) and cooling blower (J3) line cords as shown in Figure 8-3 are still attached to the top panel of the HSC power controller. Reinstall the HSC power controller.

8-8 Upgrading Your HSC60 Controller to an HSC90 Controller

12. Reinstall the front and rear doors of the HSC cabinet. Reconnect P40 on the OCP and the green grounding wire at the bottom of the HSC front door.
13. Reconnect the power cord to the power source and set the HSC power controller circuit breaker CB to the 1 position.

WIRE LIST		
COLOR	POSITION	SIGNAL
BLACK	TBI-2	GROUND (5 V SENSE)
RED	TBI-1	5 V SENSE
BROWN	TBI-4	POWER FAIL
BLUE	TBI-7	ACC
BROWN	TBI-6	AC
GRN/YEL	TBI-5	CHASSIS GROUND
BLUE	TBI-3	ON/OFF
BLACK	TBI-2	GROUND (5 V SENSE)

AUXILIARY POWER SUPPLY - REAR VIEW



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Figure 8-5 Auxiliary Power Supply TB1 Connections

8.4.1 Auxiliary Power Supply Voltage Check Points

After you have completed the installation of your auxiliary power supply, check the voltages for the supply at the following points:

Voltage	Test Point	Check
+5.0 Vdc	Connector P40 on the OCP	Voltage between the red wire, pin 15, and the black wire, pin 14, should read between +5.09 and +5.15 Vdc. If this voltage is not within tolerance, remove power from the HSC controller immediately.
-5.2 Vdc	Connector P70 on the airflow sensor	Voltage between the orange wire, pin 3, and ground should read between -4.96 and -5.46 Vdc.
+12 Vdc	Connector P70 on the airflow sensor	Voltage between the purple wire, pin 1, and ground should read between 11.4 and 12.6 Vdc.

If the +5.0 Vdc output is not at least +5.1 Vdc, verify that the auxiliary power supply fan is running. If the fan is not running, verify that the power cord is correctly installed or check connector connections. If the fan is NOT running, replace the auxiliary power supply.

8.5 Post-Upgrade Tests

Use the following procedure to test the upgrade:

1. Add new requestors (disk or tape data channel modules) to the HSC controller as required. If you are installing new K.si 4-port or 8-port data channel modules, refer to the *Installation Procedure For HSC5X-DA And HSC9X-FA K.si Data Channel Modules*, included with your K.si module option kit.

The K.si modules are by default disk data channels after initial installation or on first boot of the HSC software. If the attached devices are tape drives, perform initialization and reconfigure procedures, as described in the *Installation Procedure For HSC5X-DA And HSC9X-FA K.si Data Channel Modules*.

2. Replace the card cage cover after all new modules have been installed.
3. Reconnect the HSC controller power cord to the power source.
4. Turn on the HSC controller by setting circuit breaker (CB) on the HSC power controller to 1 (ON). Ensure that the Power indicator on the OCP is lit.
5. Ensure the Secure/Enable switch is in the ENABLE position.
6. Verify that the Online switch is in the out position.
7. Ensure that the System and Utilities diskette is installed and the RX33 drive release handle is closed.
8. At the front of the HSC controller, set the dc power switch to ON.

NOTE

If this indicator is not on, reset CB to 0 (OFF), remove the new requestors from the backplane and set CB to 1 again. This check determines if any of the new requestors are causing the problem.

9. The HSC automatic reboot begins. Verify that the HSC controller console terminal displays the following boot message:

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

```
HSCxx Version x.xx day-month-year 17:00:41    System HSC009
```

```
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific. If you do not get this message, 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 reapply power.

10. All HSC controller module green status LEDs should be on.

8.6 Completing the Upgrade

Perform the following steps to complete the upgrade procedure.

1. Replace the HSC60 controller serial number label on the rear door of the HSC controller with the new HSC90 controller serial number label included with your upgrade kit.
2. Change the logo on the front door of your HSC60 controller to reflect the new HSC90 controller model number by:
 - a. On the inside of the HSC controller front door, remove the old logo by snipping off the pins behind their securing clips.
 - b. Push the new Digital HSC60 medallion through the holes in the front door and secure by twisting the new wing clips onto the medallion's pins.
3. Close and latch the front and rear doors of the HSC controller.
4. Hold the Fault switch in and switch 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...
```

```
HSCxx Version Vx.xx day-month-year 17:00:41    System HSC009
```

```
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific.

5. Enter the SHOW ALL command at the HSC> prompt and compare the display to the hard copy you made in step 2 of Section 8.2.
6. Set the system name, ID, disk allocation, and tape allocation using the appropriate SET commands. Reset other parameters as required by the site.

7. Enter the `SHOW REQUESTORS` command to identify the requestors. In the following example, a 4-port K.si module is in Requestor 2 and an 8-port K.si module is in Requestor 6. Note that the 8-port K.si module is identified by **8disk** in the Microcode Loaded column and **K.si/8** in the Status column. The Req column also lists both bulkhead connectors for the 8-port K.si module.

```

Ctrl/y
HSC> SHOW REQUESTORS Return
Req      Status      Type              Version           Microcode Loaded
0        Enabled      P.ioj
1        Enabled      K.ci      MC- 45 DS- 2 Pila-65 K.pli-5  N/A
2/A      Enabled      K.si      MC- 9  DS- 4          disk
3/B      Enabled      K.sdi     MC- 40 DS- 3          N/A
4/C      Enabled      K.sdi     MC- 42 DS- 3          N/A
5/D      Enabled      K.sdi     MC- 40 DS- 3          N/A
6/EL     Enabled      K.si/8    MC- 9  DS- 4          8disk
7/F      Enabled      K.sdi     MC- 42 DS- 3          N/A
8/M      Enabled      K.sdi     MC- 39 DS- 3          N/A
9/N      Enabled      K.sdi     MC- 42 DS- 3          N/A

SETSHO-I Program Exit

```

For each requestor, the following information is displayed:

- Requestor number and bulkhead
 - Status (enabled or disabled)
 - Type of requestor (P.ioj/c, K.ci, K.si, K.sdi, K.sti, or Empty)
 - Microcode version
 - If the requestor is a K.si, the microcode loaded is also displayed. In the example, Requestor 2 is a K.si that is configured as a disk data channel. By default, disk microcode is loaded into a K.si.
8. Enter reconfiguring commands as follows, then reboot the HSC controller.

```

Ctrl/y
HSC>RUN SETSHO Return
SETSHO>SET REQUESTOR 2/TYPE=TAPE Return
SETSHO-I Your settings require an IMMEDIATE reboot on exit.
SETSHO>EXIT Return
SETSHO-Q Rebooting HSC, type Y to continue, CTRL/Y to abort:Y Return
INIPIO-I Booting...

```

```

HSCxx Version Vx.xx day-month-year 17:00:41   System HSC009
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.

```

9. Check to see if any red status indicators are lit on any modules in the card cage. Follow standard troubleshooting procedures and replace any failed modules. (If a module is replaced, you may have to reset all of your system parameters.)
10. Set the Online switch to the in position. Check that the Online indicator on the OCP lights within 15 seconds. If not, enter a Ctrl/y, enter the command `SET ERROR INFO`, and reconcile any error messages.

11. Ensure that VMS can access the disks for that HSC controller by mounting and performing failover on the disks, if applicable. Verify that at least one disk or tape per requestor is functional on the upgraded HSC controller.
12. Connect any cables and install any disks or tapes as required to complete the subsystem installation.

To ensure the functionality of the upgrade, run ILDISK, ILTAPE (as required), ILEXER, and ILMEMY. Refer to Chapter 4 for instructions when running these tests.

8.7 Returning The Removed Modules

Digital Customer Services personnel and customers who install their own upgrades should use the following instructions for repackaging and returning the removed HSC controller modules. Use the following procedure in the in U.S. area only.

1. Package the HSC module removed from the HSC controller in the same container(s) in which the HSC9X-CA/CB upgrade option kit was shipped. Be sure the return address label has been removed from inside the box prior to packing.

CAUTION

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.

2. Seal the container securely with packing tape.
3. Affix the return address label from the upgrade kit on the outside of the package. Be sure to cover up all previous shipping information with the label or with packing tape. If the label is lost or missing from the kit, refer to Figure 8-6 and make a suitable label.

RETURN TO Returns Sort Center D001	
DEC # _____	RA # _____
Ship to: Digital Equipment Corp. Rt 127 Dock Area D001 Contoocook, NH 03229-9210 ATTN: Returns Sort Center	

CXO-3341A

Figure 8-6 Sample Return Mailing Label

4. Contact your district CAS representative for a Return Authorization Number (RA#). CAS will also need the Digital sales order number (DEC#) and the customer name. CAS will arrange for pickup of this material.

NOTE

If you don't know the appropriate CAS representative, contact the district sales office for instructions.

5. Write the DEC# and the RA# on the return address label. Please be sure this number is legible.
6. Digital Customer Services Engineers should advise the customer that they will be billed for these modules if they are not returned to Digital Equipment Corporation. If there are any questions, customer should contact his sales representative.
7. Ensure that the package is sent to the customer shipping area for pickup.
8. Digital Customer Services Engineers: Fill out LARS form, ensuring that the fields listed in Table 8-4 are filled out as indicated.

Table 8-4 LARS Form Fields

Field	Required Entry
System Processor Type:	HSC
Activity:	N
Call Type:	I
Module/Fail Area:	HSC9X-CA/CB RA#_ _ _ _ The HSC controller upgrade kit order number (HSC9X-CA/CB) is as listed in the shipping paperwork. Ensure that the RA number (RA#) is also as listed.

9

Upgrading Your HSC70 Controller to an HSC90 Controller

9.1 Introduction

This chapter describes the steps necessary to upgrade your present HSC70 controller to the higher performance model HSC90 controller. After installing your upgrade kit, the upgraded HSC controller will be the higher level model in all respects.

To upgrade your existing HSC70 controller to an HSC90 controller, refer to Table 9–1 for the upgrade kit order number. This table also contains additional HSC controller upgrade kit order numbers to upgrade other HSC controller models.

Table 9–1 HSC Controllers Upgrade Kits Order Numbers and Descriptions

Order Number	Description
HSC6X-AA	HSC40 controller to HSC60 controller
HSC7X-AA	HSC40 controller to HSC70 controller, 60 HZ
HSC7X-AB	HSC40 controller to HSC70 controller, 50 HZ
HSC9X-CA	HSC60 controller to HSC90 controller, 60 HZ
HSC9X-CB	HSC60 controller to HSC90 controller, 50 HZ
HSC9X-AA	HSC70 controller to HSC90 controller

9.2 Preparing for the Upgrade

Perform the following steps to prepare for the upgrade:

1. Use the packing list to verify that all the components of the upgrade kit are included and are not damaged. Table 9–2 lists the components found in your upgrade kit. If there is a discrepancy between this table and the packing slip, the packing slip takes priority.

Table 9-2 HSC9X-AA Upgrade Kit Contents

Digital Part Number	Component Description	Quantity
L0111-YC	P.ioj-18 I/O Control Processor module	1
L0123-AA	M.std4 Memory Standard module	1
L0124-AA	K.pli2 Port Processor module	1
L0125-AA	PILA2 Port Buffer module	1
L0118-YA	Port LINK module	1
17-00958-01	Hydra cables	4
36-15946-01	Label, Product Conversion	1
36-21758-02	Label, HSC Controller Module Placement	1
TBS	HSC90 serial number label	1
74-38607-04	HSC Medallion	1
74-39927-01	Medallion template	1
EK-H7090-IN-001	<i>HSC70 to HSC90 Controller Upgrade Procedure</i>	1

- At the HSC> prompt on your console terminal screen display, enter the SHOW ALL command to extract the system parameters. The SHOW ALL command displays information and parameters of the following SHOW commands:

SHOW CI	SHOW MEMORY
SHOW CONNECTIONS	SHOW ODT
SHOW DISK	SHOW REQUESTORS
SHOW ERROR	SHOW SERVER CACHE
SHOW EXCEPTION	SHOW SERVER DISK
SHOW HOST	SHOW SYSTEM
SHOW LINES	SHOW TAPE
SHOW LOAD	SHOW VIRTUAL_CIRCUITS

- Print a hardcopy of these system parameters if your system does not automatically produce a copy. You will use this copy to reset the HSC software parameters after installing your upgrade components.
- If your cluster does not have failover capabilities, shut down the cluster and go to step 6.
- Fail over all disk and tape drives to the alternate HSC controller.

6. Enter the `SHOW TAPES` and `SHOW DISKS` commands to verify that no tape or disk drives are on line to the HSC controller being upgraded:

```
HSC>SHOW DISKS [Return]

Unit   Req   Port   Type   State   Cached Access  Version
   8     5     2     RA70   Not Available   Yes-A  Host   MC-79, HV-7

Units in NOHOST_ACCESS Table:

Units in NOCACHE Table:

SETSHO-I Program Exit

[Ctrl Y]

HSC> SHOW TAPES [Return]

Unit   Req   Port   Type   State   Version
  196     2     1     TA81   Not Available

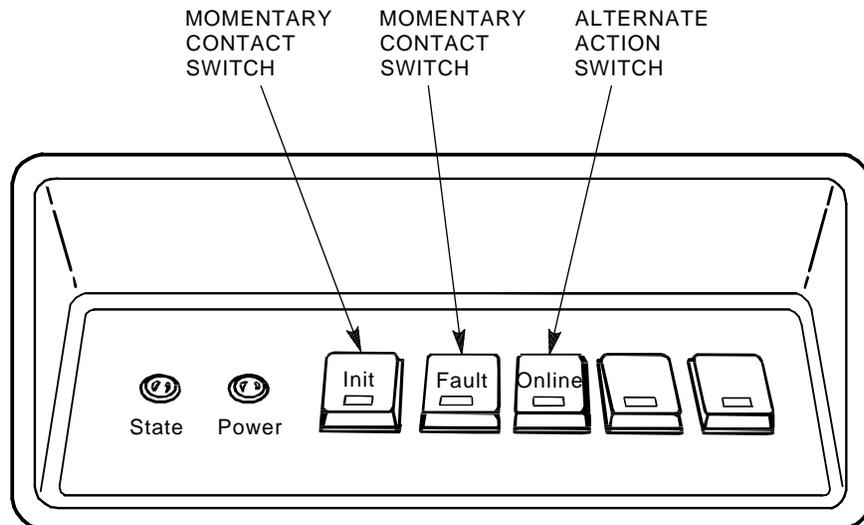
The Tape NOHOST_ACCESS Table is empty.

SETSHO-I Program Exit
```

9.3 Installing Upgrade Kit Modules

Install the new modules from the upgrade kit using the following procedure:

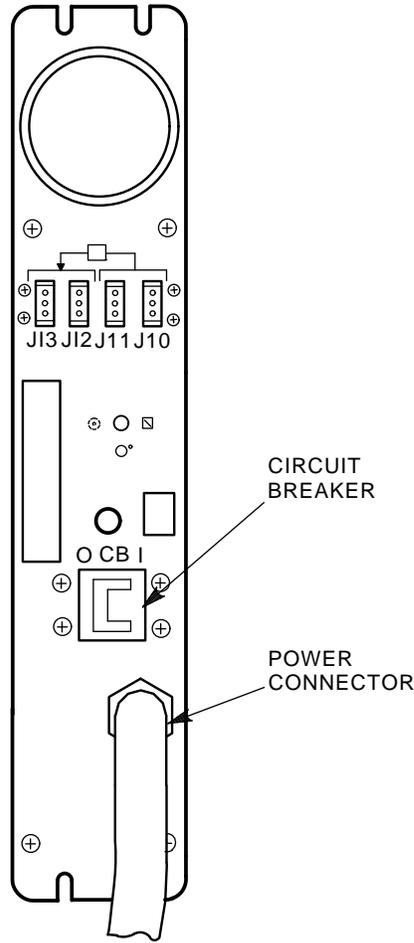
1. Set the Online switch on the HSC controller operator control panel (OCP) to the out position. Refer to Figure 9-1.



CXO-008B_S

Figure 9-1 Locating the OCP Online Switch

2. Open the front and rear doors of the HSC controller cabinet.
3. Turn the dc power off by setting the dc power switch to the 0 position. The dc power switch is located on the left side of the RX33 disk drive housing at the front of the HSC controller.



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Figure 9-2 HSC Power Controller Front Panel

4. Refer to Figure 9-2 and turn off ac power by setting the HSC power controller circuit breaker (CB) to the 0 position. Verify that power is off by checking that no LEDs are lit on the installed modules.

CAUTION

If the power control bus is connected to another device, use caution when removing the power control bus cable. This bus could be daisy chained to other equipment that is not related to the HSC controller.

5. Remove the HSC power cord from the power source.

CAUTION

Do not attempt to upgrade an HSC controller 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.

6. At the front of your HSC controller, turn the nylon latches on the card cage cover plate one-quarter turn. One latch turns clockwise, the other counterclockwise. Pull the card cage cover up and out and set it aside.
7. Remove and replace the upgrade modules listed in Table 9-3.

Table 9-3 Upgrade Modules for HSC70 to HSC90 Controller Upgrade

Card Cage Slot Number	HSC70 to HSC90 Module Changes
Slot 1:	
Remove module	L0111-00
Replace with module	L0111-YC
Slot 2:	
Remove module	L0117-AA ¹
Replace with module	L0123-AA
Slot 12:	
Remove module	L0107-YA
Replace with module	L0124-AA
Slot 13:	
Remove module	L0109-YA
Replace with module	L0125-AA
Slot 14:	
Remove module	L0100 or L0118-00
Replace with module	L0118-YA

¹May already have LO123-AA installed.

8. Attach the labels accompanying the new modules to the appropriate slot position on the module utilization label. The utilization label is located directly above the module card cage.

9.4 Installing 8-Port K.si Module SDI Cables

Use the following procedure to install the necessary SDI cables for 8-port K.si disk data channel modules:

1. Refer to Figure 9-3 and disconnect the airflow sensor power connector (J70) from the side of the exhaust duct.
2. Remove the exhaust duct from the bottom of the blower duct by lifting up the quick release latch on the right side of the exhaust duct, and turning the two quarter-turn latches on the inside left side of the exhaust duct clockwise or counterclockwise. This hardware is shown in Figure 9-3.

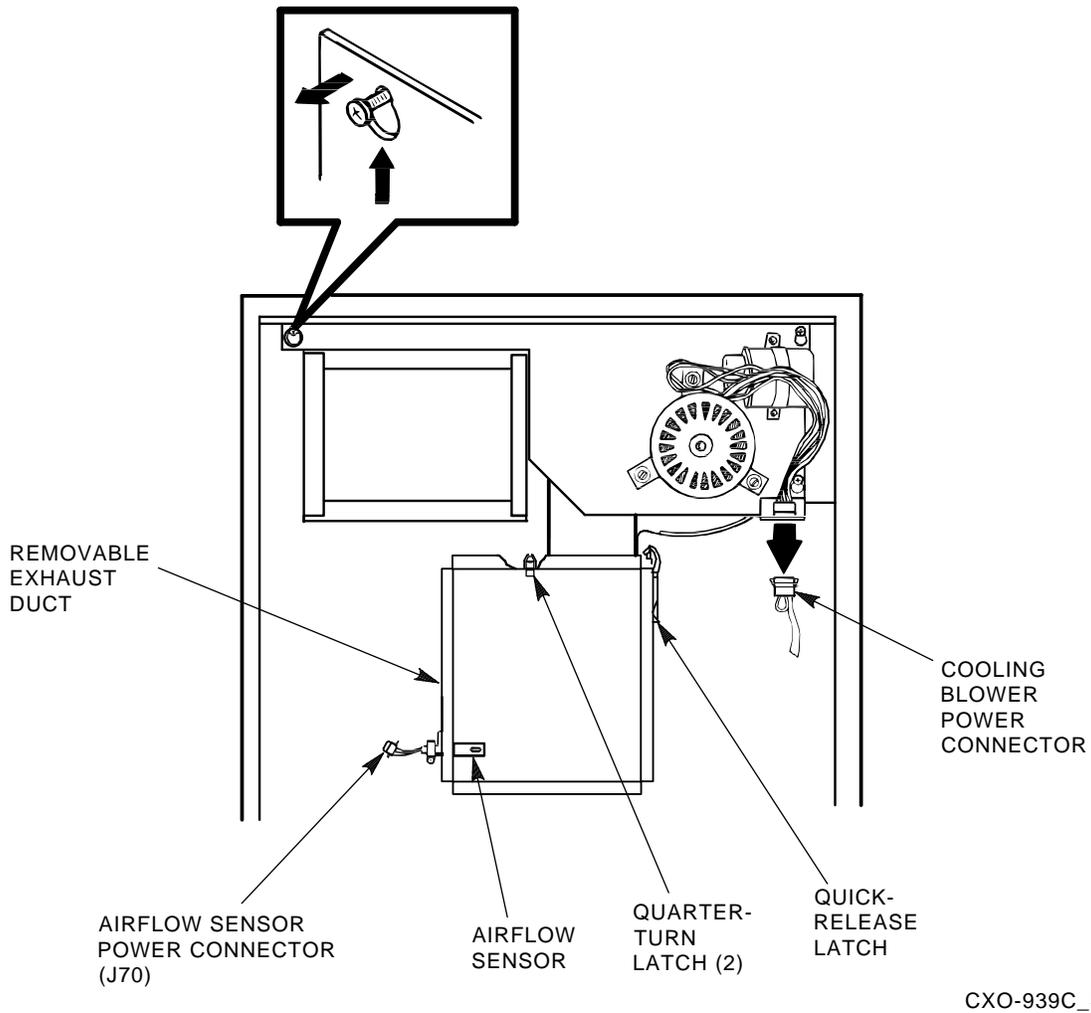


Figure 9-3 Removing the Exhaust Duct and Airflow Sensor

3. At the rear of your HSC controller, refer to Figure 9-4 and install SDI cables to the backplane at sections H/J/K/L. The SDI cable connectors are keyed to be installed only one way. Do not use excessive force; if a connector does not seat easily, be sure you have correctly aligned the connector key with the backplane connector key.
4. Connect the I/O bulkhead end of each SDI cable using Figure 9-4 and Table 9-4 as references. These cable connectors are also keyed to be installed only one way. Do not use excessive force; if a connector does not seat easily, be sure you have correctly aligned the key.

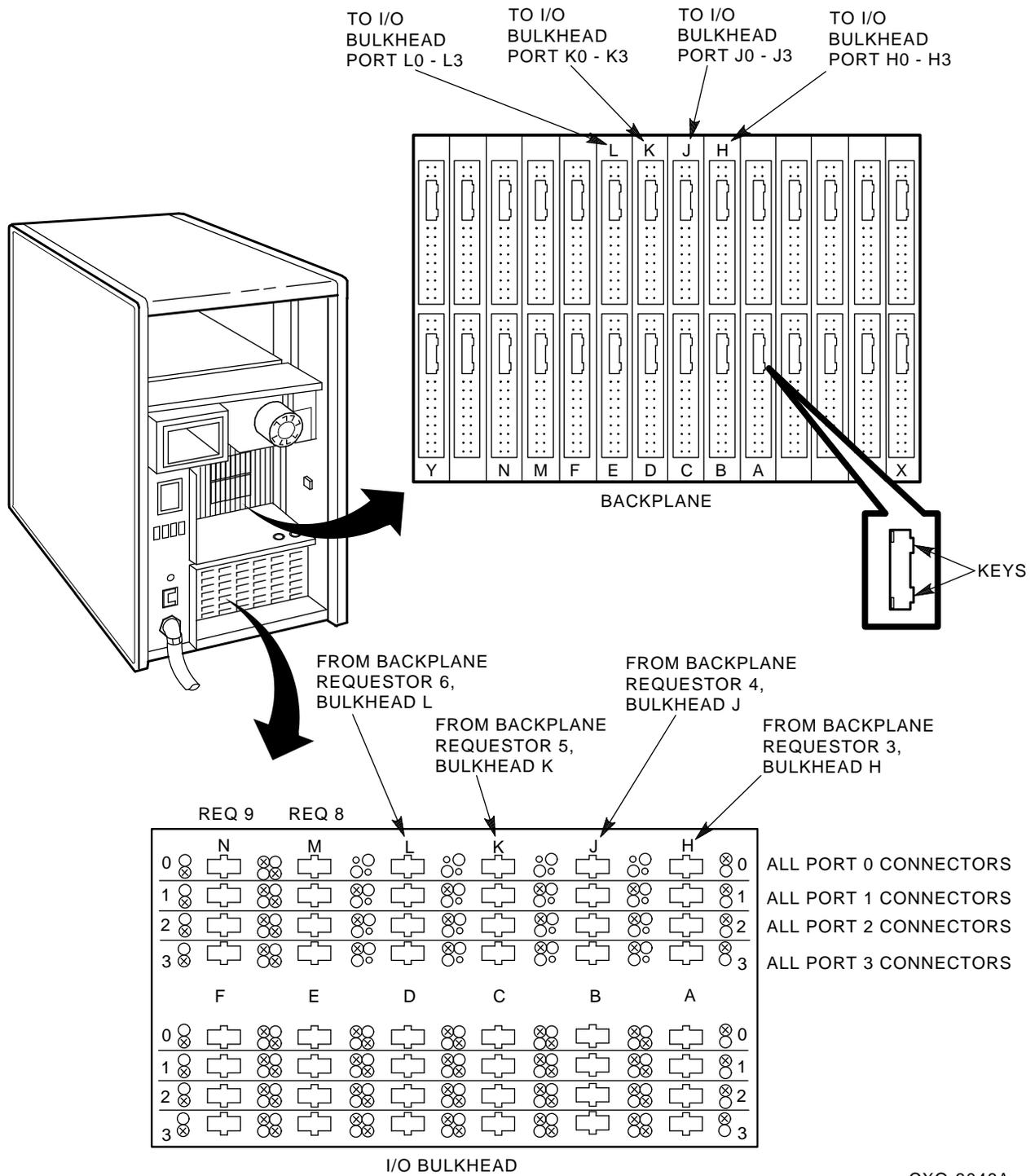


Figure 9-4 Installing SDI Interconnect Cables to the I/O Bulkhead

Table 9–4 Locations for SDI Cable Connectors

Backplane Requestor	Backplane Section	Port Connector	Position In I/O Bulkhead
3	H	0	H0
3	H	1	H1
3	H	2	H2
3	H	3	H3
4	J	0	J0
4	J	1	J1
4	J	2	J2
4	J	3	J3
5	K	0	K0
5	K	1	K1
5	K	2	K2
5	K	3	K3
6	L	0	L0
6	L	1	L1
6	L	2	L2
6	L	3	L3

5. Install the right-hand screws to all connectors on the I/O bulkhead. Then install the left-hand screws. Recheck the screws for tightness, being careful to not disturb the other I/O bulkhead connectors.
6. Verify that all connectors on the backplane and I/O bulkhead are seated. Verify that you have not disturbed any of the connectors on the CI shelf during installation.
7. Replace the exhaust duct and airflow sensor power connector.

9.5 Post-Upgrade Tests

Use the following procedure to test the upgrade:

1. Add new requestors (disk or tape data channel modules) to the HSC controller as required. If you are installing new K.si 4-port or 8-port data channel modules, refer to the *Installation Procedure For HSC5X–DA And HSC9X–FA K.si Data Channel Modules*, included with your K.si module option kit.

The K.si modules are by default disk data channels after initial installation or on first boot of the HSC software. If the attached devices are tape drives, perform initialization and reconfigure procedures, as described in the *Installation Procedure For HSC5X–DA And HSC9X–FA K.si Data Channel Modules*.

2. Replace the card cage cover after all new modules have been installed.
3. Reconnect the HSC controller power cord to the power source.
4. Turn on the HSC controller by setting the circuit breaker (CB) on the HSC power controller to 1 (ON). Ensure that the Power indicator on the OCP is on.
5. Ensure the Secure/Enable switch is in the ENABLE position.

6. Verify that the Online switch is in the out position.
7. Ensure that the System and Utilities diskette is installed and the RX33 drive release handle is closed.
8. At the front of the HSC controller, set the dc power switch to ON.

NOTE

If this indicator is not on, reset the circuit breaker CB1 to 0 (OFF), remove the requestors from the backplane and set the CB1 to 1 again. This check determines if any of the new requestors are causing the problem.

9. The HSC automatic reboot begins. Verify that the HSC controller console terminal displays the following boot message:

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

```
    HSCxx Version x.xx day-month-year 17:00:41    System HSC009
```

```
    Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific. If you do not get this message, 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 reapply power.

10. All HSC controller module green status LEDs should be on.

9.6 Completing the Upgrade

Perform the following steps to complete the upgrade procedure.

1. Replace the HSC70 controller serial number label on the rear door of the HSC controller with the new HSC90 controller serial number label included with your upgrade kit.
2. Change the logo on the front door of your HSC70 controller to reflect the new HSC90 controller model number. If the old logo is a decal, attach the new HSC90 controller logo medallion (from the upgrade kit) as follows:
 - a. Using the cardboard logo medallion template provided with your upgrade kit, align the template over the OCP. The fold at the right side of the template should fit between the door and the frame. The HSC70 decal should show through the template cutout above the OCP.
 - b. Remove the paper covering the adhesive-backed Digital HSC90 logo medallion.
 - c. While holding the template in place, stick the new logo medallion through the template cutout and over the top of the old HSC70 decal.
 - d. Press the medallion firmly on to the door.
 - e. Remove and discard the template.
3. If the old HSC70 logo is a medallion, instead of a decal, attach the new Digital HSC90 medallion as follows:
4. Attach the new Digital HSC60 medallion as follows:
 - a. On the inside of the HSC controller front door, remove the old logo by snipping off the pins behind their securing clips.
 - b. Push the new Digital HSC60 medallion through the holes in the front door and secure by twisting the new wing clips onto the medallion's pins.

5. Close and latch the front and rear doors of the HSC controller.
6. Hold the Fault switch in and switch 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...
HSCxx Version Vx.xx day-month-year 17:00:41 System HSC009
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific.

7. Enter the SHOW ALL command at the HSC> prompt and compare the display to the hard copy you made in step 2 of Section 9.2.
8. Set the system name, ID, disk allocation, and tape allocation, using the appropriate SET commands. Reset other parameters as required by the site.
9. Enter the SHOW REQUESTORS command to identify the requestors. In the following example, a 4-port K.si module is in Requestor 2 and an 8-port K.si module is in Requestor 6. Note that the 8-port K.si module is identified by **8disk** in the Microcode Loaded column and **K.si/8** in the Status column. The Req column also lists both bulkhead connectors for the 8-port K.si module.

```

[Ctrl/y]
HSC> SHOW REQUESTORS [Return]
Req      Status      Type           Version      Microcode Loaded
0        Enabled      P.ioj
1        Enabled      K.ci          MC- 45 DS- 2 Pila-65 K.pli-5 N/A
2/A      Enabled      K.si          MC- 9 DS- 4      disk
3/B      Enabled      K.sdi         MC- 40 DS- 3      N/A
4/C      Enabled      K.sdi         MC- 42 DS- 3      N/A
5/D      Enabled      K.sdi         MC- 40 DS- 3      N/A
6/EL     Enabled      K.si/8        MC- 9 DS- 4      8disk
7/F      Enabled      K.sdi         MC- 42 DS- 3      N/A
8/M      Enabled      K.sdi         MC- 39 DS- 3      N/A
9/N      Enabled      K.sdi         MC- 42 DS- 3      N/A
SETSHO-I Program Exit
```

For each requestor, the following information is displayed:

- Requestor number and bulkhead
- Status (enabled or disabled)
- Type of requestor (P.ioj/c, K.ci, K.si, K.sdi, K.sti, or Empty)
- Microcode version
- If the requestor is a K.si, the microcode loaded is also displayed. In the example, Requestor 2 is a K.si that is configured as a disk data channel. By default, disk microcode is loaded into a K.si.

10. Enter reconfiguring commands as follows, then reboot the HSC controller.

```

Ctrl/y
HSC>RUN SETSHO Return
SETSHO>SET REQUESTOR 2/TYPE=TAPE Return
SETSHO-I Your settings require an IMMEDIATE reboot on exit.
SETSHO>EXIT Return
SETSHO-Q Rebooting HSC, type Y to continue, CTRL/Y to abort:Y Return
INIPIO-I Booting...

```

```

HSCxx Version Vx.xx day-month-year 17:00:41 System HSC009
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.

```

11. Check to see if any red status indicators are lit on any modules in the card cage. Follow standard troubleshooting procedures and replace any failed modules. If a module is replaced, you may have to reset all of your system parameters.
12. Set the Online switch to the in position. Check that the Online indicator on the OCP lights within 15 seconds. If not, enter a Ctrl/y, enter the command SET ERROR INFO, and reconcile any error messages.
13. Ensure that VMS can access the disks for that HSC controller by mounting and performing failover on the disks, if applicable. Verify that at least one disk or tape per requestor is functional on the upgraded HSC controller.
14. Connect any additional cables and install any disk or tape drives as required to complete the subsystem installation.

To ensure that the upgrade modules are fully functional, run ILDISK, ILTAPE (as required), ILEXER, and ILMEMY device integrity tests. Refer to Chapter 4 for instructions when running these tests.

9.7 Returning The Removed Modules

Digital Customer Services personnel and customers who install their own upgrades should use the following instructions for repackaging and returning the removed HSC controller modules. Use the following procedure in the in U.S. area only.

1. Package the HSC module removed from the HSC controller in the same container(s) in which the HSC9X-AA upgrade option kit was shipped. Be sure the return address label has been removed from inside the box prior to packing.

CAUTION

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.

2. Seal the container securely with packing tape.
3. Affix the return address label from the upgrade kit on the outside of the package. Be sure to cover up all previous shipping information with the label or with packing tape. If the label is lost or missing from the kit, refer to Figure 9-5 and make a suitable label.

RETURN TO
Returns Sort Center
D001

DEC # _____ RA # _____

Ship to:
Digital Equipment Corp.
Rt 127 Dock Area D001
Contoocook, NH 03229-9210
ATTN: Returns Sort Center

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Figure 9-5 Sample Return Mailing Label

4. Contact your district CAS representative for a Return Authorization Number (RA#). CAS will also need the Digital sales order number (DEC#) and the customer name. CAS will arrange for pickup of this material.

NOTE

If you don't know the appropriate CAS representative, contact the district sales office for instructions.

5. Write the DEC# and the RA# on the return address label. Please be sure this number is legible.
6. Digital Customer Services Engineers should advise the customer that they will be billed for these modules if they are not returned to Digital Equipment Corporation. If there are any questions, customer should contact his sales representative.
7. Ensure that the package is sent to the customer shipping area for pickup.
8. Digital Customer Services Engineers: Fill out LARS form, ensuring that the fields listed in Table 9-5 are filled out as indicated.

Table 9-5 LARS Form Fields

Field	Required Entry
System Processor Type:	HSC
Activity:	N
Call Type:	I
Module/Fail Area:	HSC9X-AA RA#_ _ _ The HSC controller upgrade kit order number (HSC9X-AA) is as listed in the shipping paperwork. Ensure that the RA number (RA#) is also as listed.

10

HSC50 Controller Auxiliary Power Supply Option Installation

10.1 Introduction

Certain model HSC controllers do not contain auxiliary power supplies. When you are ready to upgrade your HSC controller to a higher performance model, it may be necessary to install an auxiliary power supply. The order numbers for HSC controller auxiliary power supplies are:

- HSC5X–EA, optional auxiliary power supply (60 HZ)
- HSC5X–EB, optional auxiliary power supply (50 HZ)

NOTE

If K.sdi/K.sti modules added to your HSC50 or an HSC50 (modified) controller increase the total number of K.sdi or K.sti modules to four or more, an auxiliary power supply must also be installed.

10.2 Installing the Auxiliary Power Supply Into HSC Controllers (Except HSC50 Controllers)

If you wish to upgrade your HSC40 controller to an HSC70 controller, or your HSC60 controller to an HSC90 controller, you will need to install an auxiliary power supply. Refer to Section 7.4 for the HSC40 to HSC70 auxiliary power supply installation procedure. Refer to Section 8.4 for the HSC60 to HSC90 auxiliary power supply installation procedure.

10.3 Installing the Auxiliary Power Supply Into an HSC50 Controller

The following sections describe how to install an auxiliary power supply into an HSC50 controller. The steps differ slightly from that of other HSC controllers because of differences in some of the HSC50 controller's components. (For example, a different power controller model is used in the HSC50 controller.)

10.3.1 Removing Power from the HSC50 Controller

To remove power from the HSC50 controller:

1. Open the HSC50 controller rear door.
2. Set the HSC50 power controller circuit breaker CB to 0 (OFF).
3. Disconnect the green ground wire from the rear door.
4. Remove the rear door and set it aside.

5. Unplug the ac line cord from the power source.
6. Remove the power control bus cable (J1) and delayed output cable (J3) from the power controller front panel (see Figure 10-1).

CAUTION

If the power control bus is connected to another device, exercise caution when removing the power control bus cable. You could crash the cluster.

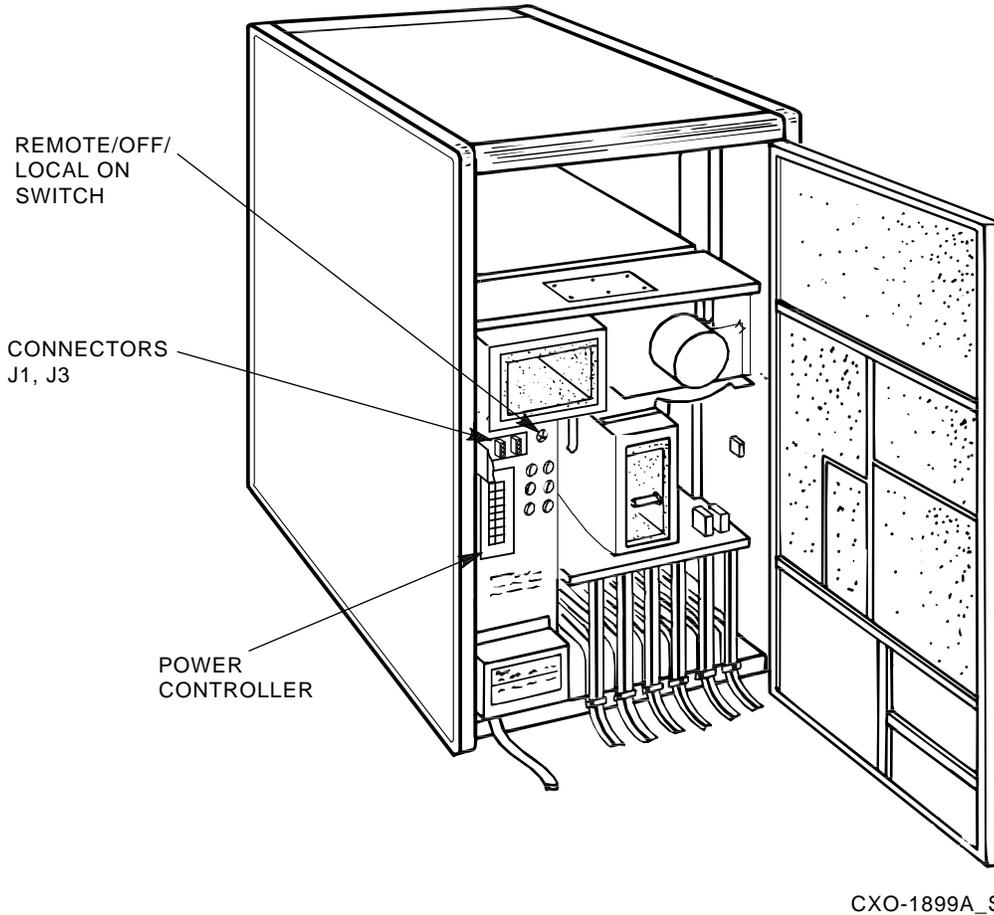


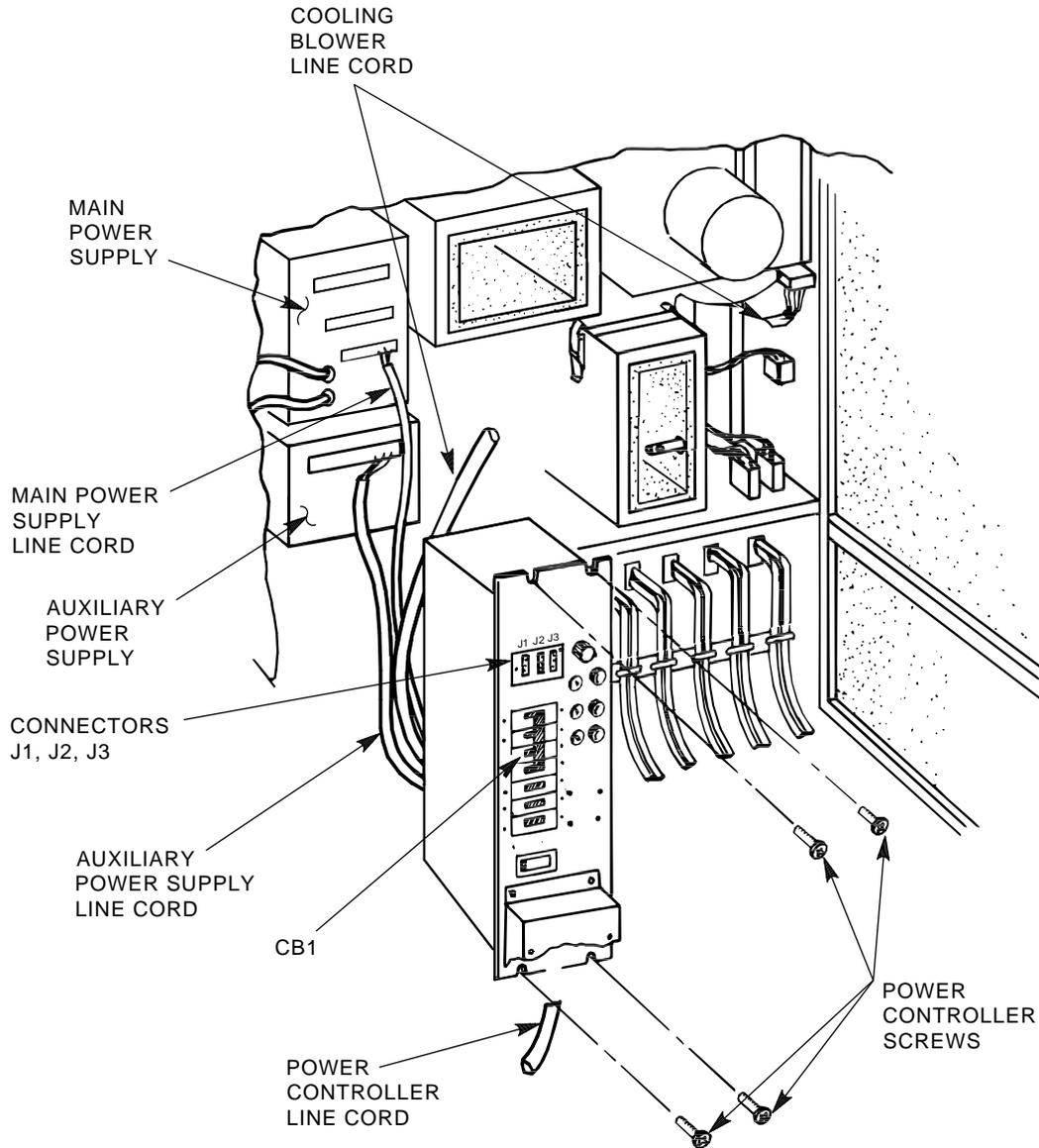
Figure 10-1 Locating the Power Control Bus Connectors on the HSC50 Power Controller

10.3.2 Preparing the HSC50 Cabinet for the Auxiliary Power Supply

Before the HSC50 auxiliary power supply can be installed, the HSC50 power controller must be pulled out of the cabinet and several other components removed. To prepare the HSC cabinet for auxiliary power supply insertion, perform the following steps:

1. Remove the top two screws securing the power controller to the cabinet as shown in Figure 10-2.
2. Remove the bottom two screws. Lift up on the power controller as the screws are removed to take the weight off the screws.

3. Pull the power controller out far enough to remove the power supply line cord, cooling blower line cord, and airflow sensor cable (J8) from the back of the power controller.



CXO-024B_S

Figure 10-2 Removing the HSC50 Power Controller

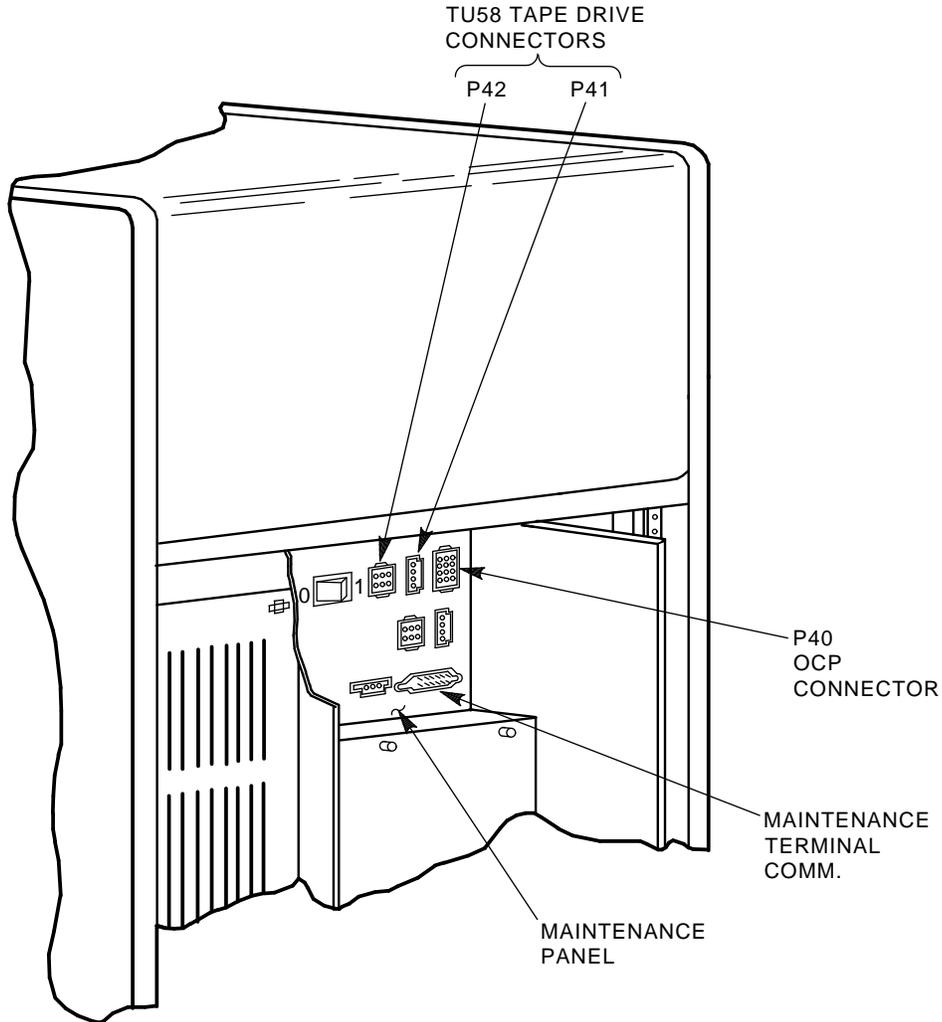
4. Pull the power controller out entirely and set it on the floor.

CAUTION

When performing the following step, take care not to damage the front door spring fingers.

5. Open the HSC50 controller front door.
6. Remove the HSC50 maintenance panel access cover.

7. Remove the OCP plug (P40) and TU58 plugs (P41 and P42) from the maintenance panel (refer to Figure 10-3).



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Figure 10-3 Locating the HSC50 Maintenance Access Panel (front of cabinet)

8. Remove the HSC50 controller front door by pulling down on the spring-loaded rod on the top hinge inside the door and then lifting the door off its bottom pin. Set the door aside.
9. Remove the cover plate shown in Figure 10-4 from the auxiliary power supply cavity by loosening the four captive screws. Discard the cover plate.

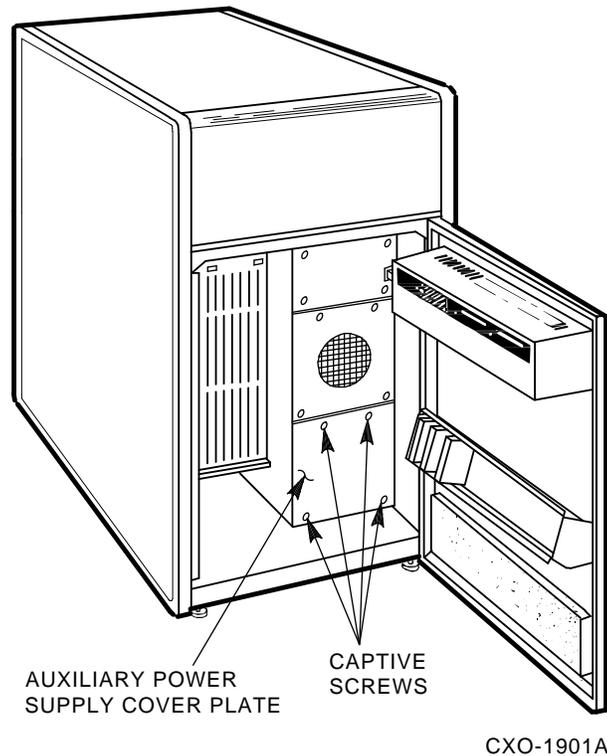


Figure 10-4 Removing the HSC50 Auxiliary Power Supply Cover Plate

10. Remove the two screws that secure the L-shaped baffle plate in the auxiliary power supply cavity. Discard this baffle plate.

10.3.3 Attaching the HSC50 Auxiliary Power Supply Power Cord

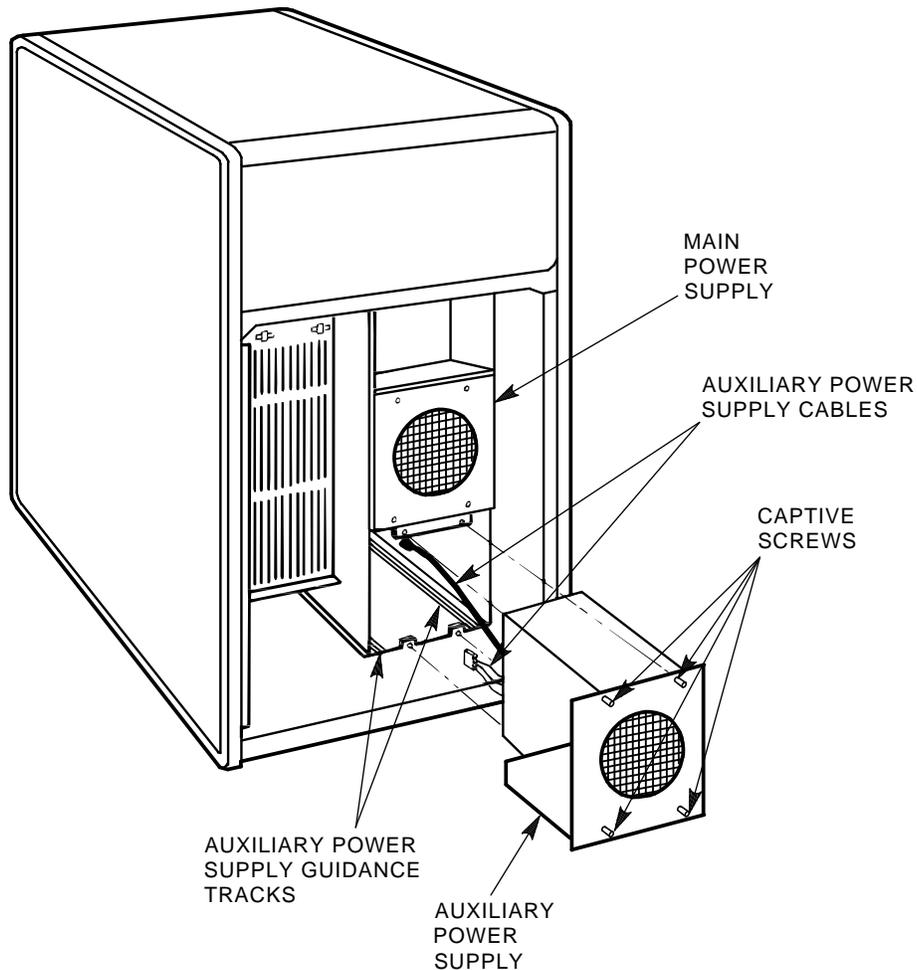
If the HSC50 auxiliary power supply does not have a power cord attached, perform the following procedure to connect the power cord:

1. Determine the appropriate cord by comparing the plug with the type of power controller receptacle.
2. Select the appropriate cord that comes with your HSC5X-EA (60 HZ) or HSC5X-EB (50 HZ) auxiliary power supply.
3. Attach the power cord to the HSC50 auxiliary power supply as follows:
 - Blue wire to TB1-7
 - Brown wire to TB1-6
 - Green/yellow wire to ground stud

10.3.4 Inserting the Auxiliary Power Supply Into the HSC50 Controller

Use the following procedure to insert the auxiliary power supply into the HSC50 controller cabinet:

1. Insert the auxiliary power supply by guiding the lower left and right edges into the guidance tracks on the HSC chassis floor. From the front of the HSC50 controller, take care not to pinch the auxiliary power supply cables between the chassis and auxiliary power supply. Figure 10-5 shows the routing of the auxiliary power supply cables through the power supply opening to the rear of the HSC cabinet.



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Figure 10-5 Inserting the Auxiliary Power Supply Into a HSC50 Cabinet

2. Tighten the four captive screws on the front of the auxiliary power supply.
3. Replace the HSC50 front door.
4. Reconnect the OCP plug (P40) and the TU58 plugs (P41 and P42) to the maintenance panel.
5. Replace the HSC50 maintenance access panel cover.
6. Close the HSC50 front door.

10.3.5 Cabling the HSC50 Controller Auxiliary Power Supply

To connect the auxiliary power supply cables perform the following steps:

1. Move to the rear of the HSC50 controller and locate the two-gauge cable with black heatshrink on its ends. Install one end of the cable to the V1 (-) stud on the auxiliary power supply. Install the other end of the cable to the bottom hole of the inside backplane bus as shown in Figure 10-6.
2. Locate the two-gauge cable with red heatshrink on its ends. Install one end of the cable to the V1 (+) stud on the auxiliary power supply. Install the other end of the cable to the bottom hole of the outside backplane bus as shown in Figure 10-6.
3. Insert the J50 jack from the power supply terminal strip into the P50 plug tied to the chassis floor.
4. Insert the dc on/off jumper (J34) (hanging from the main power supply) into P34. Insert the dc on/off jumper (J51) (hanging from the auxiliary power supply) into J51.
5. Insert the main cooling blower line cord into one of the J11 switched outlets on the back of the power controller.
6. Insert the main power supply line cord into one of the J12 switched outlets. Insert the auxiliary power supply line cord into one of the J13 switched outlets. Insert the airflow sensor cable into the J8 outlet.

NOTE

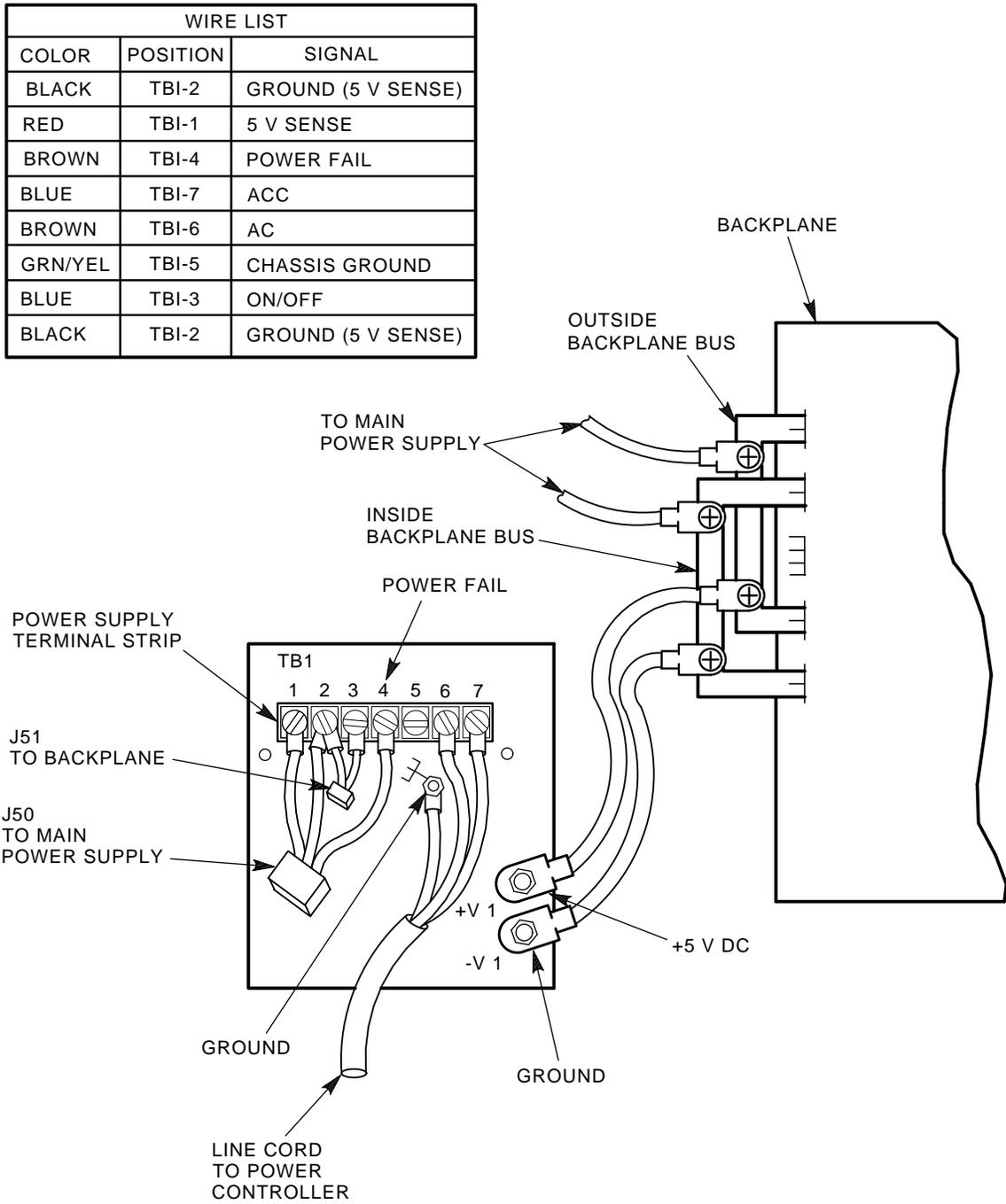
Check all the other connectors inside the HSC controller to ensure they are firmly seated.

10.3.6 Replacing HSC50 Components After Auxiliary Power Supply Insertion

After the auxiliary power supply cabling has been connected, perform the following replacement steps to complete the installation:

1. Insert the power controller into the HSC chassis. Take care not to pinch the line cords and airflow sensor cable between the chassis and the power controller.
2. Replace the four screws that secure the power controller.
3. Replace the power control bus cable into J1 on the power controller.
4. Replace the delayed output cable into J3.
5. Replace the HSC50 rear door.
6. Plug the ac line cord into the appropriate outlet.
7. Ensure that the Remote/Off/Local On switch is in the appropriate position. If no new power bus configuration is set, use the previous setting. If a new power bus configuration is set concurrent with this installation, refer to Section 2.7.
8. Turn CB on the power controller to 1 (ON).
9. Check fans and blowers
10. Turn on dc power and ensure that the Power indicator on the operator control panel (OCP) is on. If this indicator is not on, refer to the *HSC Controller Service Manual*.
11. Close the HSC50 controller rear door.

10-8 HSC50 Controller Auxiliary Power Supply Option Installation



CXO-027C

Figure 10-6 Cabling the HSC50 Auxiliary Power Supply to TB1 and the Backplane Bus

11.1 Introduction

This chapter contains information on how to install, configure, and test 4-port (HSC5X–DA) and 8-port (HSC9X–FA) K.si modules.

The HSC controller may contain a mix of the following data channel options:

- HSC5X–DA option, 4-port K.si (L0119–YA) data channel module (can be configured for disk or tape devices)
- HSC9X–FA option, 8-port K.si (L0119–YB) data channel module (does not support tape drives)
- HSC5X–BA option, K.sdi (L0108–YA) disk data channel module
- HSC5X–CA option, K.sti (L0108–YB) tape data channel module

Refer to the *HSC Controller Service Manual* for information on how to install the K.sdi (HSC5X–BA) disk data channel module and the K.sti (HSC5X–CA) tape data channel module.

NOTE

In this procedure, the term “HSC controller” refers to all models of the HSC controllers including HSC40, HSC50, HSC50 (modified), HSC60, HSC70, and HSC90 controllers.

When a specific model is being addressed, it is referred to by its name. The term “HSC50” includes the HSC50 and HSC50 (modified) controllers.

Refer to the *HSC Controller Service Manual* for a description of the HSC50 (modified) controller.

11.2 K.si Module Restrictions

Certain restrictions apply to the various data channel module types, such as minimum software versions. Some data channel modules are only usable in certain HSC controller models. For information concerning possible restrictions, refer to the software- and hardware-specific sections of this chapter.

11.2.1 HSC50 and HSC50 (Modified) Controller K.si Module Restrictions

Additional K.sdi (L0108–YA), K.sti (L0108–YB), or 4-port (L0119–YA) K.si modules may be installed in HSC50 and HSC50 (modified) controllers. However, these models do not accommodate the 8-port (L0119–YB) K.si module.

11.2.2 4-Port K.si Module Restrictions

The HSC5X-DA 4-port K.si module (L0119-YA) is the enhanced disk data channel substitute module for the HSC5X-BA (K.sdi module, L0108-YA) or the tape data channel HSC5X-CA (K.sti, L0108-YB) modules. The 4-port K.si module can be used for all HSC controller models.

11.2.3 8-Port K.si Module Restrictions

The HSC9X-FA 8-port K.si module (L0119-YB) is used for HSC60 and HSC90 controllers only. This module is for disk drives only, and cannot be configured for tape drives.

11.2.4 K.si Module Software Version Requirement

The 4-port K.si data channel module initializes only with HSC V3.90 or higher software. HSC V6.0 and higher software must be used with the 8-port K.si module.

The following sections explain how to install, configure, and test both 4-port and 8-port K.si modules, and how to configure disk and tape requestors in the HSC backplane for optimum performance.

11.3 HSC Controller Configurations and Guidelines for Enhanced Performance

To obtain maximum performance from the HSC controller, configure the tape and disk requestors in the backplane according to the following guidelines:

Each K.si, K.sdi, or K.sti module in the backplane has a requestor priority number according to its backplane slot. You can enhance the performance of the HSC controller by arranging the attached devices according to their transfer speeds by:

- Attaching the slower devices to the lower priority requestors, and
- Attaching the faster devices to the higher priority requestors.

Assign requestor priorities to the requestors while the HSC controller is powered down for K.si module installation.

With faster devices, such as the TA90 tape drive and RA90 disk drive, backplane configuration is especially important. Failure to configure the devices properly could result in a significant loss of performance.

Refer to Table 11-1 for a list of the device relative transfer speeds for different Digital storage devices:

Table 11-1 Relative Device Transfer Speeds

Device	Relative Speed
TA90/TA91 tape drive	Fastest
RA9x disk drive	.
ESE20 disk drive (including enhanced ESE20)	.
RA82 disk drive	.
RA81 disk drive	.
RA60 disk drive	.

Table 11-1 (Cont.) Relative Device Transfer Speeds

Device	Relative Speed
RA70 disk drive	.
RA80 disk drive	.
Non-TA90/TA91 tape drives	Slowest

Requestor priority ascends from Requestor 2, with the lowest priority, through the highest requestor number on the HSC controller. Note that requestor priority levels are all relative; that is, the individual requestor numbers have no intrinsic speed characteristic. If you have only one drive in your system, you will not get better performance by placing it on a high priority requestor instead of on a low priority requestor.

If it is necessary to mix TA90/TA91 tape drives with slower tape drives on a requestor, this should be done on the highest priority requestor.

When configuring, it is recommended that you leave blank slots where possible to allow for add-on drives without having to move existing cables.

11.4 Installing 4-Port or 8-Port K.si Modules

This section describes installation of the 4-port or 8-port K.si module. Refer to Section 11.4.1 for installing a 4-port or 8-port K.si module in an HSC controller and to Section 11.4.2 for installing a 4-port K.si module in HSC50 controllers.

11.4.1 Installing K.si Modules in HSC Controllers (Except HSC50 Controllers)

When installing the 4-port K.si module (L0119-YA) in an HSC40 or HSC60 controller, be sure to install the 4-port K.si module only in Requestors 2, 3, or 4; Requestors 5 through 9 must remain empty (contain module baffles only).

The 8-port K.si module (L0119-YB) must only be installed in an HSC60 or HSC90 controller. Use Requestors 3 and 4 for the HSC60. Use Requestors 3, 4, 5, or 6 for the HSC90. Your HSC40 or HSC70 controller must be upgraded to an HSC60 or HSC90 controller to use the 8-port K.si module.

Use the following procedure to install a 4-port or 8-port K.si module in an HSC controller:

1. Open the front door of the HSC cabinet by turning the key clockwise and pressing the button just above the key to expose the door handle.
2. Grasp the handle and pull it towards you to open the door.

WARNING

To prevent personal injury or module component damage, remove dc power from the card cage before installing or replacing modules. Remember to use an ESD grounding wrist strap when handling modules.

3. Turn off the dc power by setting the DC power switch to OFF. The DC power switch is located on the left side of the RX33 diskette controller housing.
4. Turn the two nylon latches on the card cage cover plate one-quarter turn clockwise or counterclockwise.
5. Pull the card cage cover up and out.

6. Refer to Section 11.3 and verify that the requestors are arranged according to the transfer speeds of their attached devices.
7. Replace the existing K.sdi or K.sti module with a new K.si module as appropriate. If you are installing a new requestor, install the K.si module in the card cage. Table 11-2 summarizes the HSC backplane requestor configuration for various HSC controller models.

NOTE

The 4- and 8-port enhanced K.sdi and K.sti modules are used only for requestor upgrades. If you are replacing a failed requestor, you may put in another K.sdi or K.sti module.

Table 11-2 Backplane Requestor Configuration for HSC Models (Except HSC50 Controllers)

HSC Controller Model	4-Port K.si		8-Port K.si	
	Requestors	I/O Bulkhead	Requestors	I/O Bulkhead
HSC40	2, 3, or 4	A, B, or C	None	None
HSC60	2, 3, or 4	A, B, or C	3 or 4	B or C and H or J
HSC70	2 through 9	A through N	None	None
HSC90	2 through 9	A through N	3, 4, 5, or 6	B through E and H through L

8. Attach the label accompanying the new K.si module option to the appropriate location on the module utilization label. The module utilization label is located above the card cage.
9. Install the SI cables to the I/O bulkhead port slots of the requestor slot for the K.si module you just installed.
10. Verify that all switches on the K.si module switchpack are set to OFF.
11. Go to Section 11.4.3 for the K.si module initialization procedure.

11.4.2 Installing the 4-Port K.si Module in an HSC50 or HSC50 (Modified) Controller

Use the following procedure to install the 4-port K.si module in an HSC50 or an HSC50 (modified) controller.

1. Unlock the HSC50 cabinet front door by turning the key clockwise.
2. Grasp the door by the lower edge and pull out gently. You will encounter some resistance as the door slides away from the spring fingers.
3. The HSC50 (modified) cabinet front door is also unlocked by turning the key clockwise. However, the HSC50 (modified) controller uses the same locking mechanism as the HSC70 controllers. To open the HSC50 (modified) controller's front door, push in on the button just above the lock mechanism to release the door handle.
4. Remove the maintenance access panel at the front of HSC50 controller by releasing the four captive screws. Release the two captive screws on the hinged maintenance access panel of HSC50 (modified) controllers.

WARNING

To prevent personal injury and module component damage, remove dc power from the card cage before installing or replacing modules.

5. Turn off dc power by setting the DC power switch to 0 (OFF). The DC power switch is located in the upper-left corner of the maintenance panel.
6. Turn the two nylon latches on the module card cage cover plate one-quarter turn clockwise or counterclockwise.
7. Pull the card cage cover up and out.
8. Refer to Section 11.3 and verify that the requestors are arranged according to the transfer speeds of their attached devices.

NOTE

When installing additional tape or disk data channel modules, keep tape data channel modules in the lower numbered requestor slots and disk data channel modules in the higher numbered requestor slots.

9. Replace existing or failed K.sdi or K.sti modules with a 4-port K.si module as appropriate. Remember that the 4-port K.si is a disk/tape data channel module. (You may elect to replace your failed K.sdi or K.sti module with another like module instead of the 4-port K.si module option.) If you are installing a new requestor, install the K.si module in the card cage at this time.
10. Attach the label accompanying the new 4-port K.si module to the appropriate location on the module utilization label located above the card cage. (If replacing a failed K.sdi or K.sti module with a like module, the module label remains the same.)

CAUTION

Ensure a module baffle is in each unused module slot and the module cage cover is replaced to avoid internal overheating.

11. Install the SI cable connectors to the I/O bulkhead for that requestor slot.
12. Verify that all switches on the new K.si module switchpack are set to OFF. Go to Section 11.4.3 for the K.si module initialization procedure.

11.4.3 Initializing K.si Modules

NOTE

All four switches of the K.si module switchpack must be in the OFF position to prevent errors during initialization and normal operation. The switchpack is used for manufacturing purposes only.

Use the following procedure to initialize a K.si module:

1. Turn on dc power by setting the DC power switch to ON.
2. Press and release the Init switch on the OCP. The HSC controller displays the following boot message on the HSC console:

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

```
HSCxx Version Vx.xx day-month-year 17:00:41 System HSC009
```

```
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

This message must show a minimum HSC software version of V3.90 for the 4-port K.si module, and V6.0 for the 8-port K.si module. The HSC model and the system number are site specific.

The K.si module is configured by default as a disk data channel when it is first booted after initial installation, or on the first boot of the HSC software. This default can result in a mismatch between the K.si module configuration and the devices attached to the K.si module. The mismatch causes device errors to be displayed on the HSC controller console terminal screen, and the HSC controller declares the device(s) to be inoperative.

This mismatch can happen under the following conditions:

- After initial installation of the K.si module, when it comes up as a default disk data path channel and the attached devices are tape drives.
- After replacing the type of device (disk or tape) with the opposite type, such as after physically configuring the HSC requestors as described in Section 11.3.

To correct this problem, connect the data channel to the proper drive or refer to Section 11.4.4 and reconfigure the K.si module. Section 11.6 describes the conditions that require you to reboot the HSC controller.

3. Enter a Ctrl/Y to return to the HSC> prompt.
4. Enter the SHOW REQUESTORS command to identify the requestors. In the following example, a 4-port K.si module is in Requestor 2 and an 8-port K.si module is in Requestor 6. Note that the 8-port K.si module is identified by **8disk** in the Microcode Loaded column and **K.si/8** in the Status column. The Req column also lists both bulkhead connectors for the 8-port K.si module.

```

Ctrl/Y
HSC> SHOW REQUESTORS Return
Req      Status      Type              Version           Microcode Loaded
0        Enabled      P.ioj
1        Enabled      K.ci      MC- 45 DS- 2 Pila-65 K.pli-5  N/A
2/A      Enabled      K.si      MC- 9  DS- 4          disk
3/B      Enabled      K.sdi     MC- 40 DS- 3          N/A
4/C      Enabled      K.sdi     MC- 42 DS- 3          N/A
5/D      Enabled      K.sdi     MC- 40 DS- 3          N/A
6/EL    Enabled      K.si/8    MC- 9  DS- 4          8disk
7/F      Enabled      K.sdi     MC- 42 DS- 3          N/A
8/M      Enabled      K.sdi     MC- 39 DS- 3          N/A
9/N      Enabled      K.sdi     MC- 42 DS- 3          N/A

SETSHO-I Program Exit

```

For each requestor, the following information is displayed:

- Requestor number and bulkhead
- Status (enabled or disabled)
- Type of requestor (P.ioj/c, K.ci, K.si, K.sdi, K.sti, or Empty)
- Microcode version
- If the requestor is a K.si module, the microcode loaded is also displayed. In the example, Requestor 2 is a 4-port K.si module that is configured as a disk data channel. By default, disk microcode is loaded into a K.si module.

11.4.4 Changing the K.si Module Configuration

When the K.si module is installed and the HSC controller is initialized, the default parameters configure both the 4-port and 8-port K.si module as a disk data channel. The K.si module configuration must be changed for all 4-port K.si modules that have tape devices attached. The 8-port K.si module can only be configured as a disk data channel.

The following example shows how to change the configuration of the 4-port K.si module in Requestor 2 (slot 10) from a default disk data channel to a tape data channel:

```

Ctrl/Y
HSC>RUN SETSHO Return
SETSHO>SET REQUESTOR 2/TYPE=TAPE Return
SETSHO-I Your settings require an IMMEDIATE reboot on exit.
SETSHO>EXIT Return
SETSHO-Q Rebooting HSC, type Y to continue, CTRL/Y to abort:Y Return
INIPIO-I Booting...

      HSCxx Version Vx.xx day-month-year 17:00:41      System HSC009
      Copyright 1982 Digital Equipment Corporation. All Rights Reserved.

```

The HSC controller model and system number are site specific.

This configuration is retained on the boot media to ensure that the K.si module initializes in the proper data channel configuration. If a K.si module is configured as a tape data channel and disk drives are attached, reconfigure the K.si module by using the same procedure and specifying TYPE=DISK.

Verify the current configuration of the K.si modules as follows:

```

Ctrl/Y
HSC> SHOW REQUESTORS Return

```

Req	Status	Type	Version	Microcode	Loaded
0	Enabled	P.ioj			
1	Enabled	K.ci	MC- 45 DS- 2	Pila-65	K.pli-5 N/A
2/A	Enabled	K.si	MC- 15 DS- 3		tape
3/B	Enabled	K.sdi	MC- 40 DS- 3		N/A
4/C	Enabled	K.sdi	MC- 42 DS- 3		N/A
5/D	Enabled	K.sdi	MC- 40 DS- 3		N/A
6/EL	Enabled	K.si/8	MC- 9 DS- 4		8disk
7/F	Enabled	K.sdi	MC- 42 DS- 3		N/A
8/M	Enabled	K.sdi	MC- 39 DS- 3		N/A
9/N	Enabled	K.sdi	MC- 42 DS- 3		N/A

```

SETSHO-I Program Exit

```

11.4.5 Completing the K.si Module Installation

Perform the following procedure to complete installation of the K.si module:

1. Close and secure the rear door of the HSC controller.
2. Replace the module card cage cover at the front of the HSC controller.
3. Ensure the system media is placed in the load device.

4. On the HSC OCP, press and release the Init switch while holding the Fault switch in. Release the Fault switch when the “INIPIO-I Booting...” portion of the boot message is displayed:

```
INIPIO-I Booting...
HSCxx Version Vx.xx day-month-year 17:00:41 System HSC009
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
```

The HSC controller model, the software version number, and the system number are site specific. For the 8-port K.si module, the message must show at least version 6.00 software and the release date.

5. Before completing the installation tests, run ILDISK, ILTAPE (as required), ILEXER, and ILMEMY device integrity tests. Refer to Chapter 4 for information on running these tests.
6. Close and lock the HSC front door.

11.5 K.si Module LED Functions and Switchpack Settings

The K.si module has the normal red and green status LEDs and an LED pack containing eight amber LEDs. The K.si module also has a switchpack containing four switches. Figure 11-1 shows the location of the K.si module switchpack and LEDs.

11.5.1 K.si Module LED Functions

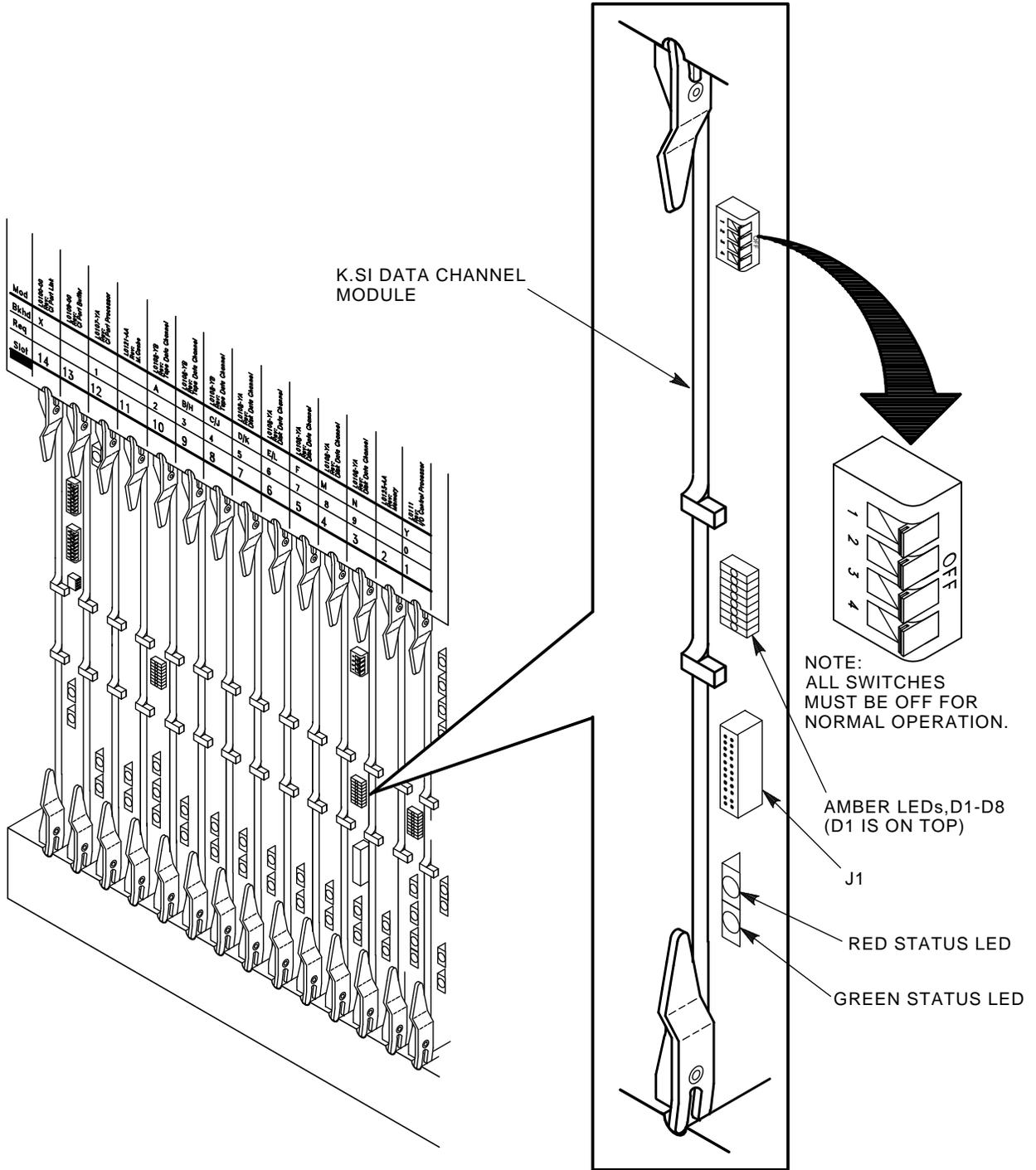
Table 11-3 describes the functions of the LEDs on the K.si module.

Table 11-3 K.si Module LED Functions

Color	Function	Description
Amber	D1	Top LED of 8-LED pack. Indicates type of load: off for microcode RAM disabled; on for microcode RAM enabled.
Amber	D2-D8	Remaining LEDs of 8-LED pack. Module clocks are inhibited when a microinstruction parity error is detected. The bit content of the upper error register 2 is displayed on the LEDs.
Red	Board status	Indicates an inoperable module, except during initialization when it comes on during module testing.
Green	Board status	Indicates the operating software is running and the self-test microdiagnostics have successfully completed.

11.5.2 K.si Module Switchpack Setting Options

Table 11-4 describes the names and functions of the four switches on the K.si module switchpack. SW1 is at the top of the switchpack.



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Figure 11-1 Locating the K.si Module Switchpack and LEDs

Table 11-4 K.si Module Switchpack Setting Options

Switch Number	Switch Name	Description	Normal Position
SW1	MFG	Provides loop on error and single port external loop.	OFF
SW2	Burn in	Continuous loop. Assumes external loop and clock.	OFF
SW3	Ext loop	Loops on all ports; for system or field use only.	OFF
SW4	Ext clock	Substitutes external clock; for manufacturing use only.	OFF

NOTE

All switches are for manufacturing and module repair use only, and must be in the OFF position during normal operation.

11.6 K.si Module New Boot Microcode

When changing to a new boot media, reboot the HSC by holding in the INIT and FAULT switch at the same time. This clears the old microcode from the K.si module. Then use the following SETSHO command:

```
HSC>RUN SETSHO 
SETSHO>SET REQUESTOR n/TYPE=XXXX 
SETSHO>
```

where:

n is the requestor number

XXXX is the requestor type (DISK,TAPE)

This procedure is described in Section 11.4.4. Repeat the SET REQUESTOR command for each improperly configured K.si module in the HSC controller to set the configuration on the new boot media.

Table 11-5 describes the conditions that determine when new microcode is loaded into a K.si module.

Table 11-5 K.si Module New Microcode Load Conditions

Action	New Microcode Load
Using the SET REQUESTOR n/TYPE=xxxx command and allowing the HSC to automatically reboot when exiting SETSHO.	Yes
Using the SET REQUESTOR n/TYPE=xxxx command and not rebooting by issuing a CTRL/C to exit SETSHO.	No
Booting the system after a total power fail or after turning off the HSC controller.	Yes
Changing requestor modules. This action requires power down of the HSC controller.	Yes
Changing to new boot media of same version HSC software.	Yes— The new microcode is loaded when the new media is first booted.
Changing to new boot media of different version HSC software.	Yes
Using the SET SCT CLEAR command.	Yes—With media that has been previously booted, hold the Fault switch until the <i>INIPIO-I Booting...</i> message appears.
Pushing in the Init switch while holding the Fault switch in until the “INIPIO-I Booting...” message appears. This action clears the system configuration table (SCT).	No

M.cache Module Option Installation

12.1 Introduction

This chapter describes how to install and test the optional HSC controller M.cache module kits. The order numbers for the M.cache module option kits are:

- HSC6X–BA, M.cache module and auxiliary power supply for the HSC60 controller (60 Hz)
- HSC6X–BB, M.cache module and auxiliary power supply for the HSC60 controller (50 Hz)
- HSC9X–BA, M.cache module option for the HSC90 controller

NOTE

These option kits are to be installed into HSC60 or HSC90 controllers only.

12.2 M.cache Module Software Version Requirement

The M.cache module must be used with HSC V6.0 or higher software. Earlier software versions are not compatible with the M.cache module.

12.3 Installing the M.cache Module

This section describes how to install the M.cache module option. When installing the M.cache module in an HSC60 controller, you must also install the auxiliary power supply included with the HSC6X–BA or HSC6X–BB option kits.

Use the following procedure to install the M.cache module in an HSC60 or HSC90 controller:

1. Fail over all disk and tape drives to the alternate HSC controller. If your cluster does not have failover capabilities, shut down the cluster.
2. Enter the SHOW TAPES and SHOW DISKS commands to verify that no tape or disk drives are online to the HSC controller being upgraded.
3. Set the Online switch on the operator control panel (OCP) to the out position.
4. Open the front door of the HSC cabinet.
5. Turn the dc power off by setting the DC power switch to OFF. The DC power switch is located on the left side of the RX33 diskette controller housing.

CAUTION

Do not attempt to install the M.cache module 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. Do not put modules on anything other than a properly grounded antistatic work surface.

6. Turn the two nylon latches on the card cage cover plate one-quarter turn clockwise or counterclockwise. Pull the card cage cover up and out.
7. Verify that the new M.cache module has a jumper installed between pins 1 and 2. If the jumper is installed between pins 3 and 4, move it to pins 1 and 2. The jumper pins are located at the top of the module near the gold contact fingers. Refer to Figure 12-1 for the location of the jumper.

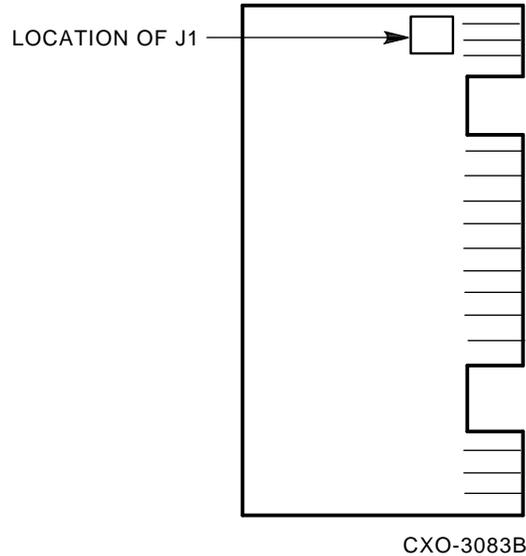


Figure 12-1 Locating the J1 Jumper on the M.cache Module

8. Install the M.cache module in slot 11 of the card cage. Attach the label accompanying the M.cache module to the appropriate location on the module utilization label. This label is located above the module card cage.
9. If you are installing the M.cache module in an HSC60 controller, perform the steps in Section 12.4 to install the auxiliary power supply.

12.4 Installing An Auxiliary Power Supply

Use the following procedure to install the auxiliary power supply in your HSC60 controller.

1. Refer to Figure 12-2. Turn off ac power by setting the HSC power controller circuit breaker (CB) to the 0 position. Verify that power is off by checking that no LEDs are lit on any of the installed modules.

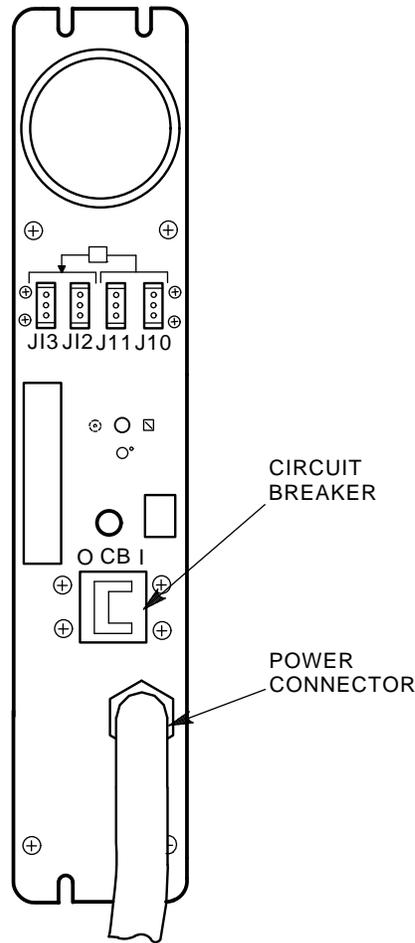
CAUTION

If the power control bus is connected to another device, use caution when removing the power control bus cable. This bus could be daisy-chained to other equipment that is not related to this HSC controller.

2. Disconnect the HSC power cord from the power source.

CAUTION

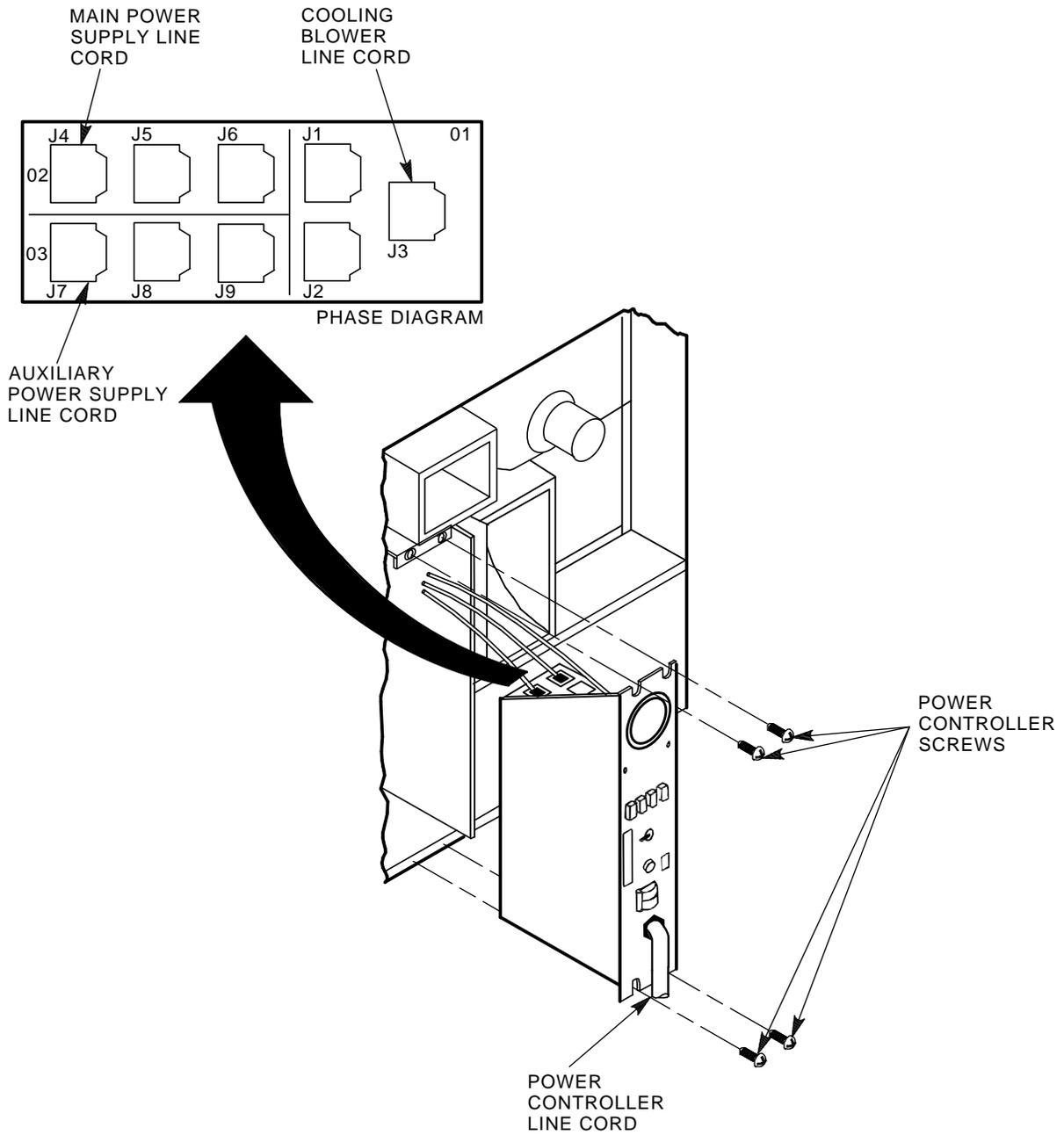
Use care when removing the HSC cabinet doors so you do not damage the OCP cable at the front door and the I/O cables at the rear door.



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Figure 12-2 Locating the HSC Power Controller Circuit Breaker

3. At the front door of the HSC controller cabinet, disconnect P40 on the OCP and the green grounding wire near the bottom of the door.
4. Remove both front and rear doors of the HSC cabinet by pulling down on the spring-loaded rod on the top hinge inside the door. Lift the doors off their bottom pins.
5. Remove the rear door latch to provide the needed clearance to remove the HSC power controller.
6. Refer to Figure 12-3. Remove the two top screws and then the two bottom screws that secure the HSC power controller to the HSC cabinet. While removing the two bottom screws, push up on the HSC power controller to take the weight off the screws.
7. Pull the HSC power controller out only enough to allow removal of the power control bus cables. Remove the power control bus cables from connectors J10, J11, J12, and J13 on the front panel of the HSC power controller. Label these cables as you remove them for reference when reinstalling.



CXO-941D

Figure 12-3 Removing the HSC Power Controller

8. Pull the HSC power controller out of the cabinet and set it on the floor next to the HSC controller. *Be careful to not stress the cables that remain attached to the top panel of the HSC power controller.*
9. Remove the baffle plate from over the auxiliary power supply space in the front of the HSC cabinet (Figure 12-4).

10. Refer to Figure 12–4. Slide the auxiliary power supply into its housing in the cabinet. Make sure that the power cord is not pinched between the auxiliary power supply and the cabinet while performing this step.
11. Secure the four captive screws on the auxiliary power supply to the power supply cabinet bracket. These screws are shown in Figure 12–4.
12. Refer to Figure 12–5. Connect the following cables to the back of the auxiliary power supply. The terminals on the auxiliary power supply terminal board TB1 are numbered from left to right.
 - a. Connect J50 to the 3-pin connector, P50.
 - b. Connect J51 to the 2-pin connector, P51.
 - c. Install the flexbus from the HSC controller backplane to the two studs on the lower righthand edge of TB1 (Figure 12–5).
 - d. Route the power cord of the auxiliary power supply through the auxiliary power supply space and around into the HSC power controller space.
13. Connect the auxiliary power supply line cord to J7 on the HSC power controller. To ensure proper phase distribution of the source voltage, verify that the main power supply (J4) and cooling blower (J3) line cords as shown in Figure 12–3 are still attached to the top panel of the HSC power controller. Reinstall the HSC power controller.
14. Reinstall the front and rear doors of the HSC cabinet. Reconnect P40 on the OCP and the green grounding wire at the bottom of the HSC front door.
15. Reconnect the power cord to the power source and set the HSC power controller circuit breaker CB to the 1 position.

12.5 Completing M.cache Module Installation

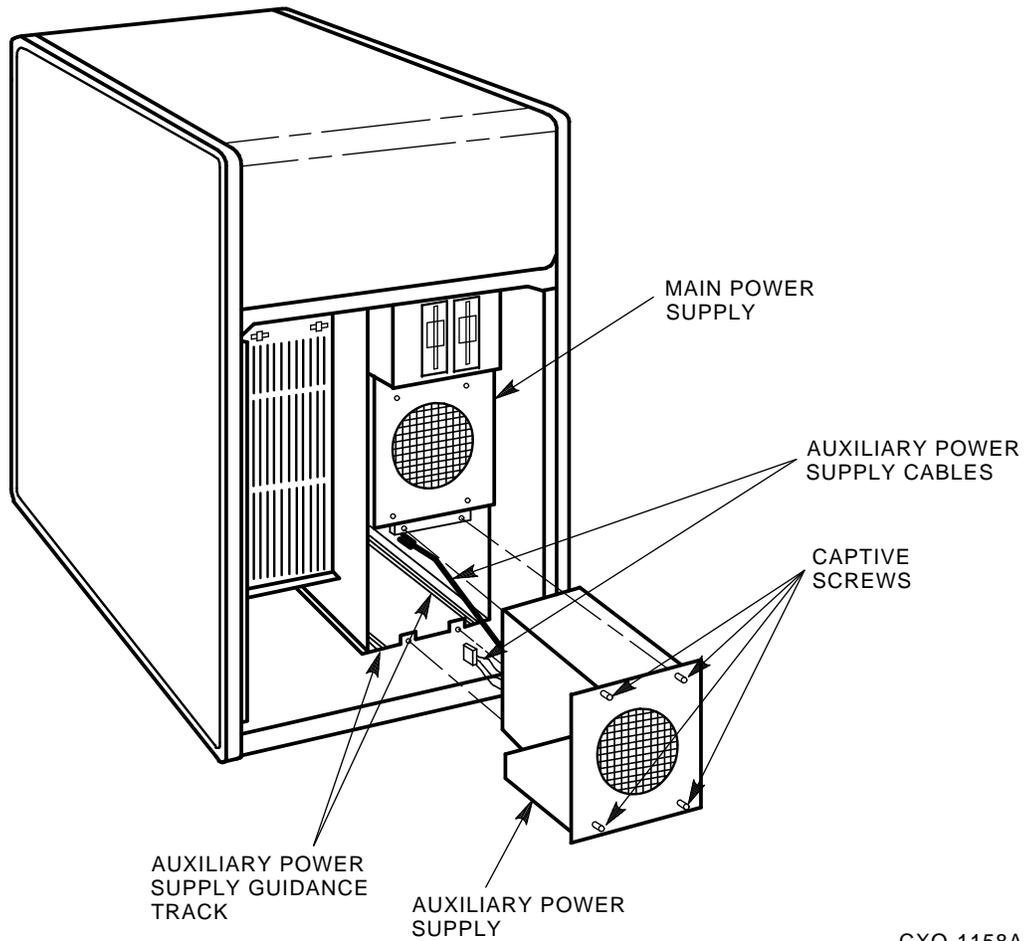
The following procedure completes installation of the M.cache module:

1. Before replacing the card cage cover, add new requestors to the HSC controller as required. If you are installing new K.si 4-port or 8-port data channel modules, refer to the *Installing New K.si Module Options* procedure included with your K.si module option kit.

NOTE

The K.si modules are by default disk data channels after initial installation or on first boot of the HSC software. If the attached devices are tape drives, perform initialization and reconfiguration procedures.

2. Replace the card cage cover.
3. Place the System and Utilities diskette in the load device.
4. Turn on dc power by setting the DC power switch to ON. Check for the green LEDs on all the modules.
5. Close and latch the front and rear doors of the HSC controller cabinet.



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Figure 12-4 Installing Auxiliary Power Supply

6. Verify that the following boot message is displayed on the HSC console:

```

INIPIO-I Booting...
HSCxx Version Vx.xx day-month-year 17:00:41   System HSC009
Copyright 1982 Digital Equipment Corporation. All Rights Reserved.
    
```

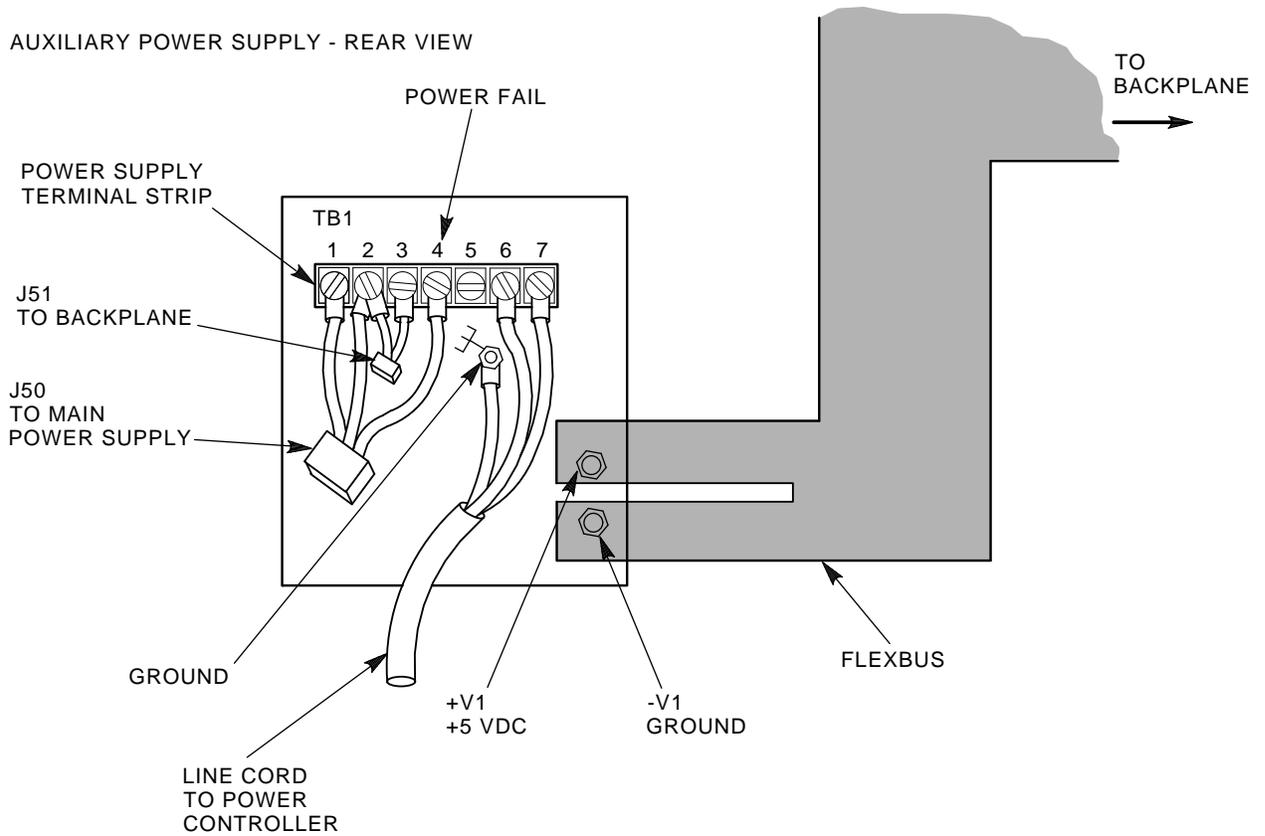
The HSC controller model and system name are site specific.

As part of the self-test diagnostics, there will be activity on the M.cache module LED indicators. Disregard this activity unless an indicator stays on for more than 60 seconds. Refer to Section 12.6.1 for a listing of M.cache module indicator functions.

7. If you have installed the auxiliary power supply as part of the HSC60 controller M.cache installation procedure, check the auxiliary power supply voltages at the points shown in Table 12-1:

WIRE LIST		
COLOR	POSITION	SIGNAL
BLACK	TBI-2	GROUND (5 V SENSE)
RED	TBI-1	5 V SENSE
BROWN	TBI-4	POWER FAIL
BLUE	TBI-7	ACC
BROWN	TBI-6	AC
GRN/YEL	TBI-5	CHASSIS GROUND
BLUE	TBI-3	ON/OFF
BLACK	TBI-2	GROUND (5 V SENSE)

AUXILIARY POWER SUPPLY - REAR VIEW



CXO-943B

Figure 12-5 Auxiliary Power Supply TB1 Connections

Table 12-1 Auxiliary Power Supply Voltage Checks

Voltage	Test Point	Check
+5.0 Vdc	Connector P40 on the OCP	Voltage between the red wire, pin 15, and the black wire, pin 14, should be between +5.09 and +5.15 Vdc. If this voltage is not within tolerance, remove power from the HSC controller immediately.
-5.2 Vdc	Connector P70 on the airflow sensor	Voltage between the orange wire, pin 3, and ground should read between -4.96 and -5.46 Vdc.
+12 Vdc	Connector P70 on the airflow sensor	Voltage between the purple wire, pin 1, and ground should read between 11.4 and 12.6 Vdc.

If the +5.0 Vdc output is not +5.1 Vdc or higher, verify that the auxiliary power supply fan is running. If the fan is not running, verify that the power cord is correctly installed. If the fan is NOT running, replace the auxiliary power supply.

- Run the memory integrity test ILMEMY. This test was automatically run as a result of normal power up, but re-running it now will display further information about memory status.

The following printout is the result of a typical successful ILMEMY run:

```
HSC>RUN ILMEMY Return
ILMEMY>D>09:33 Execution Starting
ILMEMY>D>No Disabled Buffers to Test
ILMEMY>D>09:33 Execution complete
```

A typical ILMEMY error is displayed as follows:

```
HSC>RUN ILMEMY Return
ILMEMY>D>09:33 Execution Starting
ILMEMY>D>09:33 T001 E 000
ILMEMY>D>Tested twice with no error (Buffer Retired)
ILMEMY>D>FRU1-M.std4 FRU2-
ILMEMY>D>Buffer Starting Address (physical) = 15743600
ILMEMY>D>Buffer Ending Address (physical) = 15744776
ILMEMY>D>09:33 Execution Complete
```

Refer to Chapter 4 for more information on running ILMEMY.

- Run the diagnostic ILCACH. This diagnostic was automatically run as a result of normal power-up, but rerunning it now will display further information about M.cache memory status. Once started, ILCACH cannot be terminated.

The following printout is the result of a typical successful ILCACH run:

```
HSC>RUN ILCACH Return
ILCACH>D>10:33 Execution Starting
ILCACH>D>10:33 Execution Complete
```

A typical ILCACH error is displayed as follows:

```
HSC>RUN ILCACH 
ILCACH>D>10:33 Execution Starting
ILCACH>D>10:33 T#001 E#000
ILCACH>D>Error detected with REFRESH CYCLE
ILCACH>D>FRU1-M.CACHE
ILCACH>D>10:33 Execution Complete
```

In this example, ILCACH found a memory refresh error on the M.cache module and has listed it as the only possible field replaceable unit (FRU).

Refer to Chapter 4 for more information on running ILCACH.

NOTE

The HSC is still functional and will come up with M.cache disabled.

10. Activate the M.cache module functionality as shown in the following example:

```

HSC> RUN SETSHO 
SETSHO> SET SERVER DISK/CACHE 
SETSHO-I You must EXIT SETSHO to update the drive cache state.
SETSHO> SET D8 CACHE 
SETSHO> EXIT
SETSHO-I Program Exit

HSC> SHOW SERVER CACHE
Cache Status
    Supervisor mode initialized
    Cache hardware present
    ILCACH run
    Cache tests good
    Cache Size Threshold: 8. blocks
    ERASE Purge Threshold: 256. blocks
    WRITE Threshold: 8. blocks
    Transfer Defined Extent size: 16. blocks
SETSHO-I Program Exit
```

11. Verify that the Cache Enabled indicator LED on the M.std4 module is lit. Figure 12-6 shows the location of this indicator. If this LED is not lit verify that the M.cache module is properly seated in the backplane.

12.6 M.cache Module Indicators

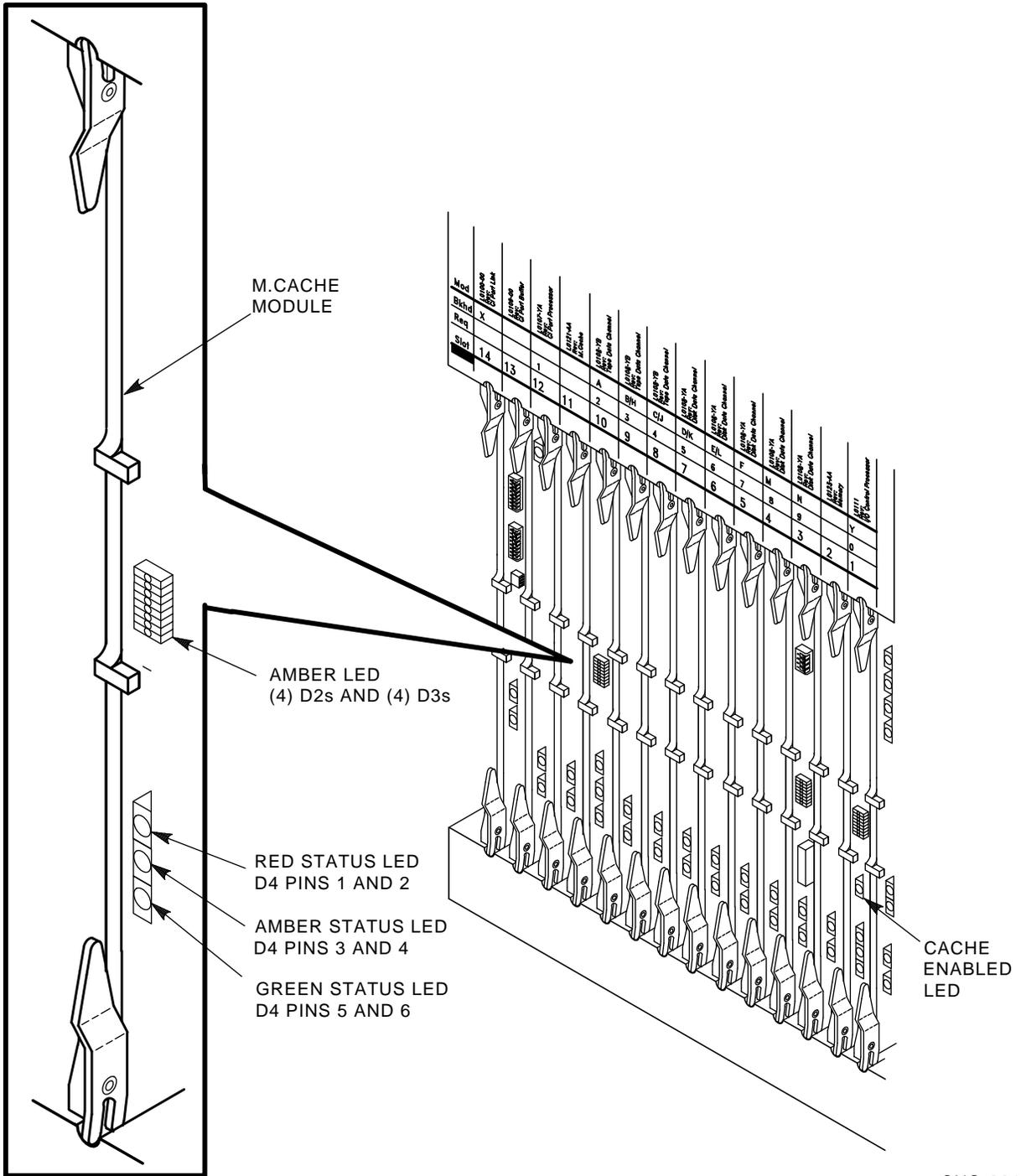
The M.cache has red, amber, and green status LEDs and a LED pack containing eight amber LEDs. Figure 12-6 shows the location of the M.cache module indicators. Also shown is the amber Cache Enabled indicator on the M.std4 module. This indicator is lit when the M.cache module is properly installed and cache memory is enabled.

12.6.1 M.cache Module Indicator Functions

Table 12-2 describes the functions of the M.cache module indicators.

Table 12-2 M.cache Module Indicator Functions

Module	Color	Function
M.cache (L0121-AA)	Green	Passed initialization tests
	Amber	Initialization tests in progress
	Red	Failed initialization tests
	Amber (upper)	D1—Single bit ECC error
	Amber	D2—Multiple bit ECC error
	Amber	D3—Hi-byte data memory parity error
	Amber	D4—Lo-byte data memory parity error
	Amber	D5—Functional state machine activity
	Amber	D6—Diagnostics state machine activity
	Amber	D7—M.cache waiting to be enabled
Amber	D8—Pattern compare failure	



CXO-3018A

Figure 12-6 Locating the M.cache Module Indicators

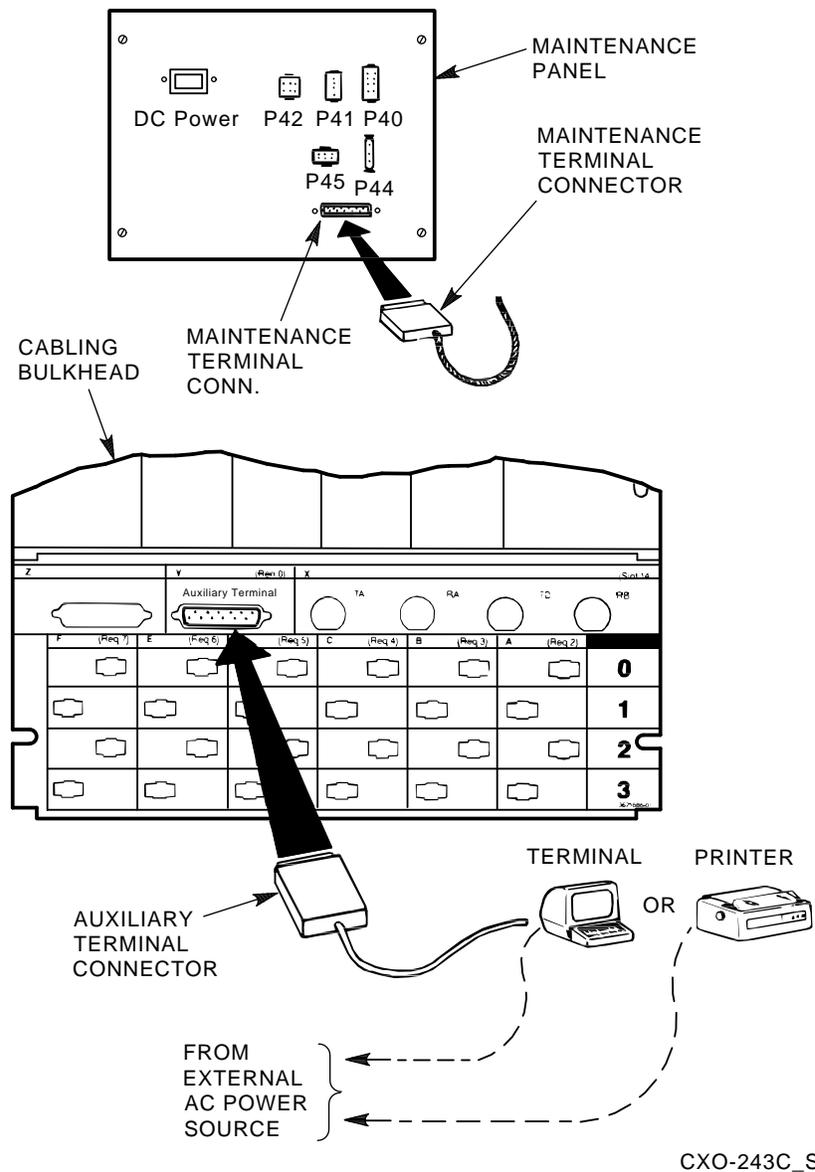
A

HSC50 Auxiliary Terminal and Maintenance Terminal Connections

A.1 Introduction

The HSC50 controller communicates with either an auxiliary terminal or a customer services maintenance terminal. The auxiliary terminal is any EIA-compatible terminal set at 9600 baud. The customer services maintenance terminal is normally found in the controlled distribution (CD) kit and operates at 300 baud.

Figure A-1 shows the placement of the two ASCII ports on the HSC50 controller. The auxiliary terminal can be connected to either the rear or the front ASCII port. Two terminals *cannot* be connected at the same time.



CXO-243C_S

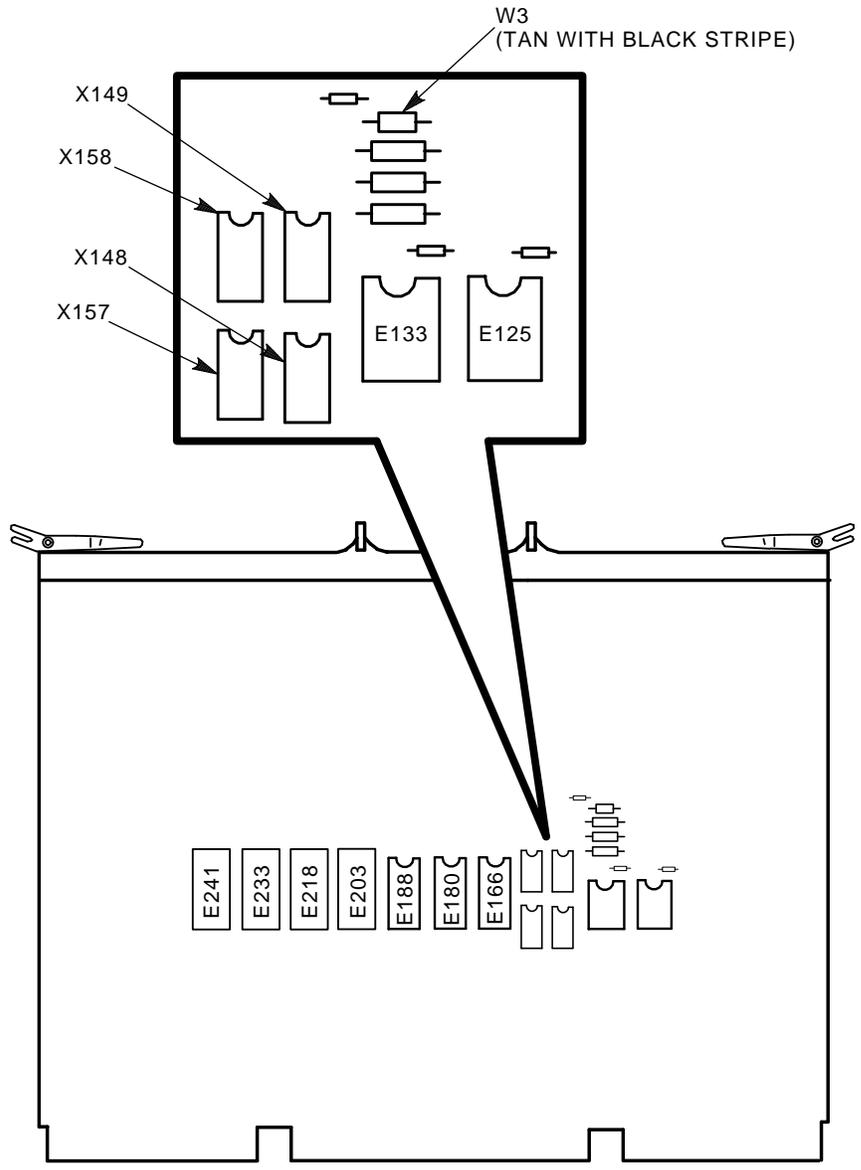
Figure A-1 Locating the Auxiliary/Maintenance Terminal Connections on HSC50 Controllers

A.2 Setting the P.ioc Module Terminal Baud Rate

Use the following procedure to set the terminal baud rate on the P.ioc module:

1. Take the HSC50 controller off line by setting the Online switch on the HSC operator control panel (OCP) to the out position.
2. Open the front door of the HSC50 controller.
3. Set the DC power switch to the 0 (OFF) position.
4. Remove the card cage cover.

5. Remove the I/O control processor module (L0105-00) from the module card cage by pulling the top and bottom module fasteners towards you.
6. Locate the W3 jumper location. W3 is a small, zero Ohm resistor with a single black band (refer to Figure A-2).



CXO-2685A

Figure A-2 Locating the HSC50 I/O Control Processor Module W3 Jumper

7. To set the terminal baud rate to 300, remove the W3 jumper. Leave the W3 jumper posts intact on the module for possible resoldering at a later date. If a slide-on W3 jumper is present, remove it and store it in the tape cartridge storage tray inside the HSC50 front door.

NOTE

The 300 baud rate is in effect until the W3 jumper is replaced. The W3 jumper must be replaced for a terminal to operate at 9600 baud.

8. To set the terminal baud rate to 9600, verify the W3 jumper is in place and intact.
9. Replace the I/O control processor module in the module card cage and secure the module fasteners.

CAUTION

Ensure that a module baffle is installed in each unused module slot and that the module card cage cover is replaced to avoid internal overheating.

10. Set the DC power switch to the 1 (ON) position.
11. Close the HSC50 front door.
12. Put the HSC50 controller on line by pressing the Online switch to the in position.

A.3 Connecting the Customer Services Maintenance Terminal to the HSC50 Controller

The customer services maintenance terminal, which communicates at 300 baud, may be used with the HSC50 controller as a substitute for the auxiliary terminal.

Use the following procedure to connect the customer services maintenance terminal to the HSC50 controller:

1. Take the HSC50 controller offline by setting the Online switch on the HSC OCP to the out position. The Online indicator should be off.
2. Open the HSC50 front door.
3. Loosen the four captive screws securing the maintenance panel access cover.
4. Set the HSC50 DC power switch to the 0 (OFF) position.
5. Ensure the terminal baud rate is set to 300 (refer to Section A.2).
6. Plug the customer services maintenance terminal power cable into the maintenance terminal power jack. (Two of the connectors in the maintenance access panel are used to connect the maintenance terminal.)
7. Plug the customer services maintenance terminal communication cable into the auxiliary terminal signal connector on the maintenance access panel (to the right of the power jack).
8. Ensure the HSC50 DC power switch is in the 1 (ON) position.
9. Close the HSC50 front door.
10. Put the HSC50 controller on line by setting the Online switch on the HSC OCP to the in position.

B

Data Channel Module Priorities and Configuration Guidelines

B.1 Introduction

This appendix addresses considerations for device priority and card cage slot assignment for disk and tape data channel modules.

B.2 Device Priority

An HSC requestor is defined as a module with the necessary components to request the control or data bus. The disk and tape data channel modules reside in HSC card cage slots that correspond to Requestors 2 through 7 or 2 through 9 depending on the HSC controller model. The requestors are assigned higher priority at the higher requestor numbers down to lower priority at lower requestor numbers. Optimum configuration of disk and tape devices depends on the assignment of data channel modules to requestors.

B.2.1 Data Channel Module Configuration Guidelines

To obtain maximum performance from your HSC controller, physically configure the tape and disk requestors according to the following guidelines:

- Each data channel module (K.si, K.sdi, or K.sti) in the HSC backplane has a requestor priority number according to its backplane slot. You can enhance the performance of the HSC controller if the attached devices (disk and tape drives) are arranged according to their transfer speeds.
- Attach the slower devices to the lower priority requestors and the faster devices to the higher priority requestors. Do this while you have the HSC controller shut down for data channel module installation.
- With the introduction of faster devices, such as the TA90 tape drive and RA92 disk drive, backplane configuration has become especially important. Failure to configure the devices properly could result in data bus overrun, EDC errors, and significant performance loss.

Table B-1 shows device relative speeds:

Table B-1 Physical Configuration for Device Relative Speeds

Device	Relative Speed	Priority/ Requestor Number
TA90/TA91 tape drive	Fastest	Highest
RA9x disk drive	.	.
ESE20 disk drive (including enhanced ESE20)	.	.
RA82 disk drive	.	.
RA81 disk drive	.	.
RA60 disk drive	.	.
RA70 disk drive	.	.
RA80 disk drive	.	.
Non-TA90/TA91 tape drives	Slowest	Lowest

Requestor priority ascends from Requestor 2, with the lowest priority, through the highest requestor number on the HSC controller. Note that requestor priority levels are all relative; that is, the individual requestor numbers have no intrinsic speed characteristic. If you have only one drive in your system, you will not get better performance by placing it on a high priority requestor instead of on a low priority requestor.

If it is necessary to mix TA90/TA91 tape drives with slower tape drives on a requestor, this should be done on the highest priority requestor.

When configuring, it is recommended that you leave blank slots where possible to allow for add-on drives without having to move existing cables.

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