Educational Services

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DECarray Owner's Manual

EK–SF7XS–OM–002

Digital Equipment Corporation

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Preface

This manual is intended for the user of SF-series storage enclosures in DECarray storage cabinets. It provides the user with all the information needed to operate these devices in a safe and effective manner. The information in this manual is organized as follows:

- **Chapter 1, Introduction,** contains a product description and specifications for the storage arrays and storage enclosures.
- **Chapter 2, Storage Array Site Preparation,** contains site preparation information for the series storage array.
- **Chapter 3, SF3x Storage Enclosure Operation,** describes the SF3x half-height storage enclosure.
- **Chapter 4, SF7x Storage Enclosure Operation,** describes the SF7x full-height storage enclosure.
- **Chapter 5, Troubleshooting,** contains simple instructions for troubleshooting the installation of the storage array and storage enclosure.
- **Appendix A, Configuration Sheets,** contains a number of blank configuration sheets.

1
Introduction

1.1 DECarray Overview

The DECarray is a storage rack cabinet designed to hold up to six SF-series storage enclosures and one or two magazine tape ISEs (such as the TF857). It may be connected to one or more host VAX systems.

Viewing the DECarray (Figure 1–1) from the front, note that the storage enclosures and magazine tapes are arranged as follows:

- Levels 1, 2, and 4 are reserved for storage enclosures. Storage enclosures are added into these levels in ascending order of position; 1, 2, 3, 4, 7, and 8.
- Level 3 is reserved for magazine tapes. Magazine tape ISEs are installed in position 5 first, then in position 6.

NOTE

The position numbers are visible on the right and left chassis side rails when the front or rear doors of the DECarray are open.

Specifications for the storage array are shown in Table 1–1.

Figure 1–1 DECarray Front View (with SF7x Storage Enclosures)

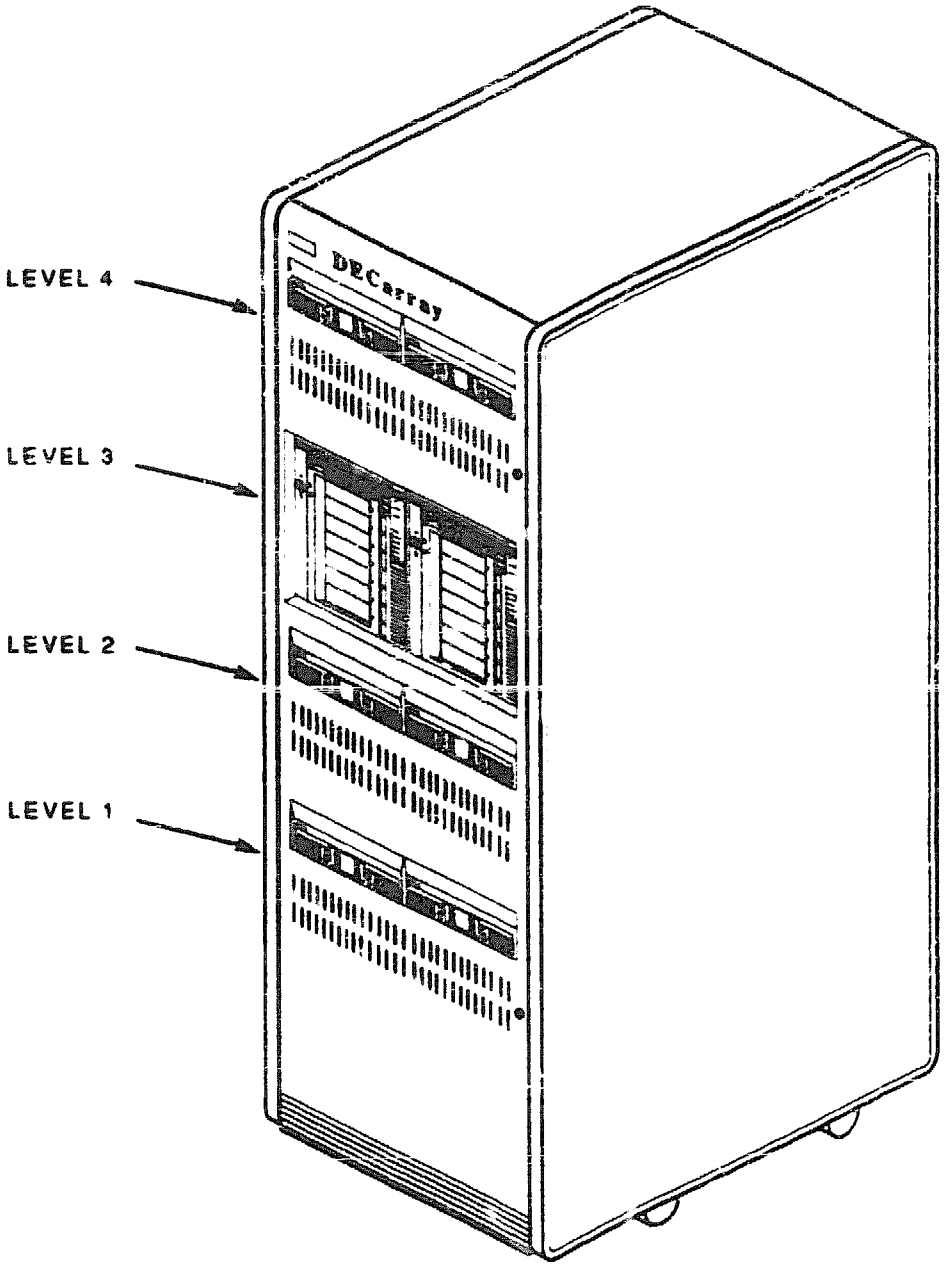

Table 1–1 DECarray Specifications

Characteristic	Specification
Number of disk ISEs	Minimum: 2, maximum: 24
Formatted storage capacity	Minimum: 2, maximum: 48 (in 2 or 4 Gbyte increments)
Dimensions (nominal)	152.4 cm (60.5 inches) H, 60.96 cm (24.0 inches) W, 76.2 cm (34.0 inches) D
Weight	
Minimum configuration[1]	228 kg (500 lb)
Maximum configuration[2]	454 kg (1000 lb)
Agency compliance	FCC, UL, IEC, CSA, and VDE
Temperature	+10°C to +40°C (+50°F to +104°F). Reduce rating by 1.8°C for each 1000 meters altitude (1.0°F for each 1000 feet altitude)
Humidity	10% to 85% @ maximum wet bulb temperature of +32°C (+90°F) and minimum dew point of +2°C (+36°F)
Recommended Environmental Limits[3]	
Operating environment	
Temperature	18°C to 24°C (64.4°F to 75.2°F) with an average rate of change of 3°C/hour maximum and a step change of 3°C or less
Relative humidity	40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)
Altitude	Up to 2400 meters (8000 feet)
Air quality (maximum particle count)	Not to exceed 500,000 particles per cubic foot of air at a size of 0.5 micron or larger
Air volume (at inlet)	50 cubic feet per minute (0.026 cubic meters per second)

[1]DECarray minimum configuration is the –Ex consisting of one –HK storage enclosure.

[2]DECarray maximum configuration is the –Jx consisting of six –JK storage enclosures and two magazine tapes.

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

Table 1–1 (Continued) DECarray Specifications

Characteristic	Specification
Recommended Environmental Limits[3]	
Nonoperating environment	
Temperature	-40°C to +66°C (-40°F to +151°F)
Relative humidity	10% to 80%, noncondensing
Altitude	4900 meters (16,000 feet)
Acoustic noise	6.8 bells
Nominal airflow through enclosure	360 to 520 cubic feet/minute
Input power requirements, with SF3x (47 to 63 Hz normal operation)	7.2 A per phase @ 100 to 120 Vac (60 Hz) 3.7 A per phase @ 220 to 240 Vac (50 Hz)
Power requirements during disk ISE spinup, with SF3x	11.5 A @ 100 to 120 Vac (60 Hz) 6.1 A @ 220 to 240 Vac (50 Hz)
Input power requirements, with SF72 (47 to 63 Hz normal operation)	6.00 A (per phase) @ 100 to 120 Vac (60 Hz), 3.00 A (per phase) @ 220 to 240 Vac (50 Hz)
Power requirements during disk ISE spinup, with SF72	21.0 A @ 100 to 120 Vac (60 Hz), 10.5 A @ 220 to 240 Vac (50 Hz)
Input power requirements, with SF73 (47 to 63 Hz normal operation)	6.6 A (per phase) @ 100 to 120 Vac (60 Hz), 3.8 A (per phase) @ 220 to 240 Vac (50 Hz)
Power requirements during disk ISE spinup, with SF73	12.8 A @ 100 to 120 Vac (60 Hz), 7.5 A @ 220 to 240 Vac (50 Hz)

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

1.2 Storage Enclosure Overview

The SF-series storage enclosures come in two series; the SF3x enclosure which contains up to twelve half-height, 3 1/2-inch ISEs, and the SF7x enclosure which contains up to four full-height, 5 1/4-inch ISEs.

In both series, each disk ISE is independently controlled by the storage enclosure operator control panel (OCP). The power supply in the enclosure provides the dc power and cooling for the disk ISEs.

The SF3x storage enclosure (Figure 1–2) holds up to twelve RF3x series ISEs. These are arranged on two DSSI buses. The six ISEs physically located on the front of the storage enclosure are on one DSSI bus and the six ISEs located on the rear of the storage enclosure are on a second DSSI bus. These can be further separated into four buses, each with three drives, for split-bus operation (see Section 3.1.2).

The SF7x series storage enclosure (Figure 1–3) holds either two or four RF7x series ISEs. The ISEs in the SF7x storage enclosure can be configured on one or two DSSI buses, as explained in Section 4.2.

Both SF-series storage enclosures have the following features:

- It can operate in one of two modes; through-bus or split-bus.
- Each disk ISE has its own set of switches and indicators on the OCP.
- The enclosure power supply provides operating power to all disk ISEs and other subassemblies in the enclosure.
- The drive dc power switches for the disk ISEs are on the front panel of the storage enclosure.

Specifications for the SF3x series storage enclosure are shown in Table 1–2. Specifications for the SF7x series storage enclosure are shown in Table 1–3.

Figure 1–2 SF3x Series Storage Enclosure

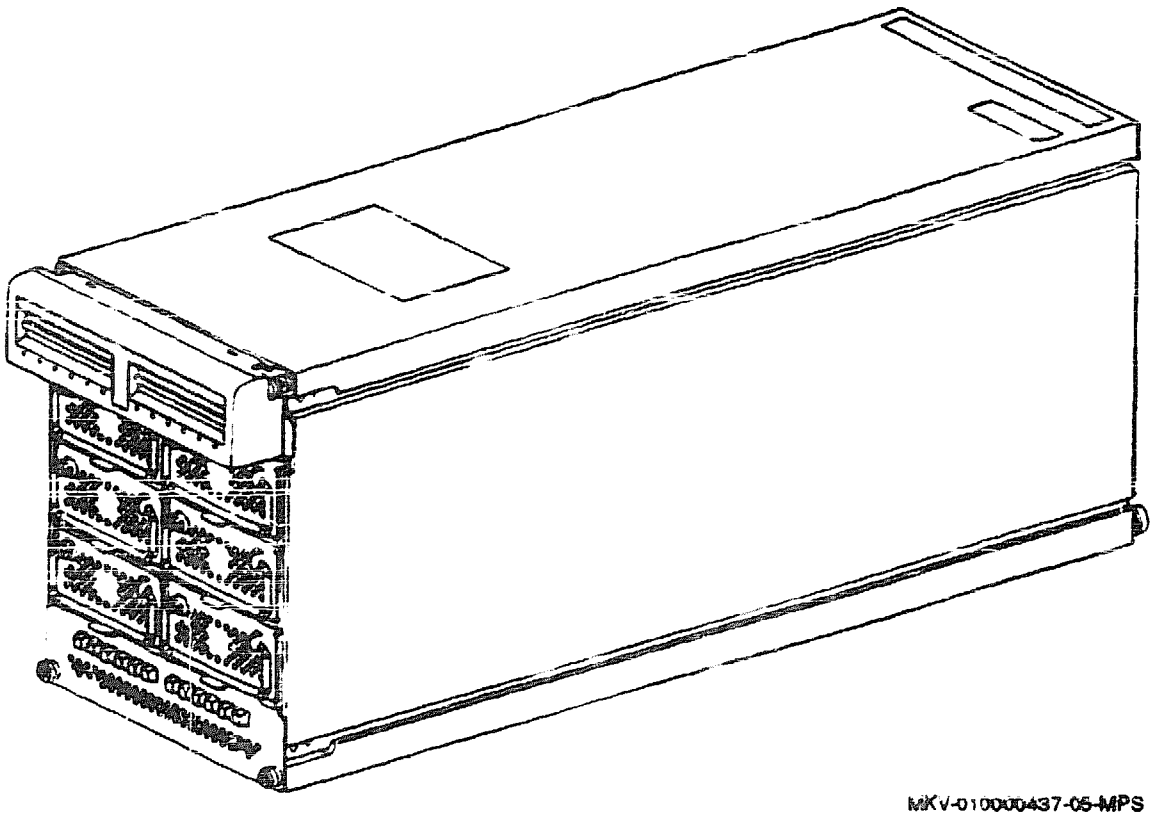

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Figure 1–3 SF7x Series Storage Enclosure

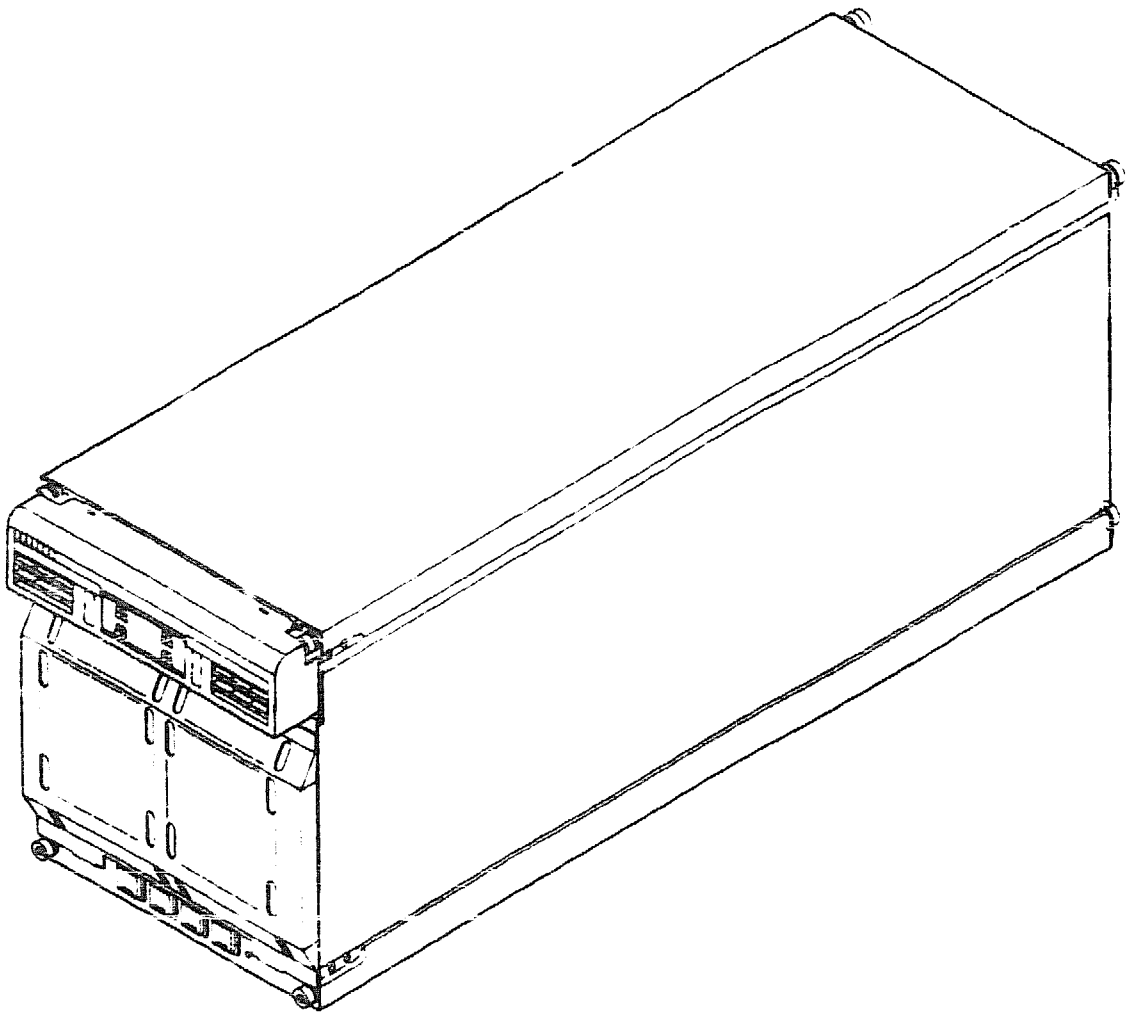

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Table 1–2 SF3x Storage Enclosure Specifications

Characteristic	Specification
Formatted storage capacity	
SF3x–BK[1]	1.7 GBytes
SF3x–HK[2]	5.1 GBytes
SF3x–JK[2]	10.2 GBytes
Dimensions	H = 26.7 cm (10.5 inches) W = 22.2 cm (8.75 inches) D = 71.1 cm (28 inches)
Weight	
SF3x–BK[1]	26 kg (58 lb)
SF3x–HK[2]	33 kg (73 lb)
SF3x–JK[3]	40 kg (88 lb)
Agency compliance	FCC, UL, IEC, CSA, and VDE
Temperature	+10°C to +40°C (+50°F to +104°F). Decrease the rating 1.8°C for each 1000 meters altitude (1.0°F for each 1000 feet altitude)
Humidity	10% to 85% @ maximum wet bulb temperature of +32°C (+90°F) and minimum dew point of +2°C (+36°F)
Recommended Environmental Limits[4]	
Operating environment	
Temperature	18°C to 24°C (64.4°F to 75.2°F) with an average rate of change of 3°C/hour maximum and a step change of 3°C or less
Relative humidity	40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)
Altitude	Up to 2400 meters (8000 feet)
Air quality (maximum particle count)	Not to exceed 500,000 particles per cubic foot of air at a size of 0.5 micron or larger

[1]The SF3x–BK contains two disk ISEs.

[2]The SF3x–HK contains six disk ISEs.

[3]The SF3x–JK contains twelve disk ISEs.

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

Table 1–2 (Continued) SF3x Storage Enclosure Specifications

Characteristic	Specification
Recommended Environmental Limits[4]	
Air volume (at inlet)	50 cubic feet/minute (0.026 cubic meters per second)
Nonoperating environment	
Temperature	-40°C to +66°C (-40°F to +151°F)
Relative humidity	10% to 80%, noncondensing
Altitude	4900 meters (16,000 feet)
SF3x enclosure acoustic noise	7.0 bels
Nominal airflow through enclosure	45 to 65 cubic feet/minute
SF3x Input power requirements (47 to 63 Hz normal operation)	3.0 A @ 100 to 120 Vac (60 Hz), 1.5 A @ 220 to 240 Vac (50 Hz)
SF3x Power requirements during disk ISE spinup	4.5 A @ 100 to 120 Vac (60 Hz), 2.3 A @ 220 to 240 Vac (50 Hz)

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

Table 1–3 SF7x Storage Enclosure Specifications

Characteristic	Specification
Number of disk ISE positions	4 (RF series disk ISEs)
Formatted storage capacity	
SF72–HK[1]	2 GBytes
SF72–JK[2]	4 GBytes
SF73–HK[1]	4 GBytes
SF73–JK[2]	8 GBytes
Dimensions	H = 26.7 cm (10.5 inches) W = 22.2 cm (8.75 inches) D = 71.1 cm (28 inches)
Weight	
SF72–HK[1]	33 kg (72 lb)
SF72–JK[2]	41 kg (91 lb)
SF73–HK[1]	33 kg (72 lb)
SF73–JK[2]	41 kg (90 lb)
Agency compliance	FCC, UL, IEC, CSA, and VDE
Temperature	+10°C to +40°C (+50°F to +104°F). Decrease rating 1.8°C for each 1000 meters altitude (1.0°F for each 1000 feet altitude)
Humidity	10% to 85% @ maximum wet bulb temperature of +32°C (+90°F) and minimum dew point of +2°C (+36°F)
Recommended Environmental Limits[3]	
Operating environment	
Temperature	18°C to 24°C (64.4°F to 75.2°F) with an average rate of change of 3°C/hour maximum and a step change of 3°C or less
Relative humidity	40% to 60% (noncondensing) with a step change of 10% or less (noncondensing)

[1]The SF72–HK contains two RF72 disk ISEs. The SF73–HK contains two RF73 disk ISEs

[2]The SF72–JK contains four RF72 disk ISEs. The SF73–JK contains four RF73 disk ISEs.

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

Table 1–3 (Continued) SF7x Storage Enclosure Specifications

Characteristic	Specification
Recommended Environmental Limits[3]	
Altitude	Up to 2400 meters (8000 feet)
Air quality (maximum particle count)	Not to exceed 500,000 particles per cubic foot of air at a size of 0.5 micron or larger
Air volume (at inlet)	50 cubic feet/minute (0.026 cubic meters per second)
Nonoperating environment	
Temperature	-40°C to +66°C (-40°F to +151°F)
Relative humidity	10% to 80%, noncondensing
Altitude	4900 meters (16,000 feet)
SF72 enclosure acoustic noise	6.2 bels
SF73 enclosure acoustic noise	6.0 bels
Nominal airflow through enclosure	45 to 65 cubic feet/minute
SF72 Input power requirements (47 to 63 Hz normal operation)	2.70 A @ 100 to 120 Vac (60 Hz), 1.20 A @ 220 to 240 Vac (50 Hz)
SF72 Power requirements during disk ISE spinup	3.50 A @ 100 to 120 Vac (60 Hz), 3.25 A @ 220 to 240 Vac (50 Hz)
SF73 Input power requirements (47 to 63 Hz normal operation)	2.4 A @ 100 to 120 Vac (60 Hz), 1.3 A @ 220 to 240 Vac (50 Hz)
SF73 Power requirements during disk ISE spinup	4.7 A @ 100 to 120 Vac (60 Hz), 2.4 A @ 220 to 240 Vac (50 Hz)

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

1.3 Related Documentation

Table 1–4 lists reference documentation that supplement this manual.

Table 1–4 Related Documentation

Title	Order Number
KFMSA Module Installation and User Manual	EK–KFMSA–IM
KFQSA Module Installation and User Manual	EK–KFQSA–IM
RFxx Series Integrated Storage Element User Guide	EK–RF7xD–UG
TF857 Magazine Tape Subsystem Service Manual	EK–TF857–SM

Other recommended manuals are the system installation guide and or technical information manuals.

2
DECarray Site Preparation

The DECarray is intended for installation in a Class A computer room environment and must meet the conditions specified in Table 1–1.

Before installing the DECarray, the following conditions must be met:

- The DECarray requires 3-phase ac power. Each phase draws up to 7.2 amperes in a fully configured array.
- Adequate space is provided around the DECarray for opening the front and rear doors, accessing cables, and for adequate airflow.
- The installation site floor can safely bear the weight of the DECarray. A fully configured DECarray (containing six storage enclosures, two magazine tapes, power controller, and cabinet weighs 454 kilograms [1000 pounds].
- The system's configuration sheet has been correctly filled out and is up-to-date. Examples configuration sheets can be found in Figure 2–1 and 2–2.
- An adequate number of DSSI adapter modules exist in the backplane (or embedded) in the system or systems, to support all the disk ISEs in the storage array.

  Appendix A has blank configuration sheets for your use.

  Refer to the *KFMSA Module Installation and User Guide*, *KFQSA Module Installation and User Guide*, and the system documentation (embedded adapters) for more details.

Figure 2–1 Single-System Configuration Sheet (Example)

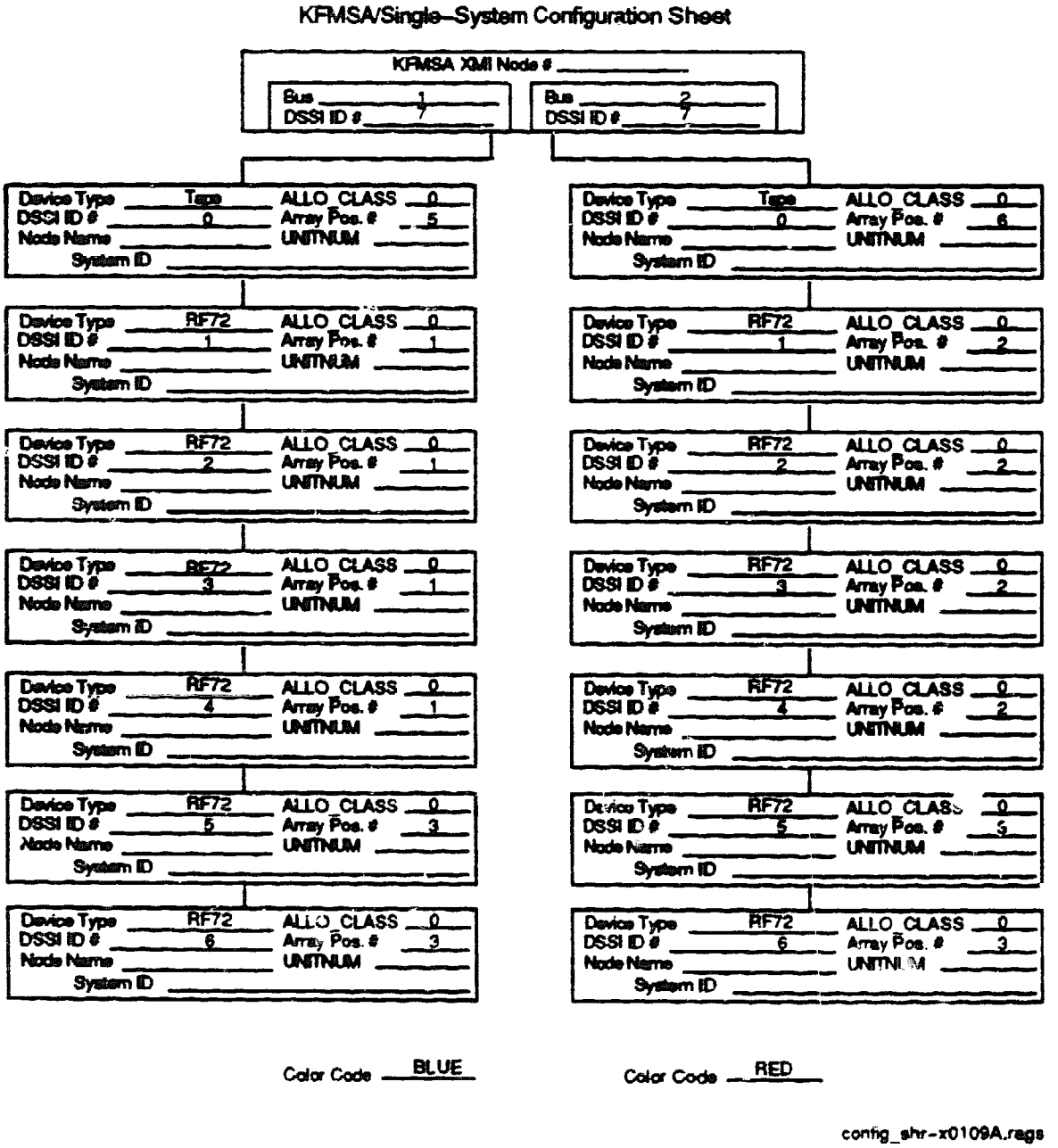
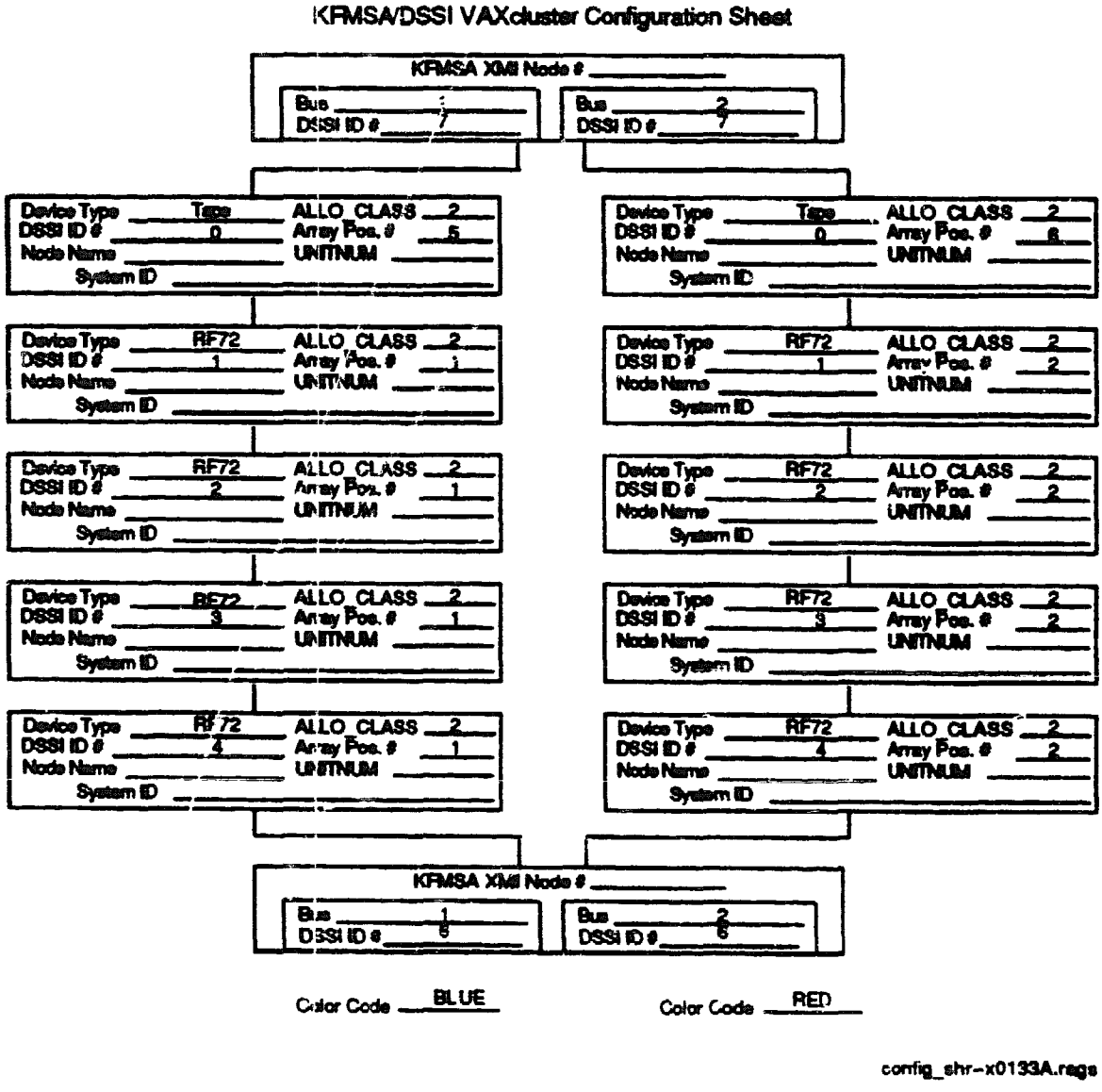


Figure 2–2 DSSI VAXcluster Configuration Sheet (Example)



3

SF3x Series Storage Enclosure

This chapter contains the following information:

- An overview of the SF3x storage enclosure
- A description of all front and rear panel controls and indicators
- Instructions on how to power up the storage enclosure
- Instructions on how to bring the storage enclosure on- and off-line

3.1 SF3x Overview

The SF3x storage enclosure comes with either two, six, or twelve half-height, 3 1/2-inch form factor disk ISEs. They are arranged on two DSSI buses, one for the front six ISEs and one for the rear six ISEs. These can be further divided into four DSSI buses, each with three ISEs by configuring the storage enclosure in split-bus mode, as described in the next section.

Each ISE slides into a slot in the enclosure, where it plugs directly into a backplane. There is one backplane for the front six ISEs and one backplane for the rear six ISEs.

Each slot in the backplane is assigned a letter designation, A through F. Each designation has a corresponding factory-assigned DSSI node ID, as shown in Table 3–1. It is possible to change the DSSI node ID for any given position by using DIP switches provided on the SF3x enclosure's transition module. For more information on changing the DSSI node ID of an ISE in the SF3X enclosure, refer to the DECarray Installation Guide (EK-SF2XX-IG).

Table 3–1 SF3x Storage Positions

Position	Backplane Location	DSSI Node ID
A	upper left slot	0
B	upper right slot	1
C	middle left slot	2
D	middle right slot	3
E	lower left slot	4
F	lower right slot	5

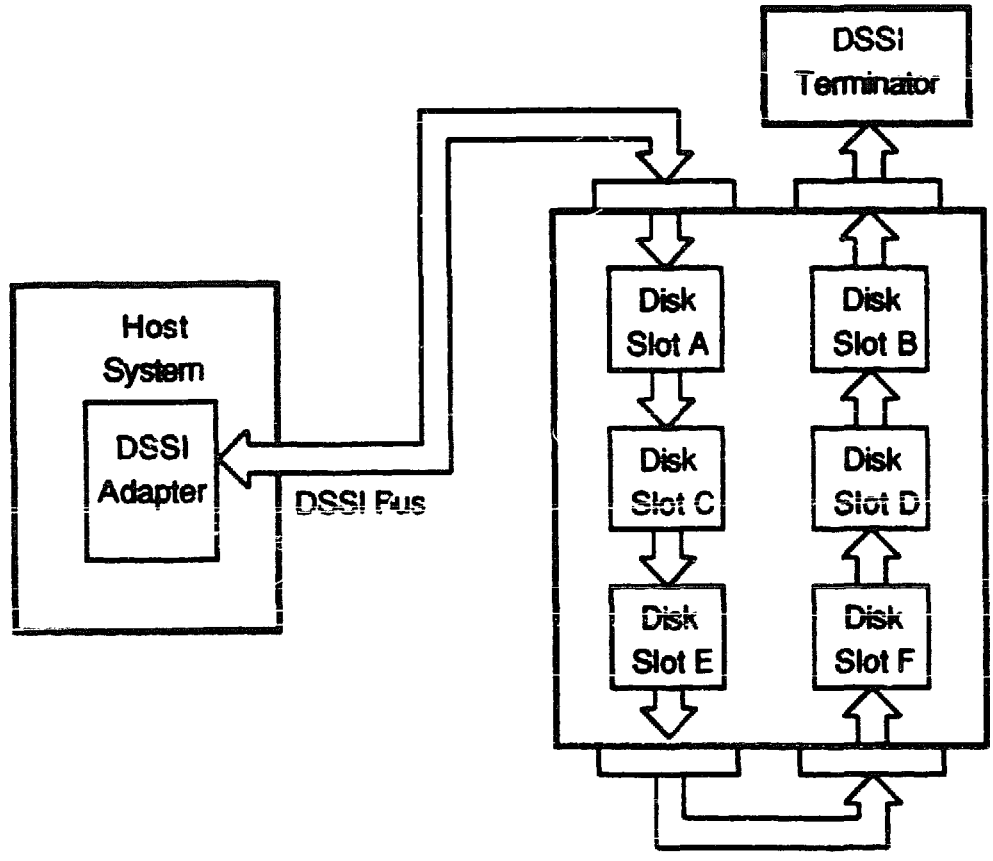
SF3x series storage enclosures can be connected to a single system, or they can be connected to multiple systems in a DSSI VAXcluster configuration. It can operate in one of two bus modes; through-bus and split-bus mode. These modes are described in the following sections.

3.1.1 Through-Bus Mode

In through-bus mode, all six disk ISEs in each half of the storage enclosure are connected to the same DSSI bus. The DSSI bus enters through the left DSSI connector on the top of the backplane, connects to the ISEs in slots A, C, and E on the left side of the enclosure, then goes through the ISEs in slots F, D, and B, and finally out the right DSSI connector (see Figure 3–1).

At this point, the DSSI bus is either terminated (with a DSSI terminator, PN 12–31281–01), connected to a magazine tape ISE, or connected to the DECarray I/O panel.

Figure 3–1 Through-Bus Mode

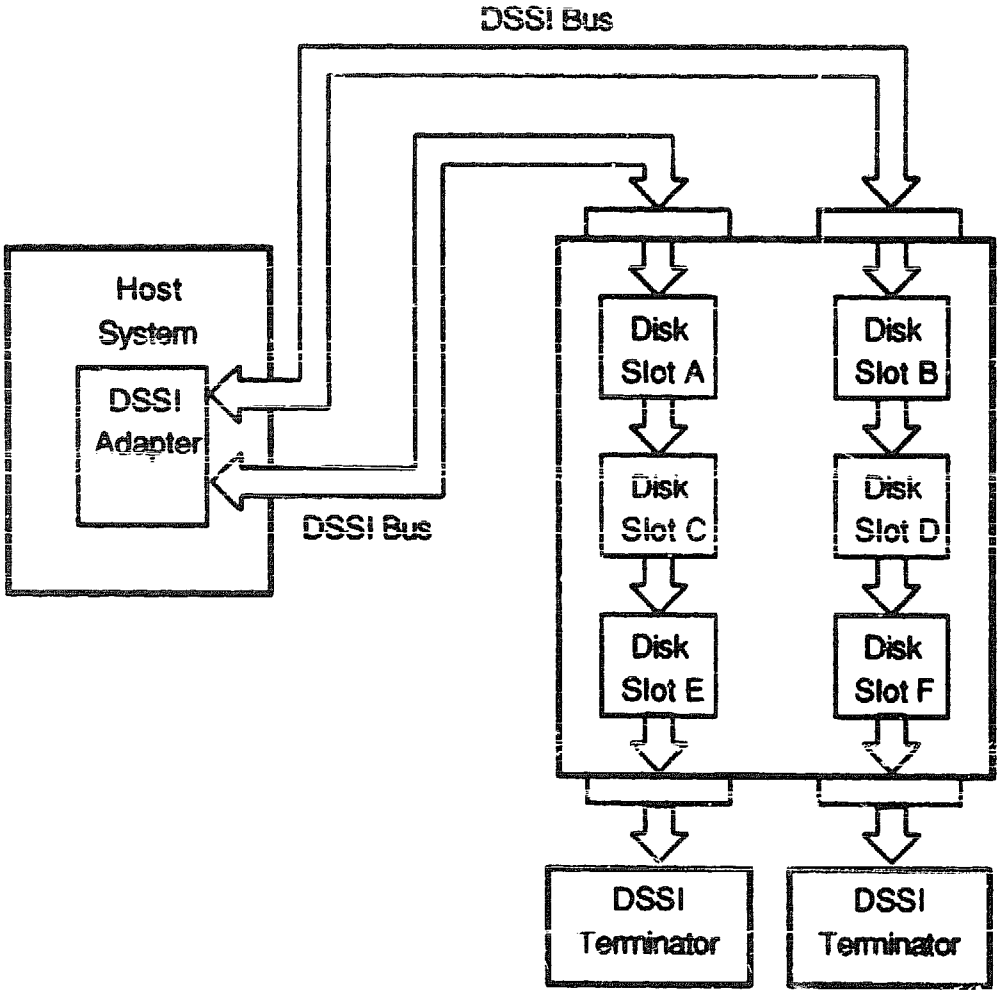


3.1.2 Split-Bus Mode

Each set of ISEs (front and rear) can be further separated by putting the ISEs on the left (slots A, C, and E) and the ISEs on the right (slots B, D, and F) on separate DSSI buses. This configuration leaves each enclosure with four distinct DSSI buses, each with three ISEs (Figure 4–2).

This configuration is most often used when the DECarray is configured in stripe sets.

Figure 3–2 Split-Bus Mode



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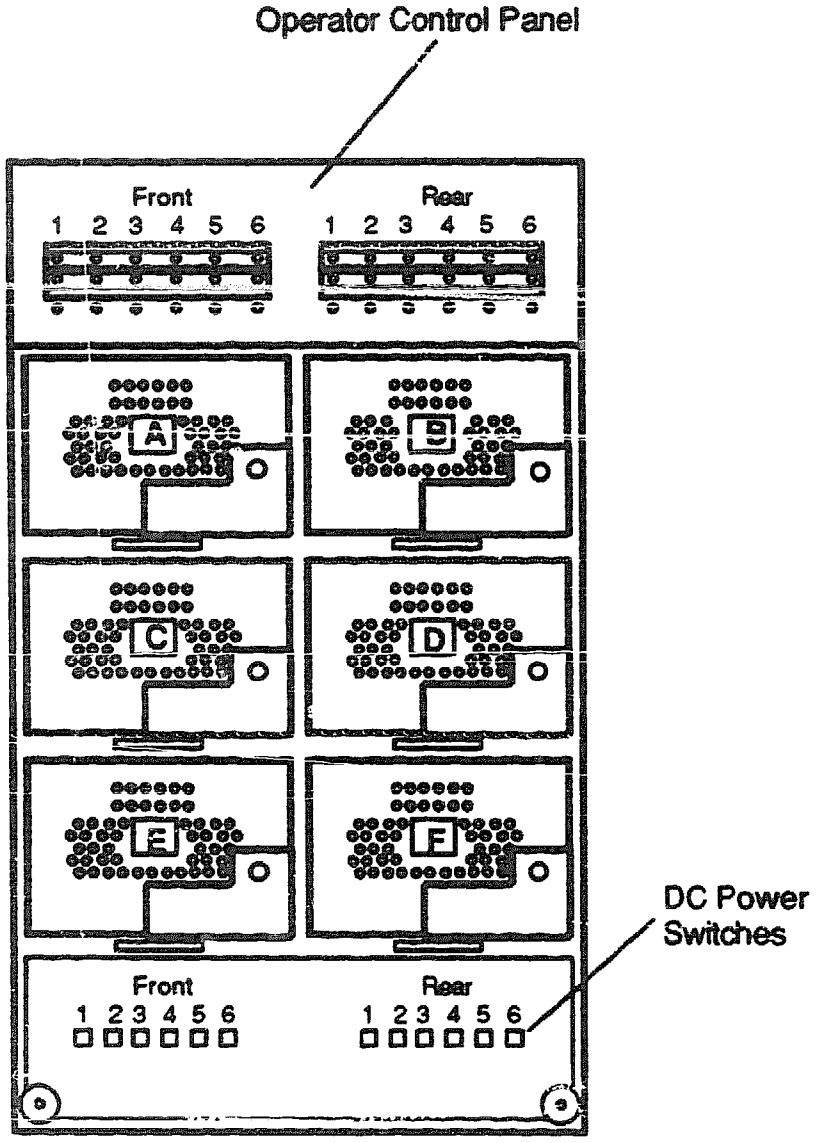
3.2 Front Panel Controls, Labels, and Indicators

Figure 3–3 shows a front view of the storage enclosure. The operator control panel (OCP) is on the top front of the enclosure. It can be accessed without opening the cabinet front door.

The dc power switches for each ISE are on the bottom front of the enclosure. These switches are not accessible when the front door of the cabinet is closed.

Figure 3–3 Front View of the SF3x Storage Enclosure



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3.2.1 Operator Control Panel (OCP)

The OCP contains two identical sets of controls and indicators, one set for the front ISEs and one set for the rear. Each set consists of switches and LEDs for six ISEs, one for each slot in that side of the storage enclosure. Unless a disk ISE is installed and power is applied to a given slot, the corresponding controls and indicators are non-operational.

Table 3–2 summarizes the function of the controls and indicators provided for each ISE in the storage enclosure.

Table 3–2 Operator Control Panel Functions

Control/Indicator	Function
Ready switch	The Ready switch is a push-to-set switch with a green indicator. When pressed in, the Ready switch causes the disk ISE to come on-line. After the Ready switch is pressed, it takes approximately 60 seconds for the disk ISE to come on-line. The green indicator remains lit while the disk ISE is on-line. However, this indicator may flicker or go out entirely when the disk ISE is performing heavy seeks.
Write Protect switch	The Write Protect switch is a push-to-set switch with an amber indicator. When the Write Protect switch is engaged, the data on that disk ISE cannot be overwritten, nor can any new data be written to that disk ISE.
MSCP switch/FAULT indicator	The MSCP/Fault switch is a recessed switch with a multi-color indicator. During normal operation this LED is unlit. If the MSCP switch is pressed and MSCP is disabled, this LED is lit green. If the system detects a fault in the ISE, this LED is lit red. If a fault is detected while MSCP is disabled, this LED is lit amber.

3.2.2 DC Power Switches

Power switches for each ISE are on the lower front side of the storage enclosure. The six switches on the left are for the front six ISEs and the six switches on the right are for the rear six ISEs. Each power switch is associated with a disk ISE position, as shown in Figure 3–3.

An indicator in each drive dc power switch illuminates to show that nominal power is being applied to the associated disk ISE.

Press the dc power switch to connect power to the associated disk ISE. This causes the disk ISE to spin up and run a self-test. After setting the drive dc power switch, you must press the Ready button on the OCP to bring the disk ISE on-line.

Power is applied to the rear six ISEs first, then after a 15-second delay, power is applied to the front six ISEs.

3.3 Rear Panel Controls and Indicators

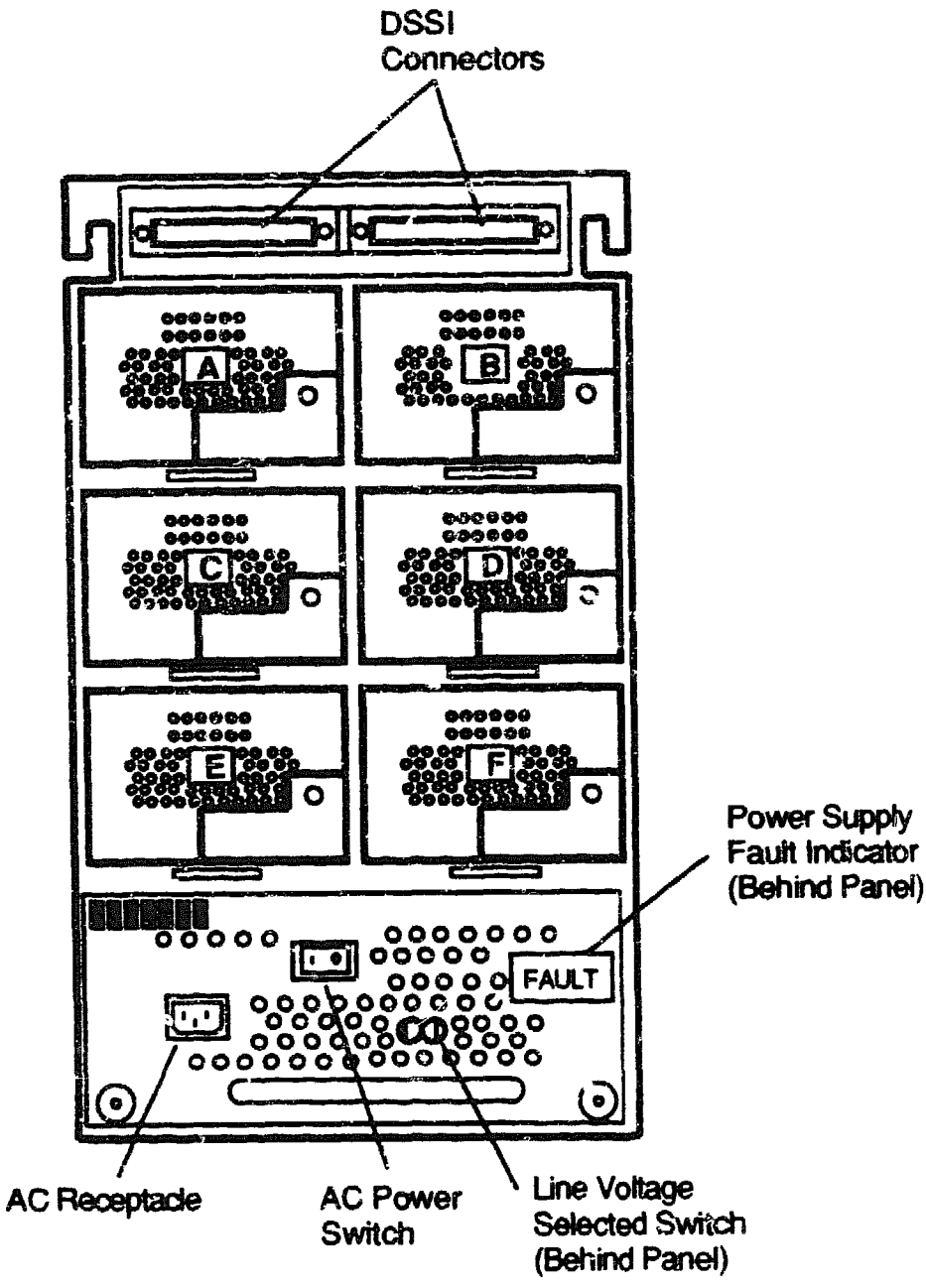
Figure 3–4 shows the rear panel of the storage enclosure. The DSSI connectors are on the top rear side of the enclosure. The ac power switch, line voltage selector switch, and power supply fault indicator are on the bottom rear of the enclosure, on the power supply chassis, as shown in Figure 3–4. These controls and indicators affect operation of the entire storage enclosure.

Table 3–3 summarizes the rear panel control/indicator functions. Details are provided in the paragraphs that follow.

Table 3–3 Summary of Rear Panel Control/Indicator Functions

Control/Indicator	Function
Power Supply Chassis	
AC power switch	Applies line voltage to dc power supply.
Line voltage selector switch	Selects between 120 Vac (60 Hz) and 240 Vac (50 Hz) line voltage.
Power supply fault indicator	Illuminates for fault or overtemperature in enclosure.

Figure 3–4 Rear Panel of the Storage Enclosure



WARNING

Hazardous voltages are present inside the equipment cabinet and the storage enclosure. Installation and service must be performed only by qualified Digital Services engineers.

The ac power switch for the storage enclosure is in the center of the rear panel. Setting the ac power switch to the (1) position applies power to the storage enclosure. Setting the switch to the (0) position removes power from the enclosure.

As you face the rear panel, the line voltage selector switch is located to the right of the ac power switch. It is visible through a hole in the rear panel. The Digital Services engineer sets this switch to the available line voltage during installation. The number *120* represents 120 Vac at 60 Hz, and the number *240* represents 240 Vac at 50 Hz.

CAUTION

The storage enclosure power supply is universal for both 120 Vac and 240 Vac. The supply is factory-set to 240 Vac and must be reset to 120 Vac for some installations. Selecting 120 Vac and using 240 Vac will damage the power supply.

The power supply fault indicator is behind the panel, in the lower right corner of the storage enclosure. When the fault indicator is lit, a green light is visible through the holes in the rear panel. The storage enclosure automatically shuts down when the dc power supply detects a fault or overtemperature condition.

3.4 Applying Power to the Enclosure

This section describes the correct procedure for applying power to the storage enclosure. Perform *all* steps in the order in which they are presented.

1. Check that the drive dc power switches and all disk ISE control buttons on the front of the enclosure are in the off position (completely out and unlit)
2. Set the ac power switch to the *on* (1) position to apply ac power to the dc power supply.
3. Check that the power is on by making sure the fan starts and there is normal airflow through the enclosure.

   NOTE

   It is possible to have airflow through the enclosure and not have output voltage. This indicates that the line voltage selector switch, located behind the rear panel of the enclosure, is in the wrong position.

   Set the ac power switch to the *off* (0) position and reset the line voltage selector switch.
4. Press in the dc power switcher for all ISEs in the enclosure, and make sure the green indicators illuminate for the rear six ISEs (right six buttons on the front of the enclosure), then after 15 seconds the dc power switches for the front six ISEs illuminate.

3.5 Placing a Disk ISE On-Line

After power is applied to the storage enclosure, use the following procedure to place a disk ISE on-line. Perform *all* steps in the order in which they are presented.

1. Press the Ready button on the OCP to bring the ISE on-line.
   a. The Ready indicator flickers while the disk ISE is spinning up. If you power up a disk ISE with the Ready button *in* you must press the button *out* momentarily, then press the button *in* to bring the disk ISE on-line correctly.
   b. All other indicators remain off.
   c. When the disk ISE has completed spinup, the Ready indicator illuminates, indicating that the disk ISE is ready for read/write operation.
   d. The Fault indicator illuminates if the disk ISE detects a fault. Refer to Chapter 5 of this manual for recovery procedures.
2. Press the Write Protect button on the OCP, as required, to turn on write-protect mode. To deselect write-protect mode, press this button a second time.

Repeat this entire procedure for each disk ISE being placed on-line.

NOTE

The Ready indicator remains lit during normal operation, though it may flicker during heavy seeks.

The Write Protect indicator is lit when the disk ISE is write-protected, and off when the disk ISE is write-enabled.

3.6 Taking a Disk ISE Off-Line

To take a disk ISE off-line, press the Ready button *out* and wait until the LED goes out.

4

SF7x Series Storage Enclosure Operation

This chapter contains the following information:

- An overview of the SF7x storage enclosure.
- A description of the various bus modes and system configurations in which the storage enclosure functions
- A description of all front and rear panel controls and indicators
- Instructions on how to power up the storage enclosure
- Instructions on how to bring the storage enclosure on- and off-line

4.1 SF7x Overview

The SF7x storage enclosure comes with either two or four DSSI ISEs. These can be connected to a single DSSI bus, or split between two DSSI buses. The ISEs in the storage enclosure are assigned a DSSI node ID by way of switches on the operator control panel.

4.2 Storage Enclosure Configurations

The storage enclosure is available with either two or four RF72 (1 Gbyte) or RF73 (2 Gbyte) disk integrated storage elements (ISEs) installed. The two-ISE variant is referred to as –HK, and the four-ISE variant is referred to as –JK.

SF7x series storage enclosures residing in DECarrays can be connected to a single system or to multiple systems in a DSSI VAXcluster configuration.

Single-system configurations support up to 48 GBytes (using RF72 ISEs) or 96 GBytes (using RF73 ISEs) of formatted storage with two DECarrays. DSSI VAXcluster configurations support up to 24 or 48 GBytes of formatted storage in a single DECarray connected to two or more systems.

Either of these variants operate in one of two bus modes. These modes are called through-bus and split-bus, and are described in the sections that follow.

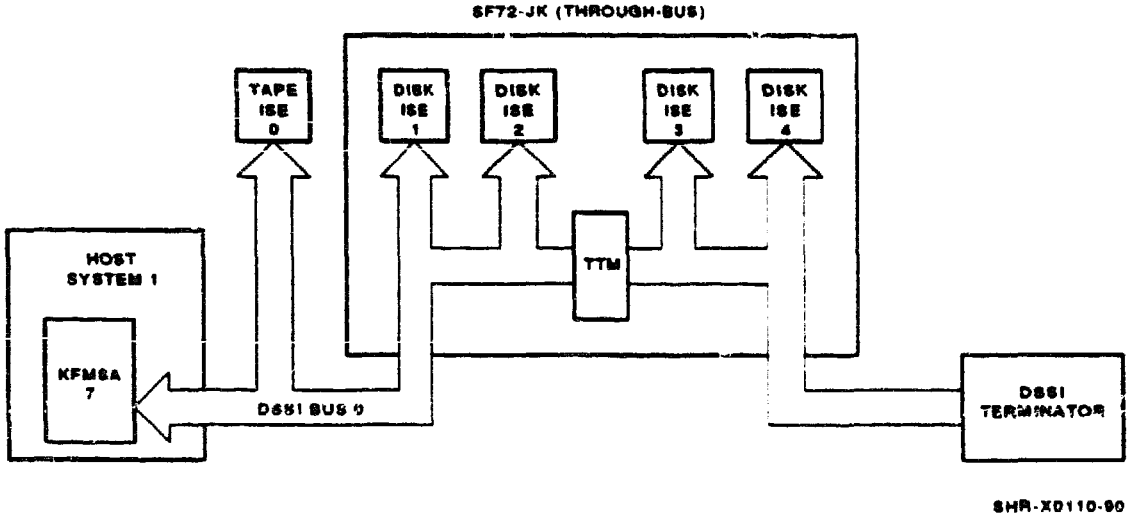
4.2.1 Through-Bus Mode

In through-bus mode, all four disk ISEs in the storage enclosure are connected to the same DSSI bus. The DSSI bus enters the enclosure from the rear, at the rightmost DSSI connector. The DSSI bus is then connected to the left rear disk ISE (facing the front of the enclosure), then the left front disk ISE, the right front disk ISE, then the right rear disk ISE, and finally out the leftmost (facing rear again) DSSI connector.

At this point, the DSSI bus is either terminated (with a DSSI terminator, part number 12–31281–01), connected to another storage enclosure (operating in split-bus mode in a single-system or stripe set configuration), or connected to the DECarray I/O panel.

Figure 4–1 shows a typical through-bus configuration.

Figure 4–1 Through-Bus Mode



The –HK variant operates in through-bus mode, in a similar fashion, but only the rear two disk ISEs are used. An SF72–UK or SF73–UK upgrade kit consisting of two RF72 or RF73 disk ISEs can be added at any time.

4.2.2 Split-Bus Mode

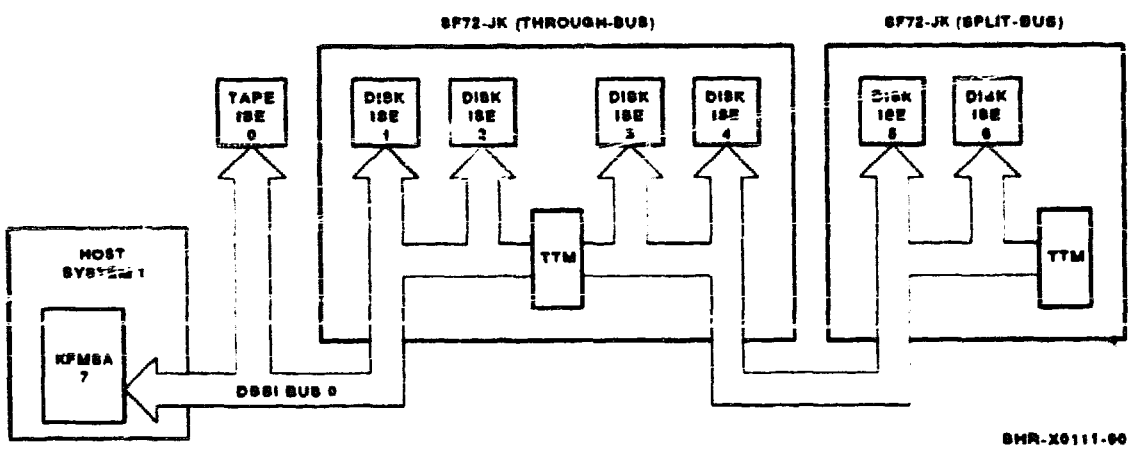
In split-bus mode, two disk ISEs in the storage enclosure operate are connected to one DSSI bus while the other two disk ISEs are connected to another DSSI bus. Each of the DSSI buses enters the enclosure from the rear, at the leftmost or rightmost DSSI connector.

The DSSI bus for the left half of the enclosure is connected to the left rear disk ISE (facing the front of the enclosure), then the left front disk ISE, and finally terminated at the transition termination module (TTM) for the left half of the enclosure.

The DSSI bus for the right half of the enclosure is connected to the right rear disk ISE (facing the front of the enclosure), then the right front disk ISE, and finally terminated at the TTM for the right half of the enclosure.

Figure 4–2 shows a typical split-bus configuration.

Figure 4–2 Split-Bus Mode



The –HK variant operates in split-bus mode, in a similar fashion, but only the rear two disk ISEs are used. An SF72–UK or SF73–UK upgrade kit consisting of two RF72 or RF73 disk ISEs can be added to an –HK at any time.

4.3 Front Panel Controls, Labels, and Indicators

Figure 4–3 shows a front view of the storage enclosure. The operator control panel (OCP) is on the top front of the enclosure. It can be accessed without opening the cabinet front door.

The drive dc power switches are on the bottom front of the enclosure. These switches are not accessible when the front door of the cabinet is closed.

Table 4–1 briefly describes the functions of the front panel controls and indicators. Details are contained in the sections that follow.

4.3.1 Operator Control Panel (OCP)

The operator control panel (OCP) contains four identical sets of controls and indicators, and two additional indicators behind the front door of the panel. Unless a disk ISE is installed in the enclosure and power is applied to that disk ISE, the controls and indicators are non-operational. Table 4–1 summarizes the controls and indicators discussed in the following sections.

Figure 4–3 Front View of the Storage Enclosure

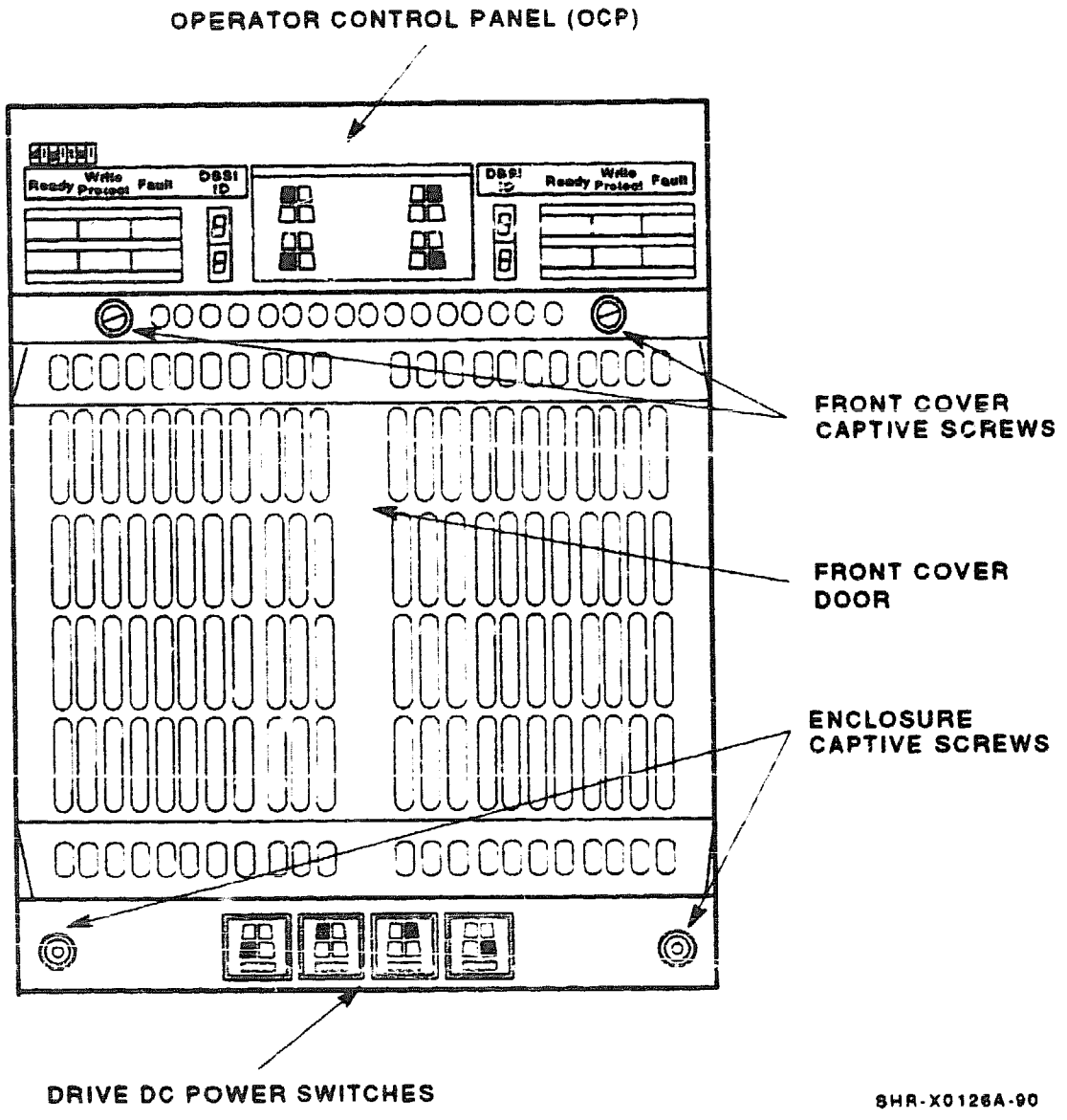


Table 4–1 Summary of Front Panel Control/Indicator Functions

Control/Indicator	Function
Operator Control Panel	
TERM PWR indicator	Indicates when termination power is being supplied.
SPLIT indicator	Indicates when enclosure is in split-bus mode.
MSCP enable switch	(Leftmost bit) Enables or disables the disk ISE.
DSSI ID select switch	(Rightmost bits) Enables DSSI ID numbers.
7-segment LED displays	Display disk ISE DSSI ID number.
Ready button	Brings disk ISE on-line. (LED lights green when ready.)
Write Protect button	Places disk ISE in write-protect mode. (LED lights yellow when disk ISE is write-protected.)
Fault button	Indicates a disk ISE fault (when LED is lit RED). Press once to display fault code, twice to clear fault.
Lower Front	
Drive dc power switches	Apply power to disk ISEs; show power status.

The icons on the door located on the OCP represent each disk ISE, as follows:

- The icon in the top left front represents the disk ISE in the left rear of the storage enclosure.
- The icon in the top right front represents the disk ISE in the right rear of the storage enclosure.
- The icon in the bottom left front represents the disk ISE in the left front of the storage enclosure.
- The icon in the bottom right front represents the disk ISE in the right front of the storage enclosure.

Colored labels on the inside of the door on the OCP help identify each of the DSSI buses. Typically, in a single-system or stripe set configuration, colors represent the following:

- Blue represents DSSI bus 1 (single-system and stripe set).
- Red represents DSSI bus 2 (single-system and stripe set).
- Yellow represents DSSI bus 3 (single-system).
- Green represents DSSI bus 4 (single-system).

Typically, in a DSSI VAXcluster configuration, colors represent the following:

- Blue represents DSSI bus 1.
- Red represents DSSI bus 2.
- Yellow represents DSSI bus 3.
- Green represents DSSI bus 4.
- Blue/white represents DSSI bus 5.
- Red/white represents DSSI bus 6.

Refer to the inside cover of the *SF Family Label Booklet* for further details.

The two indicators behind the OCP door are TERM PWR (termination power, top) and SPLIT (bus mode, bottom). The TERM PWR indicator lights green whenever the storage enclosure is connected to a DSSI bus. The SPLIT indicator lights green only when the enclosure is operating in split-bus mode, as described in Section 4.2.2.

Four switchpacks (Figure 4–4), one for each of the four disk ISEs, are located to the right and left of the two indicators behind the OCP door. The switch to the left is the MSCP enable switch and is in the down position when MSCP is enabled. The other switches are used to set the DSSI ID number, where the rightmost switch is the least significant. Typical switch settings are shown in Tables 4–2 and 4–3.

Figure 4–4 OCP Switchpacks

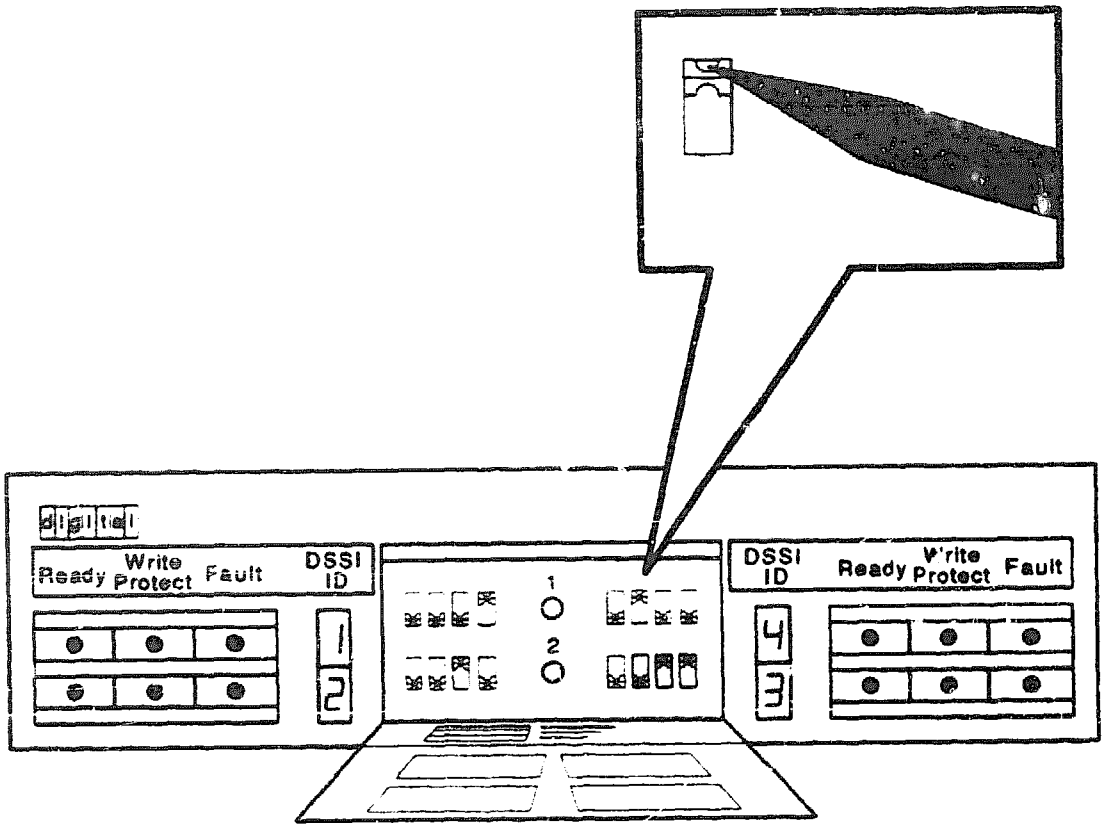


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Table 4–2 DSSI ID Switch Settings (Single-System and Stripe Set)

Disk ISE	DSSI ID	Setting[1]
Positions 1, 2, 4, and 7		
Left Rear (LR)	1	0001
Left Front (LF)	2	0010
Right Front (RF)	3	0011
Right Rear (RR)	4	0100
Positions 3 and 8		
Left Rear (LR)	5	0101
Left Front (LF)	6	0110
Right Front (RF)	6	0110
Right Rear (RR)	5	0101
Stripe Set (All Positions)		
Left Rear (LR)	1	0000
Left Front (LF)	2	0001
Right Front (RF)	2	0001
Right Rear (RR)	1	0000

[1] "0" = down, "1" = up.

Table 4–3 DSSI ID Switch Settings (DSSI VAXcluster)

Disk ISE	DSSI ID	Setting[1]
Positions 1, 2, 3, 4, 7 and 8		
Left Rear (LR)	1	0001
Left Front (LF)	2	0010
Right Front (RF)	3	0011
Right Rear (RR)	4	0100

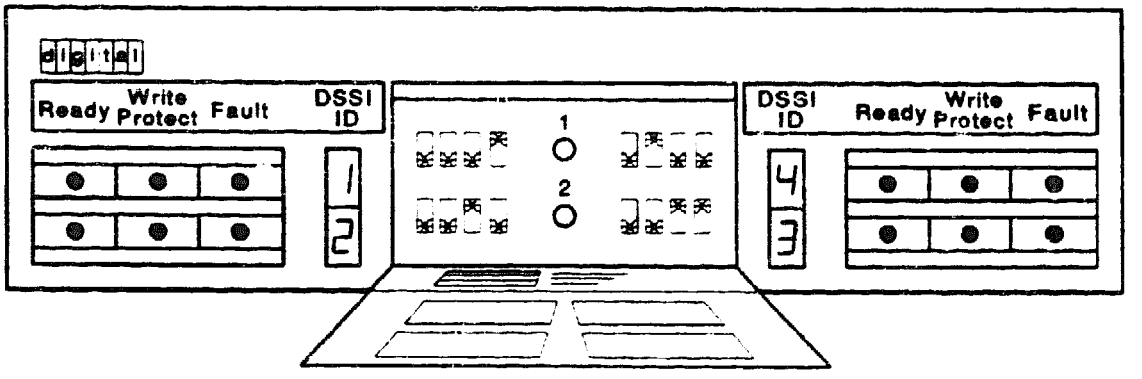
[1] "0" = down, "1" = up.

The four 7-segment LED displays on the front of the OCP display these DSSI ID numbers. If a display is not lit, then that disk ISE position in the enclosure is not occupied by an disk ISE.

The three disk ISE controls and indicators are to the right or left side of the 7-segment LED displays. These controls, with their associated indicators, are as follows (Figure 4–5):

- **Ready**—The Ready button is a push-to-set switch with a green indicator. When pressed in, the Ready button causes the disk ISE to come on-line. After the Ready button is pressed, it takes approximately 60 seconds for the disk ISE to come on-line. The green indicator remains lit while the disk ISE is on-line. However, this indicator may blink or go out entirely when the disk ISE is performing heavy seeks.
- **Write Protect**—The Write Protect button is a push-to-set switch with a yellow indicator. When the Write Protect button is engaged, the data on that disk ISE cannot be overwritten, nor can any new data be written to that disk ISE.
- **Fault**—The Fault button is a momentary switch with a red indicator. A disk ISE fault is indicated when the red indicator is lit. Press the Fault button once to display the disk ISE fault code, and a second time to clear the fault code and clear the disk ISE fault.

Figure 4–5 Controls and Indicators



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4.3.2 Drive DC Power Switches

Four drive dc power switches are on the lower front side of the storage enclosure. Each drive dc power switch is associated with a disk ISE position, as shown ir Figure 4–3.

An indicator in each drive dc power switch illuminates to show that nominal power is being applied to the associated disk ISE. The switches are shown on the icon located on the front of the chassis of the storage enclosure.

Setting a drive dc power switch connects power to the associated disk ISE and causes the disk ISE to spin up and run a self-test. After setting the drive dc power switch, you must press the Ready button on the OCP to bring the disk ISE on-line.

4.4 Rear Panel Controls and Indicators

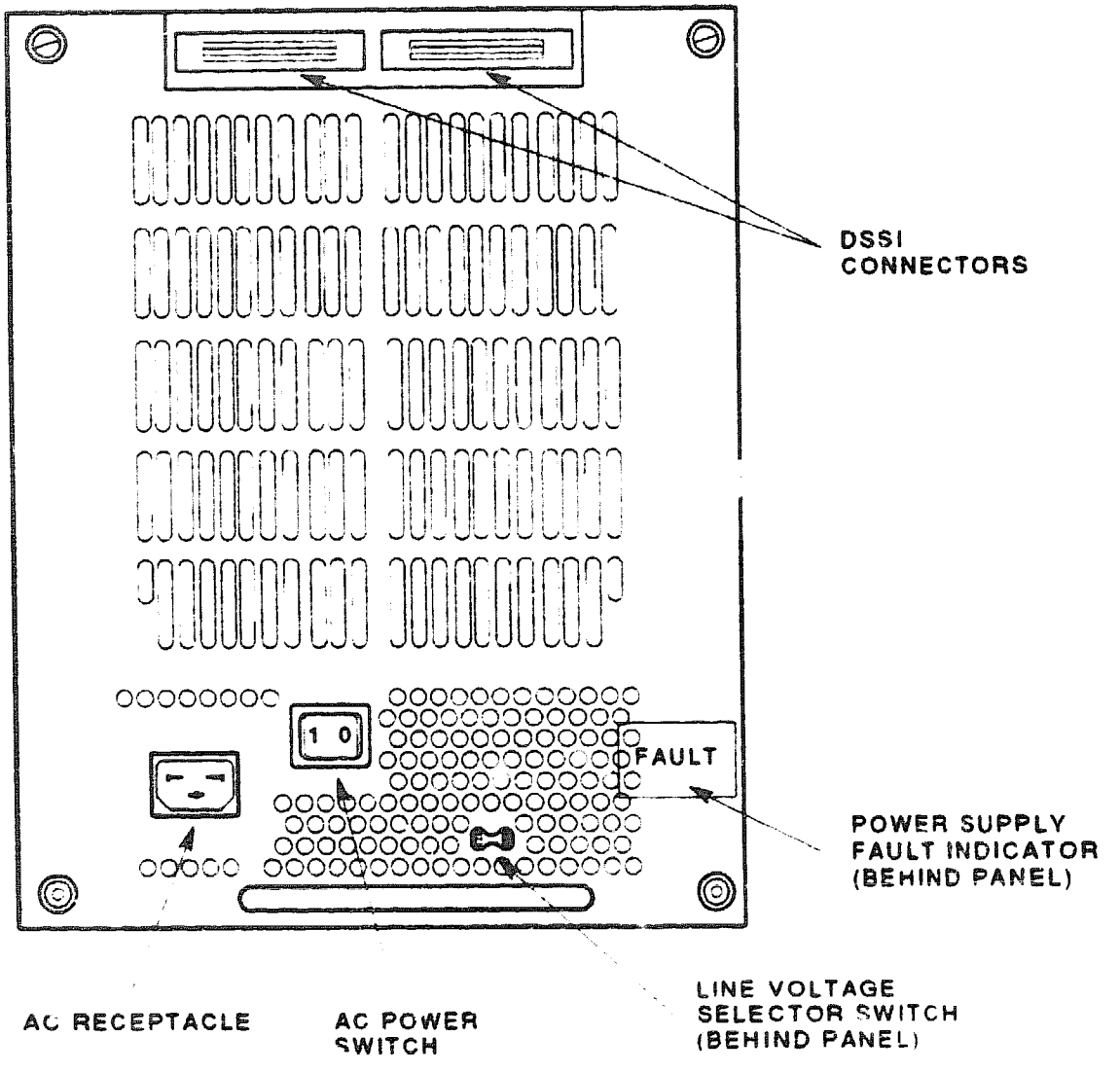
Figure 4–6 shows the rear panel of the storage enclosure. The DSSI connectors are on the top rear side of the enclosure. The ac power switch, line voltage selector switch, and power supply fault indicator are on the bottom rear of the enclosure, on the power supply chassis, as shown in Figure 4–6. These controls and indicators affect operation of the entire storage enclosure.

Table 4–4 summarizes the functions of the rear panel controls and indicators. Details are provided in the paragraphs that follow.

Table 4–4 Summary of Rear Panel Control/Indicator Functions

Control/Indicator	Function
Power Supply Chassis	
AC power switch	Applies line voltage to dc power supply.
Line voltage selector switch	Selects between 120 Vac (60 Hz) and 240 Vac (50 Hz) line voltage.
Power supply fault indicator	Illuminates for fault or overtemperature in enclosure.

Figure 4–6 Rear Panel of the Storage Enclosure



WARNING

Hazardous voltages are present inside the equipment cabinet and the storage enclosure. Installation and service must be performed only by qualified Digital Services engineers.

The ac power switch for the storage enclosure is in the center of the rear panel. Setting the ac power switch in the position labeled "1" applies power to the storage enclosure. Setting the switch in the position labeled "0" removes power from the enclosure.

As you face the rear panel, the line voltage selector switch is located to the right of the ac power switch. It is visible through a hole in the rear panel. The Digital Services engineer sets this switch to the available line voltage during installation. The number "120" represents 120 Vac at 60 Hz, and the number "240" represents 240 Vac at 50 Hz.

CAUTION

The storage enclosure power supply is universal for both 120 Vac and 240 Vac. The supply is factory-set to 240 Vac and must be reset to 120 Vac for some installations. Selecting 120 Vac and using 240 Vac will damage the power supply.

The power supply fault indicator is behind the panel, in the lower right corner of the storage enclosure. When the fault indicator is lit, a green light is visible through the holes in the rear panel. The storage enclosure automatically shuts down when the dc power supply detects a fault or overtemperature condition.

4.5 Applying Power to the Enclosure

This section describes the correct procedure for powering up an storage enclosure. Perform *all* steps in the order in which they are presented.

NOTE

Do not change the DSSI ID setting while the power is on.

Apply power to the enclosure as follows:

1. Verify that the drive dc power switches and all disk ISE control buttons on the front of the enclosure are in the off (0) position.
2. Set the ac power switch to the on (1) position to apply ac power to the dc power supply.
3. Verify that the power is on by checking that the fan starts and there is normal airflow through the enclosure.

   NOTE

   It is possible to have airflow through the enclosure and not have output voltage. This indicates that the line voltage selector switch, located behind the rear panel of the enclosure, is in the wrong position.

   Set the ac power switch to off (0) and reset the line voltage selector switch.
4. Verify that the termination power indicator is on.
5. Verify that the bus mode indicator is on, only if that storage enclosure is in the split-bus mode.
6. Turn the drive dc power switch on. Verify that the green indicator lights.

4.6 Placing a Disk ISE On-Line

After power is applied to the storage enclosure, use the following procedure to place a disk ISE on-line. Perform *all* steps in the order in which they are presented.

1. Press the Ready button on the OCP to bring the ISE on-line.
   a. The Ready indicator flickers while the disk ISE is spinning up. If you power up a disk ISE with the Ready button for that disk ISE in the on (in) position, you must press the Ready button to put it in its off (out) position momentarily, then press the button in to bring the disk ISE on-line correctly.
   b. All other indicators remain off.
   c. When the disk ISE has completed spinup, the Ready indicator illuminates, indicating that the disk ISE is ready for read/write operation.
   d. The Fault indicator illuminates if the disk ISE detects a fault. Refer to Chapter 5 of this manual for recovery procedures.
2. Press the Write Protect button on the OCP, as required, to turn on write-protect mode. To deselect write-protect mode, press this button a second time.

Repeat this entire procedure for each disk ISE being placed on-line.

NOTE

The Ready indicator remains lit during normal operation, though it may flicker during heavy seeks.

The Write Protect indicator is lit when the disk ISE is write-protected, and off when the disk ISE is write-enabled.

4.7 Taking a Disk ISE Off-Line

To take a disk ISE off-line, press the Ready button (out position) and wait until the LED goes out.

5
Troubleshooting

This chapter contains procedures a user can perform, before calling Digital Services, to verify that a problem exists in the SF7x series storage enclosure. Procedures to attempt recovery from a fault condition are also included here.

For RF7x series enclosures, before attempting recovery from a fault condition record the fault code shown on the storage enclosure operator control panel (OCP), as described in Section 5.2. RF3x series enclosures do not display a fault code.

5.1 Verifying a Hardware Problem

If your storage enclosure or an installed disk ISE is not operating correctly, check the following items before calling Digital Services:

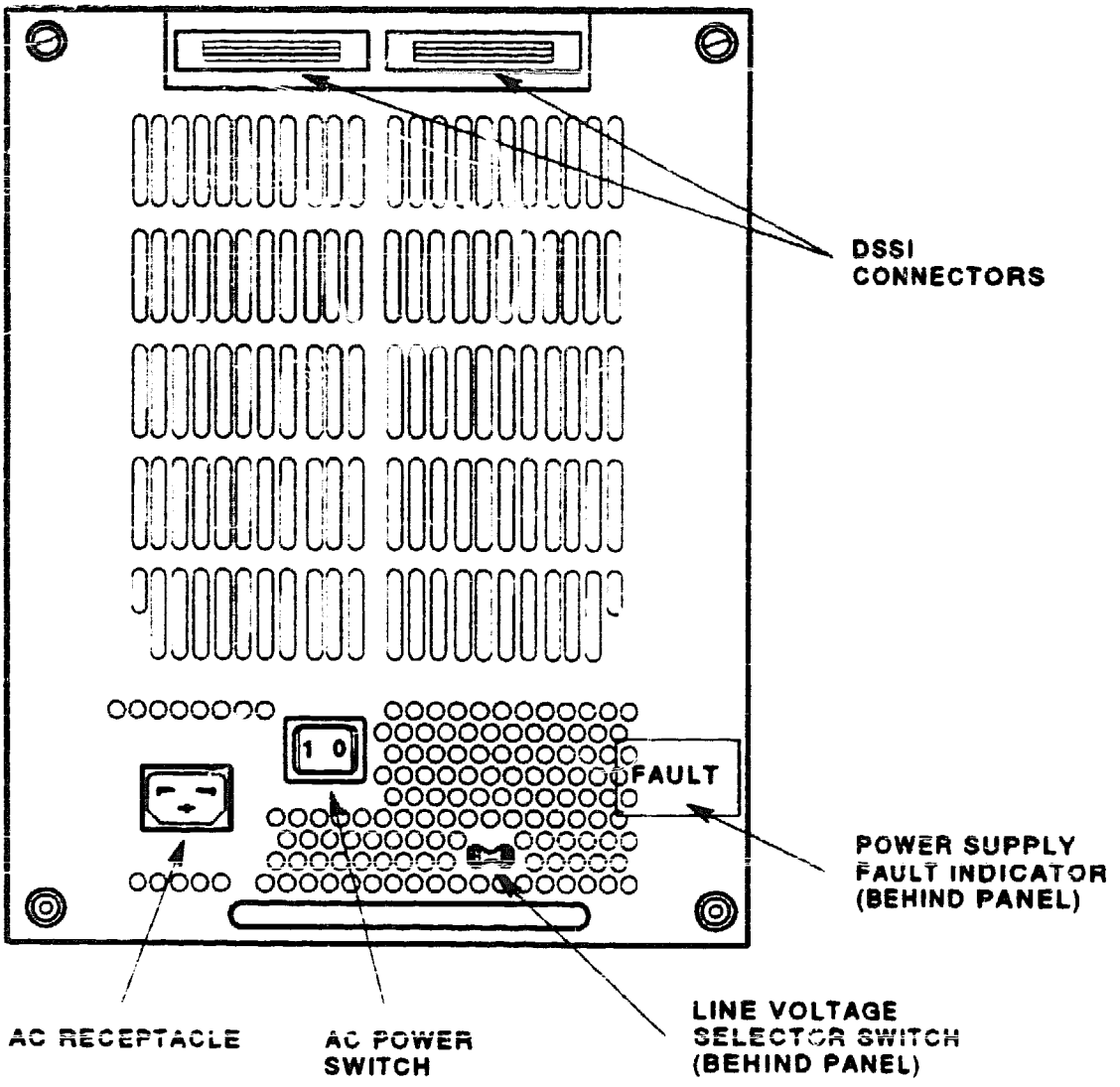
WARNING

Hazardous voltages are inside the equipment cabinet and the storage enclosure. Installation and service must be performed only by qualified Digital Services engineers.

When performing any operation involving the source power, verify that the enclosure ac power switch, located on the power supply at the rear of the enclosure, is turned off. Disconnect the line cord from the enclosure rear panel and from the cabinet power controller, if possible. Perform the operation, then reconnect the cord.

1. If the entire storage enclosure is not operating, check the power supply fault indicator. When lit, this indicator is visible, through holes in the lower right corner of the storage enclosure. (Refer to Figure 5–1).

Figure 5–1 Rear Panel of the Storage Enclosure

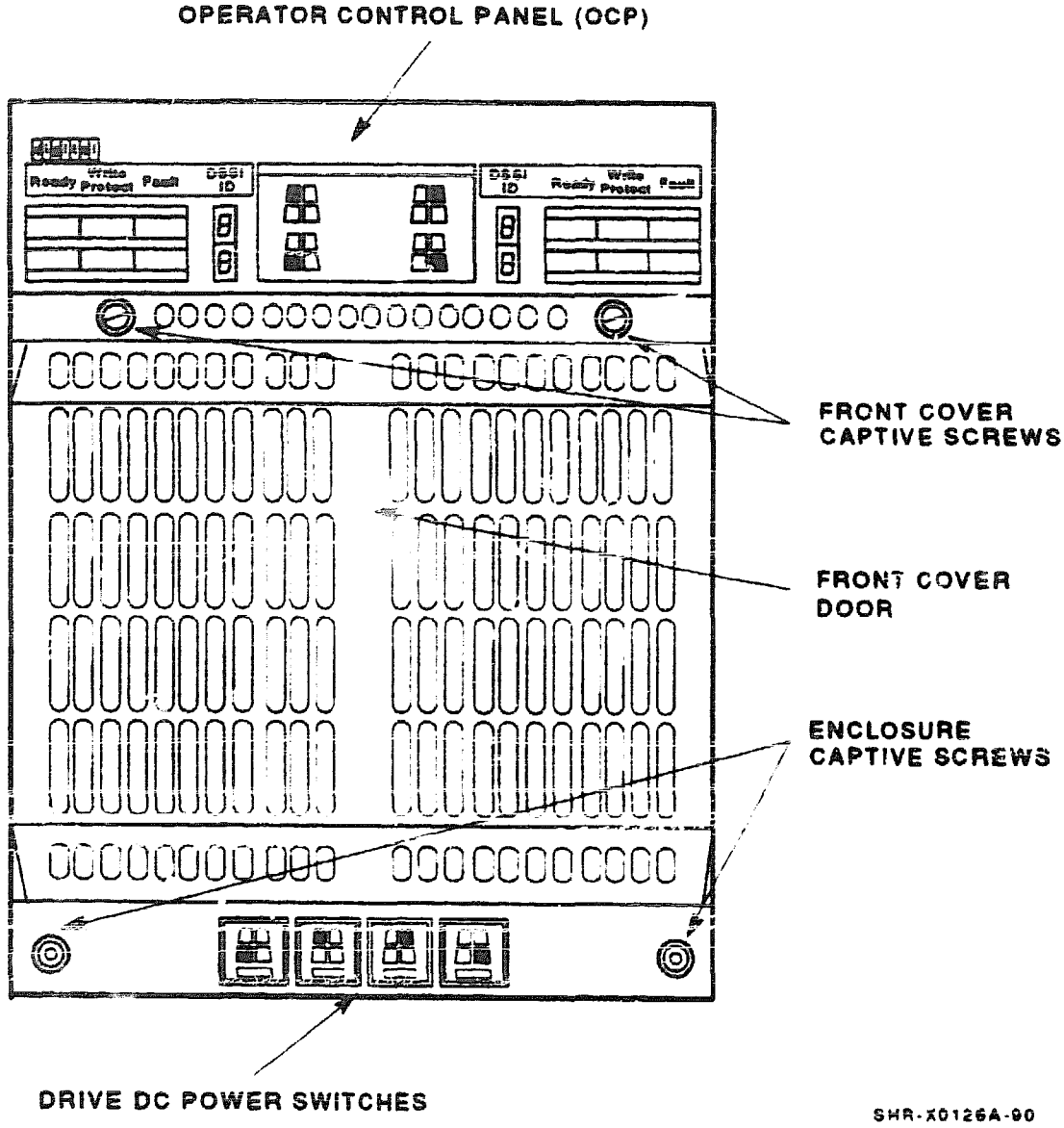


If this indicator is lit, immediately turn off the ac power switch on the bottom rear of the storage enclosure. Call Digital Services.

If the green fault indicator is not on, proceed as follows:

a. Check for an overload current condition in the power supply by turning off all ISE dc power switches on the front panel. (Refer to Figure 5–2). If the enclosure fan starts, go to step 2 (recovery when dc power switches are blinking).

Figure 5–2 Front Panel of the Storage Enclosure



b. Verify site power by checking other equipment on the same line and the circuit breakers to the cabinet.

c. Verify that the enclosure power plug is connected to the line outlet in the cabinet.

d. Verify that the power plug of the cabinet is connected to the line voltage outlet.

e. Verify that the line voltage selector switch on the rear panel of the power supply is set to the correct line voltage. Refer to Figure 5–1 for the location of the line voltage selector switch.

f. Attempt to restart the enclosure.

2. If the ISE dc power switches on the front panel of the enclosure are blinking, an overload at the output of the power supply is the likely cause.

a. Place *all* OCP buttons for each disk ISE in the out (off) position. Refer to Figure 5–2.

b. Turn off *all* ISE dc power switches.

c. Turn on the ISE dc power switches one at a time. If the indicator on a ISE dc power switch illuminates steadily when you turn it on, that disk ISE is not causing the overload. When you turn on a switch and the indicator blinks, you have found the overload. Turn that switch off and resume operation on the remaining disk ISEs.

d. Call Digital Services.

3. If a single disk ISE is not communicating with the system controller or does not respond to control panel commands (all other disk ISEs are normal):

a. Make sure the Ready button for that disk ISE is asserted.

b. For RF7x series enclosures, record any fault code displayed on the OCP, as described in Section 5.2. For RF3x series enclosures, follow the appropriate procedures for removing and replacing the ISE.

c. Reset all OCP switches for that disk ISE. If the disk ISE was on-line previously, dismount it from the system and take it off-line. Spin the disk ISE down by pressing the Ready button. When the Ready indicator goes out, set the front panel drive dc power switch to off (Figure 5–2). Removing power to the disk ISE for 10 seconds resets the disk ISE's circuits.

d. Verify that the DSSI cable connectors from the host system are securely tightened at the cabinet I/O bulkhead of the enclosure.

e. Bring the disk ISE back on-line and attempt to restore normal operation.

5.2 Recovering from a Disk ISE Fault Condition (RF7x Enclosures Only)

The disk ISE contains sophisticated circuits to detect and report fault conditions. These faults are reported through a fault code display on the storage enclosure OCP. The Digital Services engineer uses these codes and other error reporting mechanisms in the disk ISE to pinpoint the source of a fault and return your disk ISE to service in the least amount of time.

If the Fault indicator illuminates to signal that the disk ISE has detected a fault, perform the following steps to obtain an error code and clear the fault:

1. Press the Fault button once. This causes the disk ISE to display an error code at the disk ISE's indicator set on the OCP.

   The error code is displayed as a binary number in flashing lights across the indicator set. A flashing indicator signifies a 1; a dark indicator signifies a 0. The most significant bit of the binary number is displayed on the Ready indicator. The Fault indicator counts as the fifth most significant bit in this display.

2. Record this binary number for later reference by your Digital Services engineer.

3. Press the Fault indicator again. This commands the disk ISE to clear the fault and return to normal operation. If the fault clears, you may resume operation. Record the occurrence of the fault in the system log as it may become relevant in future system fault analysis. If the fault recurs, call Digital Services.

A

DECarray Configuration Sheets

This appendix contains blank configuration sheets.

Figure A–1, Figure A–2, and A–3 are to be used with systems containing variants of the KFMSA adapter module. Figure A–4 and A–5 are to be used with systems containing either KFQSA adapter modules or embedded DSSI adapter(s).

Figure A–1 Single-System Configuration Sheet (Dual Port)

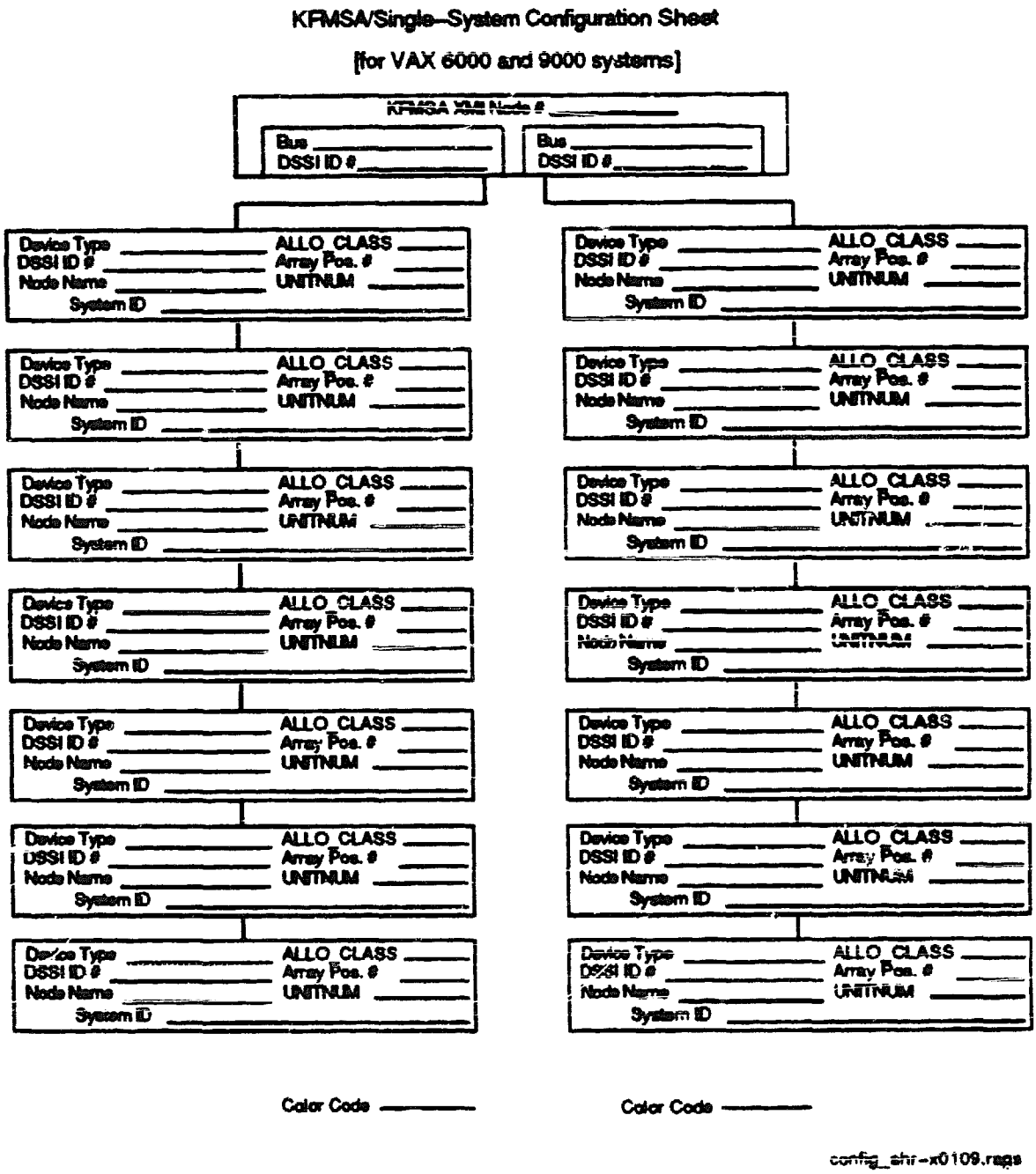


Figure A–2 Two-Host DSSI VAXcluster Configuration Sheet (Dual Port)

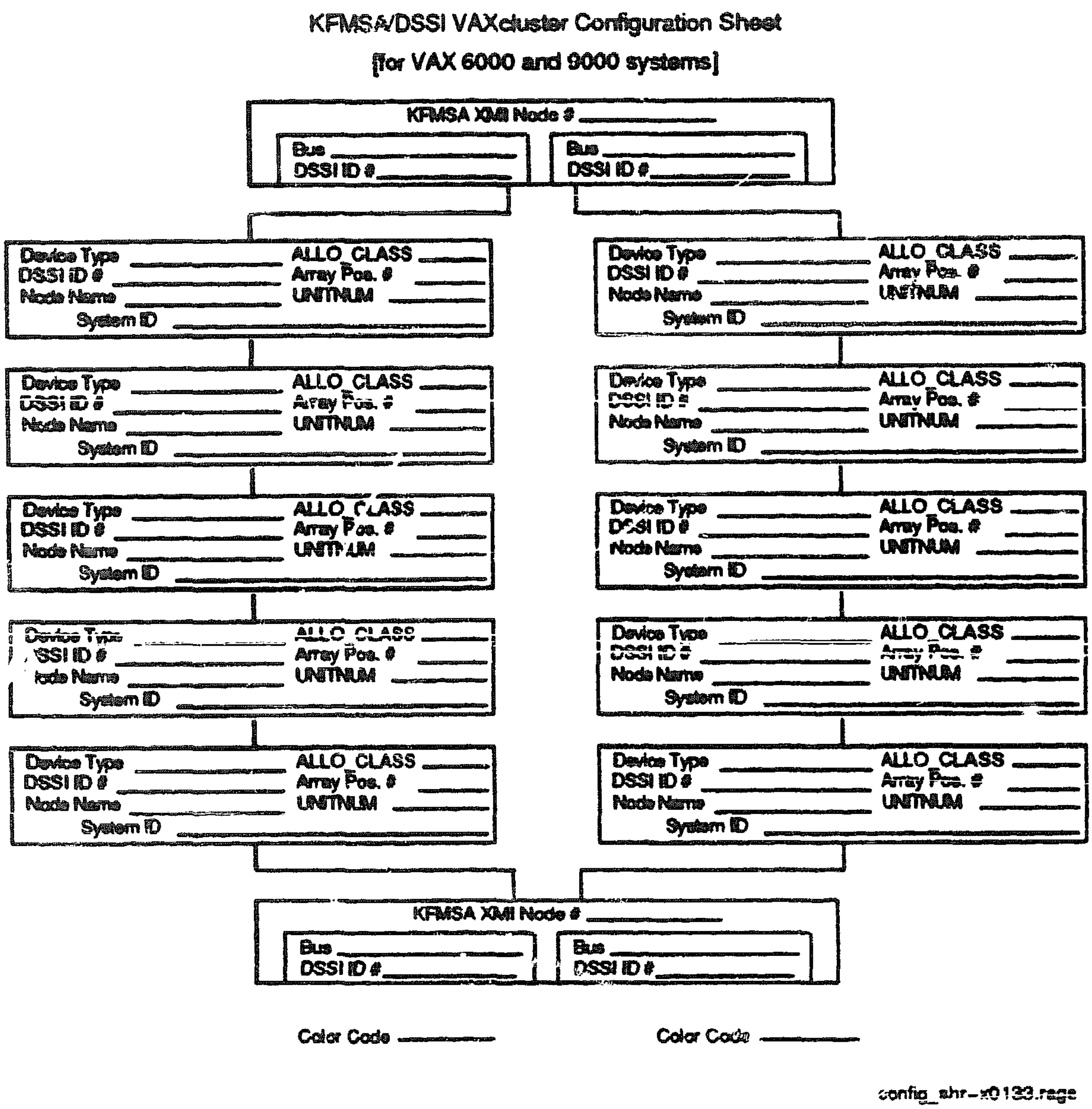


Figure A–3 Three-Host DSSI VAXcluster Configuration Sheet (Dual Port)

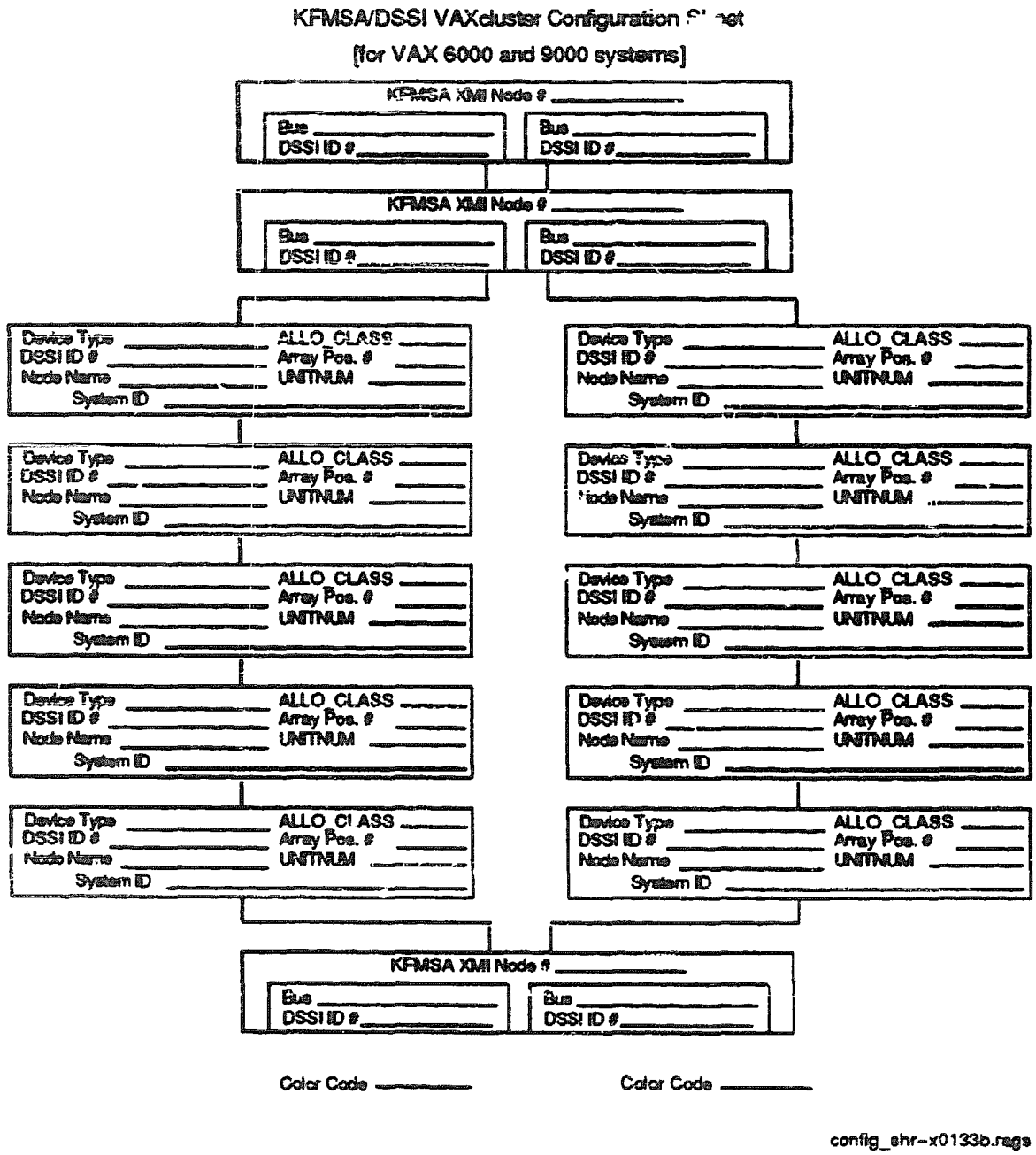


Figure A–4 Single-System Configuration Sheet (Single Port)

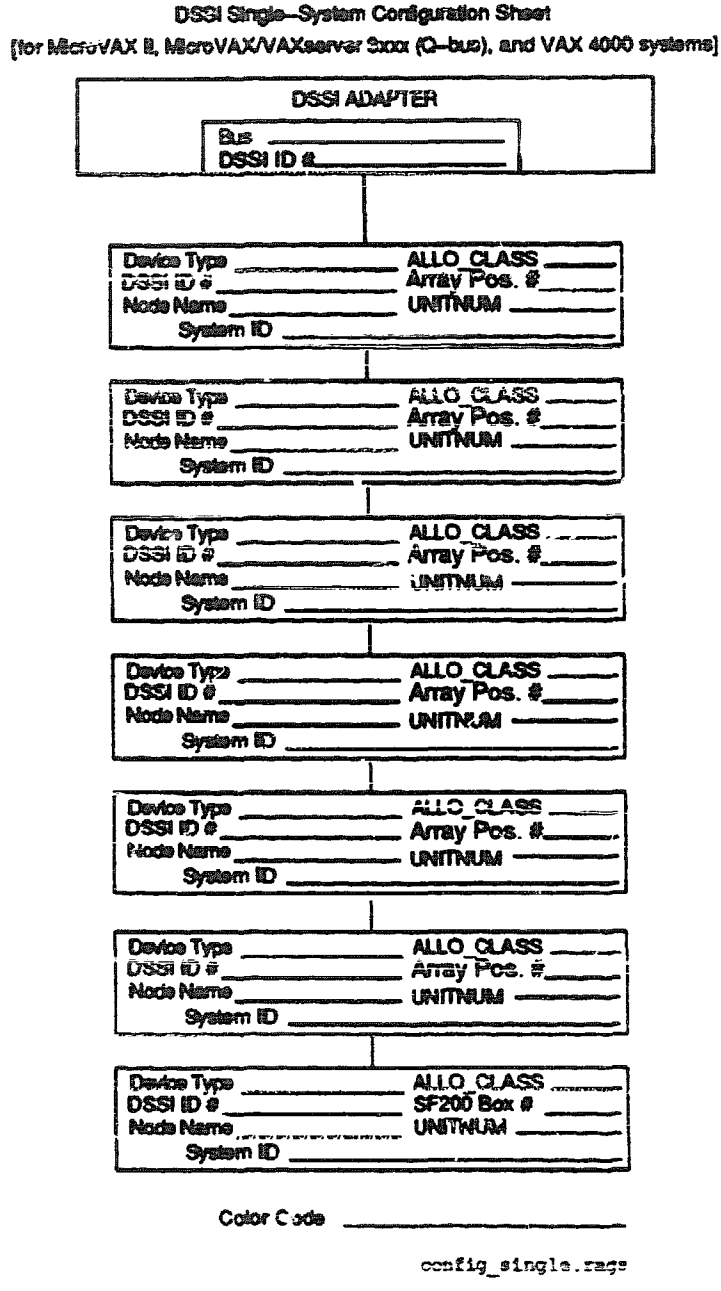
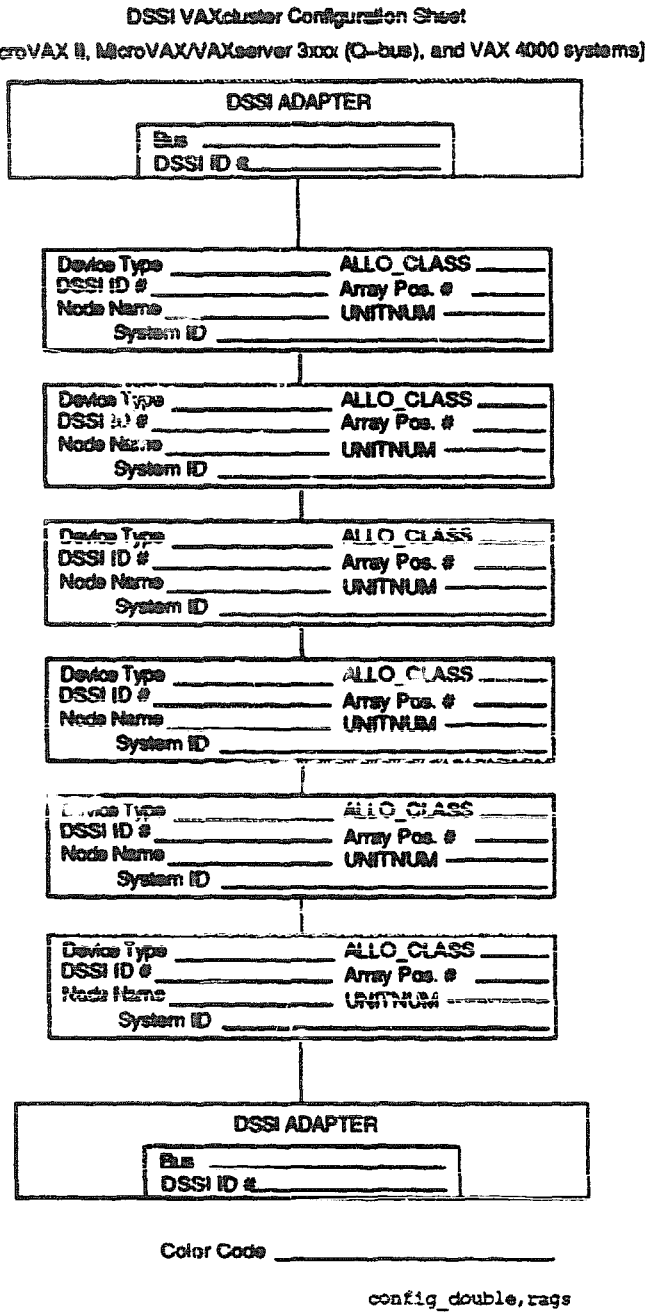


Figure A–5 DSSI VAXcluster Configuration Sheet (Single Port)



Glossary

ADAPTER A module that connects one or more device controllers to the system bus and hides many of the system bus requirements from the controller. The KFQSA module is an Q–bus to DSSI bus adapter. The KFMSA module is an XMI to DSSI bus adapter.

ALLOCATION CLASS A numerical value assigned to the ISE to indicate which system(s) on a cluster it will be served by.

BLOCK The smallest data unit addressable on a disk. Also called a sector. In DS3I ISEs, a block contains 512 bytes of customer data, EDC, ECC, flags and the block's address header.

DECarray A storage array that houses up to six storage enclosures and up to two magazine tape ISEs (such as the TF857).

DEVICE NAME A unique name given to each device by the VMS operating system. The device name generally includes either the allocation class and MSCP unit number assigned to the device (if the allocation class is not zero), or the node name and MSCP unit number (if the allocation class is zero).

DRVTST A local program resident on the ISE. It is a comprehensive hardware test used to verify ISE operation.

DSSI Digital Storage System Interconnect. A DSA-based storage interconnect used by the KFMSA adapter and the RF- and TF-series integrated storage elements to transfer data and to communicate with each other.

DSSI VAXcluster Storage configuration where DSSI ISEs are shared between two DSSI adapters and systems.

DUP Diagnostic and utility protocol. A SYSAP-level protocol by which a computer directs a storage device controller to run internal diagnostics or utility functions. DUP is implemented as a class driver on the system side, and a corresponding class server on the storage controller side.

EEPROM Electrically erasable programmable read only memory. Used by the KFMSA adapter to store configuration, manufacturing, and error information in a nonvolatile location.

EMBEDDED ADAPTER A adapter that connects one or more device controllers to the system (such as a VAX 4000) bus and hides many of the system bus requirements from the controller. Refer to the system documentation for further information.

ISE Integrated storage element. All DSSI storage devices are ISEs.

KFMSA XMI bus to DSSI bus adapter.

KFQSA Q–bus to DSSI bus adapter.

MAGAZINE TAPE ISE A DSSI tape ISE with tape loader, such as a TF857.

MSCP Mass Storage Control Protocol. An application layer protocol used by the system to perform disk I/O operations and I/O control functions.

NODE NAME A 6-character (maximum) value that is assigned to each DSSI ISE. The node name of each ISE must be unique across the system topology.

OCP Operator control panel. An enclosure interface that allows remote control of DSSI node ID selection and ISE operating status.

PARAMS A local program resident on the ISE. PARAMS is used to view and modify current device parameter settings on an ISE.

Q-BUS The system bus for the MicroVAX II, MicroVAX/VAXserver 3xxx, and VAX 4000 series systems.

RF35 A 3-1/2", half-height, 0.8-gigabyte formatted capacity DSSI disk ISE.

RF72 A 5-1/4", full-height, 1-gigabyte formatted capacity DSSI disk ISE.

RF73 A 5-1/4", full-height, 2-gigabyte formatted capacity DSSI disk ISE.

RLL Run length limited. The format used in the DSSI ISE to record data.

SF3x A DSSI storage enclosure that houses up to six half-height RF series disk ISEs.

SF7x A DSSI storage enclosure that houses up to four full-height RF series disk ISEs.

SINGLE-SYSTEM Storage configuration where DSSI ISEs are connected to only one DSSI adapter and system.

SPLIT-BUS A mode of operation where the ISEs in the one side of a storage enclosure are connected to a different DSSI bus than those on the other side.

STRIPE SET A set of disk drives operating in concert as a single virtual disk so as to provide increased I/O performance. In a DSSI bus application, all SF7x storage enclosures are in split-bus mode and each half of each enclosure is connected to it's own dedicated DSSI adapter port.

THROUGH-BUS A mode of operation where all the ISEs in an storage enclosure are connected to the same DSSI bus. In this mode, the DSSI bus is terminated using an external terminator.

TMSCP Tape Mass Storage Control Protocol. Application layer protocol that is used by the system to perform tape I/O operations and I/O control functions.

TTM Transition termination module. A PC board that provides connection between the storage enclosure OCP and RF series disk ISE, and also provides DSSI bus termination when in split-bus mode.

UNIT NUMBER Also called the MSCP/TMSCP unit number. Default value is the ISE's DSSI node ID. A unique value can be selected using PARAMS.

VAX DIAGNOSTIC SUPERVISOR A diagnostic environment that allows access to DSSI tests and programs in VAX 6000 and 9000 series systems

VIRTUAL CIRCUIT A logical point-to-point link between nodes.

XMI Extended Memory Interconnect. The system bus for the VAX 6000 and 9000 series systems.

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