ESE50 SDI Solid State Disk User Guide

Order Number: EK–ESE50–UG. B01

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Preface

This manual contains the following information:

- ESE50 solid state disk specifications
- Environmental considerations
- Installation information and references
- Start-up procedures
- Acceptance testing criteria
- Troubleshooting procedures

Although this manual is written primarily for ESE50 solid state disk customers, installation procedures described or referenced in this manual are intended for Digital Customer Services engineers performing original installation of the ESE50 solid state disk. Qualified Customer Services engineers must be trained in the following:

- ESE50 solid state disk
- DSA concepts
- ESD procedures

This manual does not cover cabinet cable routing and connections. Specific information concerning subsystem cabinet-related procedures can be found in product-specific manuals. A list of related documentation follows:

Document Title	Order Number
SA300/SA350 Storage Array Family Configuration Guide	EK–SA300–CG
SA600/SA800 Storage Array Family Configuration Guide	EK–SA600–CG
SA650/SA850 Storage Array Family Configuration Guide	EK–SA650–CG
SAxxx Storage Array Family Configuration Guide	EK–SAxxx–CG

Conventions Used in This Guide

The following conventions are used in this guide:

Note — Notes provide general information on the current topic.

Caution — Cautions provide information to prevent damage to equipment or software. Read these carefully.

Warning — Warnings contain information to prevent personal injury. Read these carefully.

1
Introduction

1.1 General Information

The ESE50 solid state disk (SSD) is a member of the Digital Storage Architecture/Standard Disk Interconnect (DSA/SDI) family, and is plug-compatible with all DSA/SDI controllers.

The ESE50 solid state disk is a random access low latency mass storage device that uses DRAM semiconductor technology for fast response time. The ESE50 is Digital's fastest disk drive and is used when I/O response time is a key metric. The ESE50 is contained in a half rack (RA92 style) enclosure with its own power and data retention capabilities. It connects and operates on the standard disk interface (SDI) and may be used with controllers implementing this bus. The operator control panel (OCP) from the RA9x disk drive is also used on the ESE50 SSD. The ESE50 can also be packaged in any SA3xx, SA6xx, SA8xx, or SA9xx storage array cabinet.

The following controllers support the ESE50:

- HSC (40/60/65/70/90/95)

- KDM70

The ESE50 has been tested under OpenVMS Versions 5.4 and 5.5. Under these versions, the ESE50 is identified as a DU device (rather than by the ESE50 name). Identification as a DU device does not impact any standard Digital disk functionality. Shadowing, failover, dual porting, bound volumes, and so forth are supported.

However, when running the ESE50 under OpenVMS Versions 5.4-n, 5.5, or 5.5-1, key things to be aware of are:

- All shadow sets must be comprised of the same capacity ESE50 units.

- Controller-based volume shadow sets require manual verification that all members of the shadow set are on the same controller.

The ESE50 is fully supported under OpenVMS Version 5.5-2 and OpenVMS AXP Version 1.5 (and all subsequent releases).

Figure 1–1 shows an ESE50 solid state disk.

Figure 1–1   ESE50 Solid State Disk

ZK-6039A-AP

1.1.1 Media Type, Model Byte, and Capacity

The ESE50 has a unique media type and model byte depending on the capacity. This is done for operating system compatibility.

Option	Media Type	Model Byte	Capacity (LBNs)
ESE50–AA,AB	ESE52	31	238080
ESE50–BA,BB	ESE56	48	1196544
ESE50–DA,DB	ESE58	49	1915392

The storage medium for the ESE50 SSD are 4M bit DRAMs and the data is accessed in 512-byte blocks. The formatted capacity of the ESE50 option is shown in Table 1–1.

Table 1–1 SDI SSD Capacity

Option[1]	No. of Arrays	Unformatted Capacity	Formatted Capacity	No. of LBN Cyl's	No. of Logical Blocks
ESE50–Ax	2	128.0 MB	121.9 MB	465	238080
ESE50–Bx	10	640.0 MB	612.6 MB	2337	1196544
ESE50–Dx	16	1024.0 MB	980.6 MB	3741	1915392

[1]"x" equals "A" for 120 Vac or "B" for 240 Vac.

The ESE50 has the following common characteristics:

- 20.0 megabits/second transfer rate
- Full data retention
- Extensive resident microcode diagnostics
- Internal error log capabilities
- Multifunction OCP

Figure 1–2 represents a typical ESE50 SSD subsystem configuration including an SDI controller.

Figure 1–2 Typical ESE50 SSD Subsystem Configuration
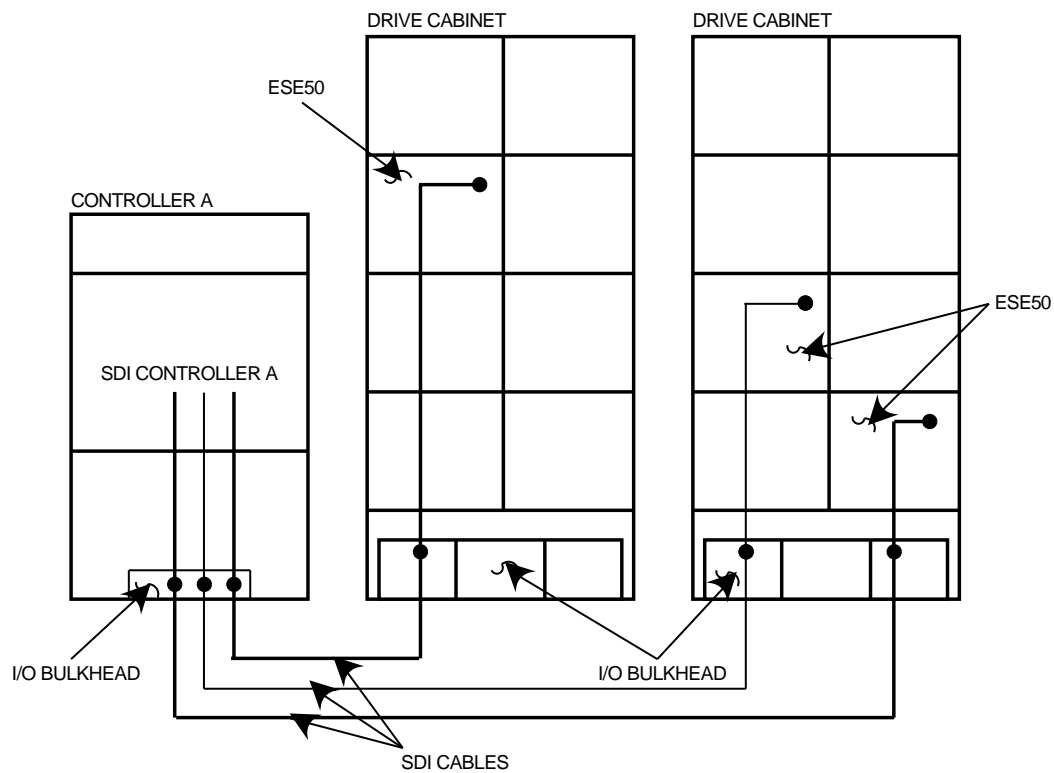
1.2 Hardware Maintainability

The ESE50 SSD uses modular field replaceable units (FRUs) for easy access and servicing. An extensive set of drive-resident microcode diagnostics and a drive-resident error log help simplify problem isolation.

1.3 Dual-Port Capability

Ports are enabled by the port select switches (A or B) on the front of the OCP. With both port switches selected, the ESE50 operates in a static dual-port mode. Static dual porting means that an SSD is shared between two controllers but is on line to only one controller at a time for data transfers. The second controller must wait until the drive is available before placing the drive on line.

An additional SDI cable is required for dual porting. Figure 1–3 shows an ESE50 dual-port configuration.

Figure 1–3 ESE50 Dual-Port Configuration
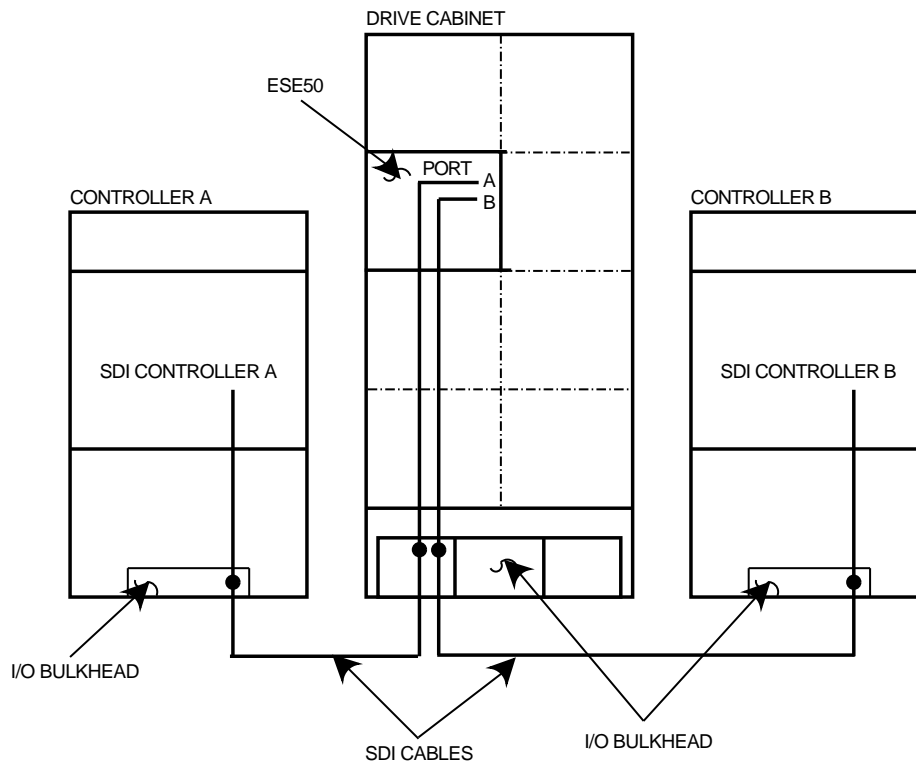
1.4 Drive-Resident Diagnostics Overview

Drive-resident diagnostics run during powerup and spin-up cycles to test basic drive functions.

Patrol diagnostics run periodically during normal operations.

Drive-resident diagnostics can be run from the OCP while the drive is off line. See Chapter 4 for a list of drive-resident diagnostics.

1.5 User Precautions/Recommendations

Digital recommends that certain precautions be taken to protect equipment and user data. These precautions involve data backup methods, recommended operating temperatures, and electrostatic discharge protection, and are described in this section.

1.5.1 Data Retention

The ESE50 provides data nonvolatility through the use of an integrated data retention system. This data retention system is comprised of a controller, an SCSI magnetic Winchester disk drive, and batteries. Data retention is invoked *only* when ac power is lost to the ESE50 unit during normal operation. In this situation, the batteries will power the unit while all data in the memory arrays is transferred to the Winchester disk drive. If ac power is restored any time during the transfer process, then the ESE50 unit is instantly available. On Rev. A and B ESE50 units, the ESE50–AA/AB (120 MB) and ESE50–BA/BB (600 MB) options contain the complete data retention system. On Rev. C ESE50 units, the

ESE50–AA/AB (120 MB), ESE50–BA/BB (600 MB), and ESE50–DA/DB (1 GB) options options contain the complete data retention system.

Table 1–2 lists the data retention times.

Table 1–2   Summary of Data Retention Times

ESE50 Option	Revision	Data Retention Time	Backup Time	Start Time	Maximum Number of Complete Backups (Within Two-Hour Period)†
ESE50_AA/AB	A or B	120 MB	90 seconds	120 seconds	8
ESE50_BA/BB	A or B	600 MB	360 seconds	390 seconds	2
ESE50_AA/AB	C	120 MB	60 seconds	90 seconds	16
ESE50_BA/BB	C	600 MB	300 seconds	360 seconds	4
ESE50_DA/DB	C	1 GB	480 seconds	540 seconds	3

†A two-hour battery recharge period is required afterward. Power failure exceeding this duty cycle may result in data loss.

Although the ESE50 provides nonvolatile features, it is the user's responsibility to protect data by using proper backup procedures similar to backup of magnetic disks. The following backup methods are recommended for an ESE50:

- File duplication

  This method normally involves copying the data onto removable media, such as magnetic tape.

- Journaling

  This method is recommened for files up to the last checkpoint or backup.

Caution

A data retention operation *does not* occur when the ESE50 main ac power switch, located on the rear panel, is turned off. A data retention operation is invoked automatically only *when ac power is lost to the input power cord*. Refer to Section 1.5.2 for the orderly shutdown procedures.

1.5.2 Orderly Shutdown

To shut down an ESE50–AA/AB, –BA/BB (Rev. A, B, or C) , or –DA/DB (Rev. C) system and to preserve data within the data retention system, the following procedures are recommended:

1. Dismount the ESE50 unit from the OpenVMS operating system *without* using the /NOUNLOAD qualifier. Wait for the RUN indicator to extinguish (approximately six minutes) while data is transferred to the ESE50 internal Winchester disk.

2. Press the RUN/STOP button out, and wait for the RUN indicator to extinguish (approximately six minutes) while data is transferred to the ESE50 internal Winchester disk.

Caution

The ESE50 data retention system should never be considered a substitute for a site-specific data backup policy. The ESE50 should be treated as any other master media in this regard.

1.5.3 Recommended Operating Temperature

The ESE50 SSD is designed to operate in a Class A environment.

1.5.4 Electrostatic Discharge Protection

Electrostatic discharge (ESD) is caused by the buildup and release of static electricity. An electrical charge from a person or object can damage hardware components and result in premature device or option failure.

Caution

To avoid product damage, always use ESD grounding straps when handling static-sensitive modules and components.

Use the following guidelines when handling static-sensitive components and modules:

- Read all instructions and installation procedures included with the static control materials and kits.

- Wear a properly grounded ESD wrist strap when handling modules, components, or static-sensitive devices. Figure 1–4 shows an ESD wrist strap in use.

  When using an ESD wrist strap:

  - Ensure that the wrist strap fits snugly for proper conductivity.

  - Attach the alligator clip securely to a clean, unpainted, grounded metal surface, such as the drive or cabinet chassis.

  - Do not overextend the grounding cord.

- Use static-protective containers to transfer modules and components (including bags and tote boxes).

Figure 1–4 ESD Wrist Strap
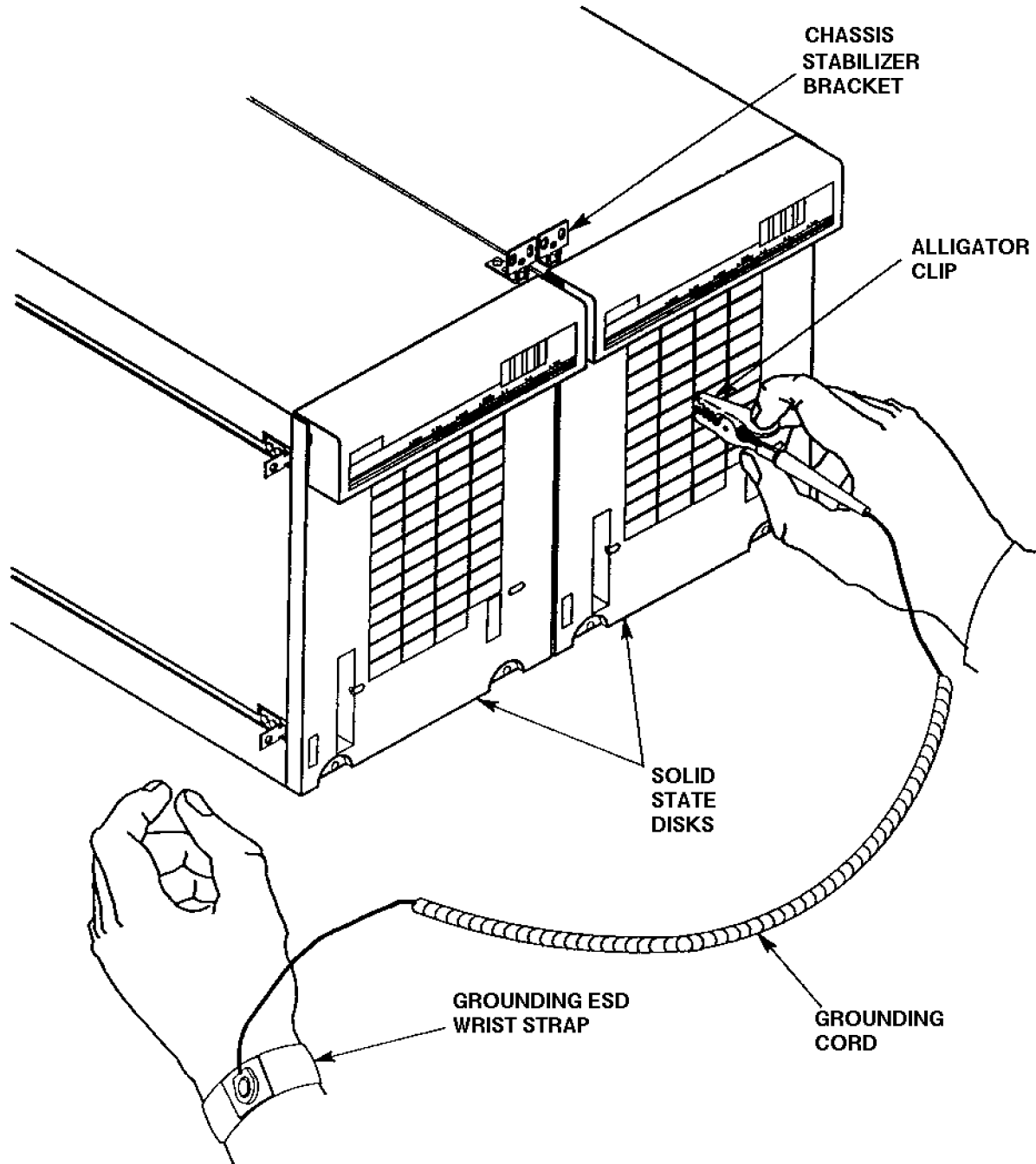
1.6 ESE50 SSD Maintenance Strategy

It is recommended that only trained Digital Customer Services engineers attempt to service an ESE50 SSD.

To repair an ESE50, replace the FRU. An extensive set of drive-resident microcode diagnostics and a drive-resident error log help simplify problem isolation. A listing to all ESE50 FRUs is contained in the *ESE50 Electronic Storage Element Service Guide*.

Appendix A describes the customer's equipment maintenance responsibilities.

1.7 ESE50 SSD Specifications

Table 1–3 lists the data organization, performance, physical, electrical, and environmental specifications of the ESE50 electronic storage element.

Table 1–3 Specifications for the ESE50 SSD

Data Organization	ESE50–Ax	ESE50–Bx	ESE50–Dx
Storage capacity, formatted	120.0 MB	612.6 MB	980.6 MB
Storage capacity, unformatted	128.0 MB	640.0 MB	1024 MB
User logical cylinders	465.0	2337	3741
Cylinder/group	1	1	1
Tracks/group	128	128	128
Sector/track	4	4	4
Number of logical blocks	238,080	1,196,544	1,915,392
Performance			
Access time	0.25 milliseconds		
Transfer rate	20.0 Mbits/sec		
Single Start/Stop Time			
Start†	90 to 540 seconds (capacity dependent)		
Stop	60 to 480 seconds (capacity dependent)		
Physical Dimensions			
Height	26.56 cm (10.42 inches)		
Width	22.19 cm (8.74 inches)		
Depth	46.99 cm (18.50 inches)		
Weight (maximum)	24.95 kg (55 pounds)		

†Starting time is slightly longer due to powerup diagnostics.

Table 1–3 (Cont.)   Specifications for the ESE50 SSD

Power Requirements

Standards	UL listed; CSA certified; FCC Class A verified
Voltage	120/208 Vac at 60 Hz; Single-phase WYE
	220/240 Vac at 50 Hz
Inrush Current:	
	5.08 amperes peak @ 132 Vac
	2.31 amperes peak @ 264 Vac
Running current:	
	1.87 amps @ 120 Vac
	1.105 amps @ 220–240 Vac
Power factor:	
	0.65 @ 120 Vac
	0.57 @ 220–240 Vac

Operating Environment

Temperature	15 to 32°C (59 to 90°F)
	Maximum allowable operating temperature is reduced by a factor of 1.8°C/1000 m (1°F/1000 ft) for operation at high altitude sites
Relative humidity	20 to 80%
Maximum wet bulb	25°C (77°F)
Minimum dew point	2°C (36°F)

Table 1–4 contains additional electrical specifications by model for the ESE50 SSD.

_____ **Note** _____

The ESE50 is not line-frequency dependent.

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Table 1–4   Additional Electrical Specifications by Model for the ESE50 SSD

	Nominal	Input Current (Amps)[1]	
Model	Voltage	Startup Current	Power Dissipation
ESE50	120v	2.4A	300w (max)
ESE50	240v	1.5A	300w (max)

[1]Currents are for nominal voltages of 120 Vac phase to neutral *or* for 240 Vac phase to neutral. For 101 Vac and 220 Vac nominal voltages, the drives will have proportionately higher phase currents by a ratio of 120/101 or 240/220 to the currents specified in this table.

2
Installation

2.1 Introduction

This chapter describes site preparation and planning considerations and procedures for unpacking the ESE50. Cabling, safety precautions, and voltage selection are also discussed.

2.2 Site Preparation and Planning

Site preparation and planning are necessary before installing an ESE50 or subsystem. Consider the following:

- **Power Requirements:** The ESE50 SSD use a single-phase power supply; however, operating voltages are supplied through an 881, 874, H405, or other applicable (system-specific) power controller.

- **Thermal Stabilization:** Thermal stabilization prevents temperature differences between the equipment and its environment from damaging drive components. Equipment must be placed in its operating environment at least 24 hours before operation.

_____ **Caution** _____

The thermal stabilization procedure is mandatory. Failure to do this may cause premature equipment failure.

- **Environment:** The ESE50 SSD must be operated in an environment where the ambient air particle count does not exceed 500,000 particles (larger than 0.5 micron) per cubic foot of air. Refer to Chapter 1 for additional environmental specifications.

- **Floor Loading:** Consider placement and calculate the total weight of your subsystem. An ESE50 weighs approximately 24.95 kg (55 pounds).

- **Operating Temperature and Humidity:** The required relative humidity range is between 10 percent and 90 percent, with a minimum wet bulb temperature of 28°C (82°F) and a minimum dew point of 2°C (36°F) (noncondensing) with a step change of 10 percent or less.

  The ESE50 can be operated in temperatures ranging from 10°C to 40°C (50°F to 104°F). However, it is recommended that the ESE50 be operated in a temperature below 25°C (77°F) to increase reliability and extend product life.

2.3 Unpacking ESE50 Add-Ons

Check packaging for external damage. Read and save any packing information. Unpack the ESE50 SSD using the following procedure (Figure 2–1):

1. Cut and remove the shipping straps.

2. Open the shipping container.

3. Remove and save all packing material surrounding the disk drive.

4. Lift the disk drive from the shipping container.

Warning

ESE50s weigh approximately 24.95 kg (55 pounds) each and must be handled with care.

Do not use the cardboard handles to lift the disk drive from the shipping container. Injury to personnel or damage to equipment could result if the cardboard handles are used for this purpose.

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5. Once the **mandatory** thermal stabilization period has elapsed, remove the barrier bag surrounding the disk drive.

Caution

The thermal stabilization procedure is mandatory. Failure to do this may cause premature equipment failure.

Figure 2–1   ESE50 Disk Drive Packaging

ESE50 DISK DRIVE
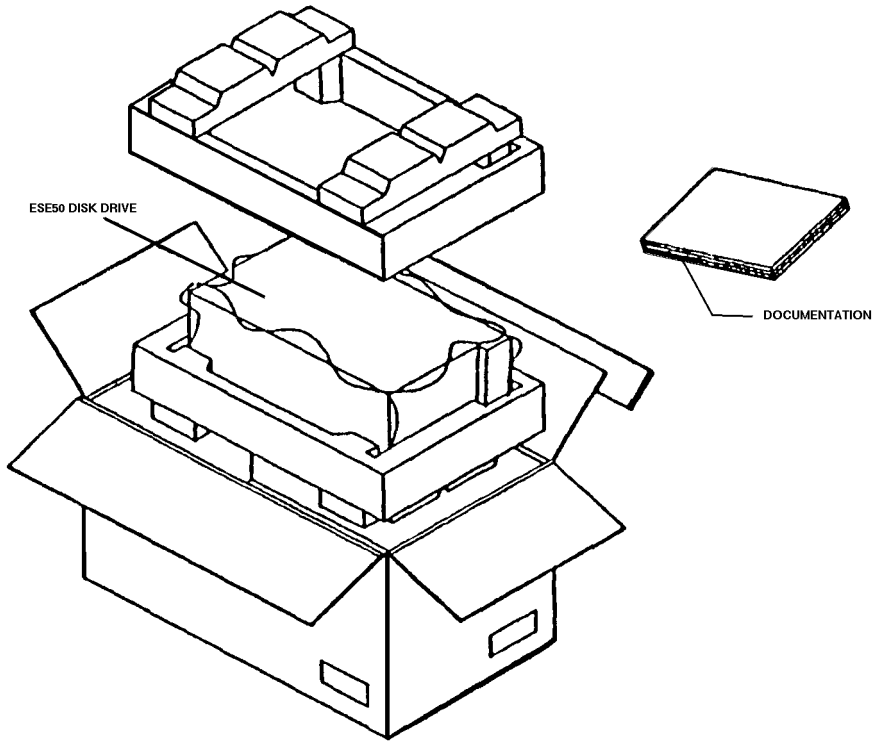
DOCUMENTATION

2.4 Installing SDI Cables and Power Cords

Use this section as a reference only. For detailed procedures and illustrations, refer to subsystem-specific documentation.

Most fully configured cabinets have internal SDI cables and power cords in place. However, when installing an ESE50 unit in an SA900 cabinet, the CK-SA900-L2 installation kit is required. Internal SDI cables are connected to the rear I/O bulkhead located at the base of the cabinet.

Drive power cords are connected to the 881 (or system-specific model) power controller located behind the rear I/O bulkhead at the bottom of the cabinet. Figure 2–2 shows the 881 power controller, used with some ESE50 storage array products, as viewed from the rear of the cabinet. Drive power cords are routed through the grommeted cord opening in the front of the power controller, then plugged into the rear power receptacles of the power controller.

_____ **Note** _____

For a list of related documentation, refer to the preface in the front of this manual. The list supplies titles and Digital part numbers of subsystem manuals that contain specific ESE50 SSD system cabling and power cord information.

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2.4.1 Installing Internal SDI Cables

Internal SDI cables are installed at the factory for all drive positions in most subsystem configurations (with exception of the SA900). Refer to subsystem-specific documentation for details about internal SDI cable routing, connections, and availability.

2.4.2 Installing Internal Power Cords

Internal power cords are installed at the factory and connected to existing drives and the power controller for your system. Connect add-on drive power cords using the illustrations and procedures found in your system-specific documentation.

2.4.3 Installing External SDI Cables

When installing external SDI cables from the I/O bulkhead to the host, refer to system-specific documentation for procedures and illustrations of bulkhead port configurations. Many systems have an I/O port label adhered to the rear door/panel of the system.

2.5 Power and Safety Precautions

The ESE50 does not present any unusual fire or safety hazards. However, it is recommended that you check ac power wiring for the computer system to determine adequate capacity for expansion. To protect personnel and equipment, ensure that power sources meet the specifications required for this equipment.

_____ **Warning** _____

Hazardous voltages are present inside the ESE50. Installation and service must be performed by trained Digital Customer Services personnel. Bodily injury or equipment damage may result from incorrect servicing.

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Figure 2–2   881 Power Controller (Example)
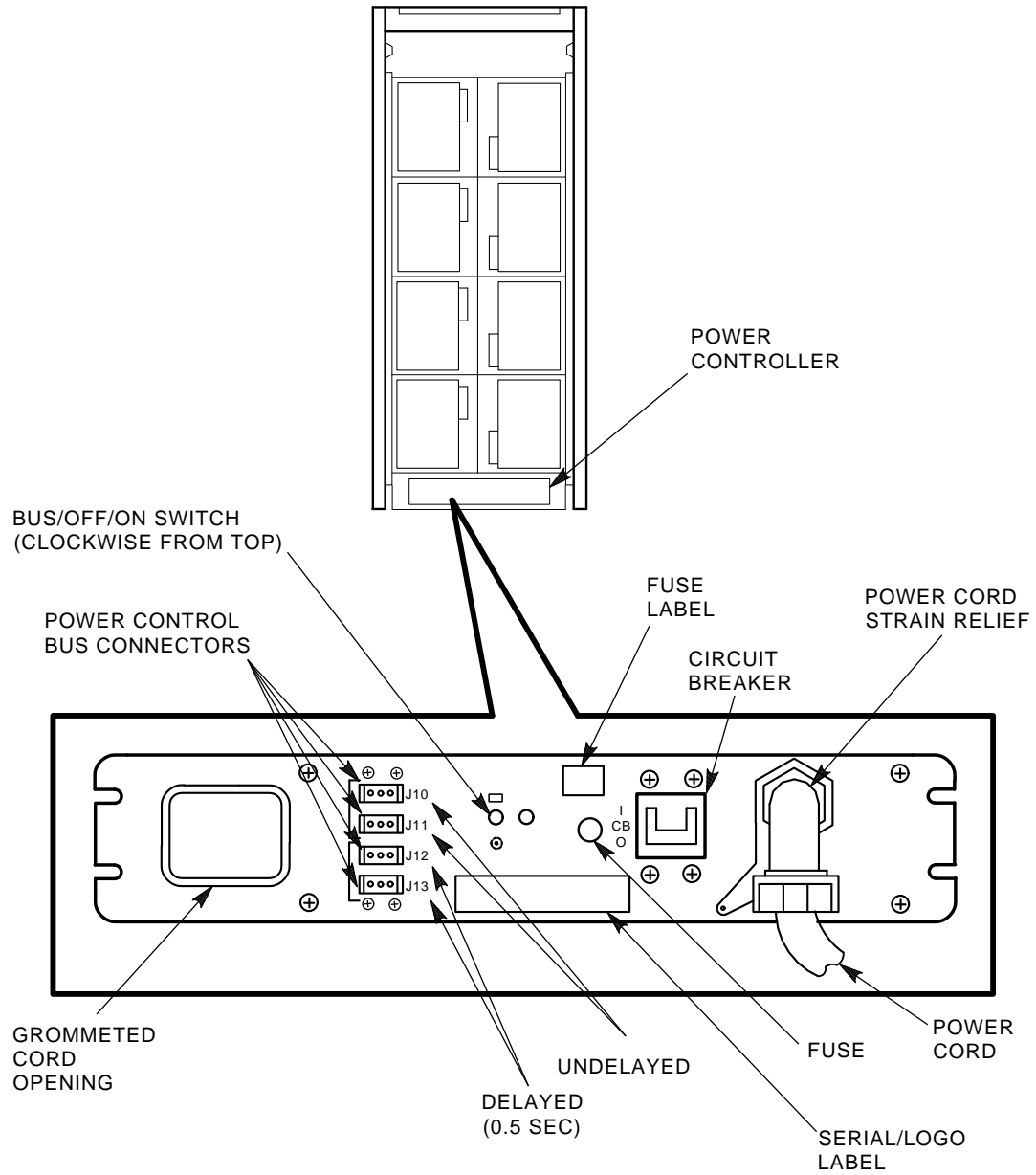
CXO-2136A

2.6 AC Power Wiring

Three-phase power must be present to support the installation of the 60-inch
cabinet. The 40-inch cabinet requires single-phase power. Check system-specific
documentation for the power requirements for your system.

The wiring used by Digital Equipment Corporation conforms to UL, CSA, and
ISE standards. Figure 2–3 shows the ac plug configurations for the ESE50s and
the 881 and 874 power controllers.

_____ **Note** _____

Do not apply power to the power controller until proper voltage has been
selected.

_____
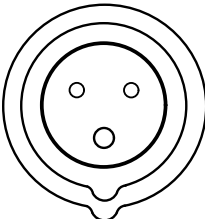
Figure 2–3 Electrical Plug Configurations

POWER CORDS GOING TO POWER CONTROLLER

120V 60HZ POWER CORD DEC NO. A-PS-1700083-23 PLUG - POWER CONTROLLER END	

240V 50HZ POWER CORD DEC NO. A-PS-1700083-24 PLUG - POWER CONTROLLER END	

120/240V 47-63HZ 10A/6A POWER CORD DEC NO. A-PS-1700442-18 OR A-PS-1700442-19 PLUG - DRIVE END	

PLUGS GOING TO WALL OUTLET (FROM CONTROLLER)

40-INCH CABINET

120V 60HZ 24A 1-PHASE		NEMA NO. L5-30P DEC NO. 12-11193 (874-D)
220/240V 50-60HZ 16A 1-PHASE		IEC 309 320-P6W DEC NO. 12-14379-03 (874-F)

60-INCH CABINET

120/208V AC 60HZ 30A 3-PHASE WYE USED WITH 881-A AND 881-C POWER CONTROLLERS		5-WIRE NEMA NO. L21-30P
220-240/380-415V AC 50HZ 20A OR 16A 3-PHASE WYE USED WITH 881-B POWER CONTROLLER		5-WIRE, 4-POLE, IEC 309

CXO-1872D

3

Operating Instructions

3.1 Introduction

This chapter describes the operator control panel (OCP), drive-resident powerup diagnostics, acceptance tests, and ESE50 operating modes. Functional flowcharts are included to aid the user when operating the ESE50.

3.2 OCP Functions, Switches, and Indicators

The OCP interfaces with the ESE50 SSD and performs the following functions:

- Selects Run, Write Protect, Port A, and Port B
- Displays faults and error codes
- Selects tests in the test mode
- Communicates with the ESE50 master processor

Use the following OCP switches and indicators to execute these functions (Figure 3–1):

- Six input switches (Run, Fault, Write Protect, Port A, Port B, and Test)
- Seven LED indicators (Ready, Run, Fault, Write Protect, Port A, Port B, and Test)
- A four-character alphanumeric display

There are no physical *in* or *out* states for the OCP switches. Instead, the logical state of the switch is changed each time a switch is selected, similar to the way a calculator works.

The switch states are shown in the OCP display. The LED indicators show the state of the drive relative to the controller.

Figure 3–1 ESE50 OCP

3.3 Powerup Diagnostics

Do not select any OCP switches.

A sequence of drive-resident diagnostics run when power is applied to the drive. This sequence consists of hardcore tests and basic processor tests. Successful completion of these tests is indicated by a series of OCP displays, as follows:

1. Blank (30 seconds)

2. **[WAIT]** (1 minute for 120 MB, 8 minutes for 600 MB, and 1 GB units)

3. **[0000]** (If previously programmed, the drive unit number is displayed; otherwise, zeros are displayed)

3.3.1 Problems at Powerup

If a problem occurs during powerup, the Fault LED indicator should light. However, if any of the basic processor functions fail and no front panel activity occurs, perform the following steps:

1. Ensure that the OCP is seated properly.

2. Check ac power at the outlet.

3.3.2 Operator Control Panel Lamp Testing

Next, perform an OCP lamp test to ensure that the LED indicators and the alphanumeric display are functioning properly. Use the following procedure:

1. Select the Test switch. (The Test LED indicator lights.)

2. Select the Fault switch. (All lamps light momentarily.)

3. Deselect the Test switch.

3.3.3 Testing Spin-Up Drive

To spin up the drive:

1. Deselect the Test switch. The Test LED indicator goes out and the unit address (if programmed) is displayed.

2. Select the Run switch. (An **R** appears in the OCP display, and the Run LED indicator lights.)

Allow the drive to reach the ready state, as indicated by the front panel Ready LED indicator.

The steps that follow invoke a sequence of resident diagnostic tests. These tests check drive functions in the following areas:

- Processor
- IMB bus
- Internal SCSI bus
- Power monitor logic
- Controller logic
- Fault detection circuitry

3.4 Programming the Drive Unit Address

Once power has been applied to the drive, set the unit address. You must set the drive unit address before placing the ESE50.

The ESE50 unit address is programmable from 0 to 4094. (Remember that the operating system or subsystem type can limit the unit address range.)

Use the following procedure to set the drive unit address. Refer to Figure 3–2 for a flowchart of this procedure.

1. Select the Test switch. (The Test LED indicator lights and a unit address (if previously programmed) is displayed; otherwise, zeros are displayed.)

2. Select the Port A switch for the 1's position. (Position 0 blinks.)

3. Select the Port B switch. (Position 0 increments 1 through 9 every time Port B is selected.)

4. Select the Port A switch for the 10's position. (Position 1 blinks.)

5. Select the Port B switch. (Position 1 increments 1 through 9 every time Port B is selected.)

6. Select the Port A switch for the 100's position. (Position 2 blinks.)

7. Select the Port B switch. (Position 2 increments 1 through 9 every time Port B is selected.)

8. Select the Port A switch for the 1000's position. (Position 3 blinks.)

9. Select the Port B switch. (Position 3 increments 1 through 4 every time Port B is selected.)

10. Select the Test switch to exit.

Figure 3–2 Unit Address Programming Flowchart

```
                    ┌─────────────┐
                    │ NORMAL MODE │────────────────────────┐
                    └──────┬──────┘                        │
                           │                               ▼
                           ▼                    ┌──────────────────┐
DISPLAY = [R][  ][A][B]                         │ INCREMENT        │
                           │                    │ NUMBERS 0–9      │
                           ▼                    │ BY SELECTING     │
                 ┌──────────────────┐           │ PORT B           │
                 │ DESELECT         │           │ SWITCH           │
                 │ PORT A AND       │           └────────┬─────────┘
                 │ B TO SET UNIT    │                    │
                 │ ADDRESS          │                    ▼
                 └────────┬─────────┘           ┌──────────────┐
                          │                     │ SELECT       │
                          ▼                     │ PORT A       │
DISPLAY = [R][  ][  ][  ]                        │ SWITCH       │
                          │                     └──────┬───────┘
                          ▼                            │
                 ┌──────────────────┐                  ▼
                 │ SELECT TEST      │       DISPLAY = [0][0*][0][0]
                 │ SWITCH (TEST     │                  │
                 │ LED LIGHTS)      │                  ▼
                 └────────┬─────────┘         ┌──────────────────┐
                          │                   │ INCREMENT        │
                          ▼                   │ NUMBERS 0–9      │
                 ┌──────────────┐             │ BY SELECTING     │
                 │ SELECT       │             │ PORT B           │
                 │ PORT A       │             │ SWITCH           │
                 │ SWITCH       │             └────────┬─────────┘
                 └──────┬───────┘                      │
                        │                              ▼
                        ▼                     ┌──────────────┐
DISPLAY = [0][0][0][0*]                        │ SELECT       │
                        │                     │ PORT A       │
                        ▼                     │ SWITCH       │
              ┌──────────────────┐            └──────┬───────┘
              │ INCREMENT        │                   │
              │ NUMBERS 0–9      │                   ▼
              │ BY SELECTING     │        DISPLAY = [0*][0][0][0]
              │ PORT B           │                   │
              │ SWITCH           │                   ▼
              └────────┬─────────┘          ┌──────────────────┐
                       │                    │ INCREMENT        │
                       ▼                    │ NUMBERS 0–4      │
              ┌──────────────┐              │ BY SELECTING     │
              │ SELECT       │              │ PORT B           │
              │ PORT A       │              │ SWITCH           │
              │ SWITCH       │              └────────┬─────────┘
              └──────┬───────┘                       │
                     │                               ▼
                     ▼                      ┌──────────────┐
DISPLAY = [0][0][0*][0]                      │ SELECT       │
                     │                      │ TEST         │
                     └──────────────────────│ SWITCH       │
                                            └──────┬───────┘
                                                   │
          0* Indicates Flashing Readout           ▼
                                                 DONE
```

0* Indicates Flashing Readout

3.5 ESE50 Operating Modes

The ESE50 operates in three setup modes: **normal**, **fault display**, and **test**.
The following sections describe the functions of each mode.

3.5.1 Normal Mode Setup

The normal mode setup is the usual operating mode of the ESE50 SSD. Switch
selection during normal operation usually consists of the Run switch, Write
Protect switch (for normal write protection), and Port A or B switches. No Fault
or Test LED indicators are lit.

During normal operations:

- Selecting the Run switch causes an **R** to appear in the OCP display and
  causes the drive to spin up. Additionally, the Run LED indicator lights. The
  Ready LED indicator lights once the drive is up to speed.

- Selecting the Port A or Port B switch causes an **A** or **B** to appear in the OCP
  display and logically makes the drive available to the controller.

- Selecting the Write Protect switch logically write-protects the drive and lights
  the Write Protect LED indicator.

- Selecting the Fault switch:

  - (Without a fault indication) causes a two-second OCP lamp test.

  - (With a fault indication) causes an error code to display. Selecting the
    Fault switch a second time (with a fault indication) clears the fault.

- Selecting the Test switch:

  - (With the Port A or Port B switch selected) causes a two-second display of
    the unit address.

  - (Without the Port A or Port B switch selected) causes the drive to enter
    the test mode.

3.5.2 Fault Display Mode Setup

To enter the fault display mode, select the Fault switch. The fault display mode
can only be entered if the Fault LED indicator is lit; otherwise, selecting the
Fault switch causes a two-second OCP lamp test.

An error code is displayed in the format shown in Figure 3–3. To exit the fault
display mode and clear the fault, select the Fault switch a second time.

_____ **Note** _____

Hard faults will not clear. If a hard fault occurs, note the error code and
contact Digital Services.

_____

Figure 3–3 Fault Display Example

```
                    ( NORMAL MODE )
                           │
                           ▼
   DISPLAY =  | R | W | A | B |
                           │
                           ▼
                    ┌──────────────┐
                    │    FAULT     │        ┌──────────┐
                    │  INDICATION  │───────▶│  SELECT  │
                    │  ON DRIVE    │        │  FAULT   │
                    │      ?       │        │  SWITCH  │
                    └──────────────┘        └──────────┘
                           │                     │
                           ▼                     ▼
                    ┌──────────┐          ┌──────────┐
                    │  SELECT  │          │ OCP LAMP │
                    │  FAULT   │          │   TEST   │
                    │  SWITCH  │          │ (2 SEC)  │
                    └──────────┘          └──────────┘
                           │                     │
                           ▼                     │
 *DISPLAY =  | E |  | 0 | F |                     │
                           │                     │
                           ▼                     │
                    ┌──────────┐                 │
                    │  SELECT  │                 │
                    │  FAULT   │                 │
                    │  SWITCH  │                 │
                    └──────────┘                 │
                           │                     │
                           ▼                     │
                    ┌──────────┐                 │
                    │  FAULT   │                 │
                    │  CLEARS  │                 │
                    └──────────┘                 │
                           │                     │
                           ▼                     │
                    ( NORMAL MODE )◀─────────────┘
```
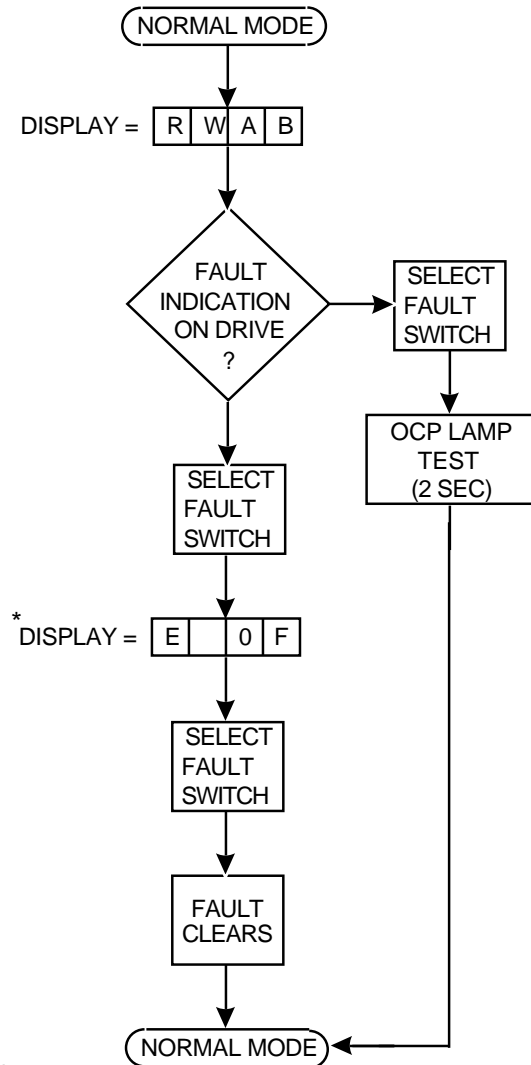
*NOTE: Any combination of legal alphanumeric
        error codes (HEX).

Refer to Figure 3–4 for a fault display mode flowchart.

Figure 3–4 Fault Mode Flowchart

DISPLAY = | E | | 0 | F |

3.5.3 Test Mode Setup

You must enter the test mode to set the ESE50 unit address or to run resident diagnostic tests. In this mode, Port A and Port B switches have the function of selecting both the unit address numbers and test numbers. In addition, the port switches are used to abort running diagnostics. The Write Protect switch starts the tests and the Port A or Port B switches stop selected tests. The tests that run are a subset of the power-on diagnostics.

The test mode is characterized by three displays. Figure 3–5 shows an OCP after test selection is made. Figure 3–6 shows a display while the test is running.

Figure 3–5 ESE50 Test Display

DISPLAY = | T | | 0 | 1* |

*Indicates Flashing Readout

Figure 3–6 Running Test OCP Display

DISPLAY = | T | | 0 | 1* |

DISPLAY = | S | | 0 | 1 | (START)

DISPLAY = | C | | 0 | 1 | (COMPLETE)

DISPLAY = | T | | 0 | 1* |

*Indicates Flashing Readout

4

Diagnostics

4.1 General Information

This chapter contains general information concerning drive-resident diagnostics
and acceptance testing procedures.

4.2 Drive-Resident Diagnostics

Drive-resident diagnostics are invoked under four conditions:

- Powerup or master processor reset
- External init (SDI command)
- Operator control panel (OCP) test mode selection
- Functional firmware sequences (idle loop)

Drive-resident diagnostics test three hardware areas. These areas are:

- Hardcore (CPU, ROM, RAM, SCSI, and timer)
- Logic
- Functional

4.2.1 Powerup Resident Diagnostics

The drive-resident diagnostics that run at powerup or master processor reset run without manual intervention in the following order:

- Master CPU test
- Master ROM test
- Master RAM test
- Master timer test
- Servo data bus loopback test
- Head select test

4.3 Test Selection from the OCP

Use the following procedure to select and run resident diagnostics from the OCP (Figure 4–1):

1. Select the Test switch. (Test defaults to zero.)
2. Select the Write Protect switch to initiate resident diagnostics.
3. Select the diagnostic using Port A and Port B switches (Figure 4–1).
4. Start the test by selecting the Write Protect switch.
5. Stop the test by selecting the Port A or Port B switch.
6. Restart the test by selecting the Write Protect switch again.
7. Select the Test switch to exit the test mode.

Run the resident diagnostics from the OCP in the following order:

1. Test T 00: Drive spin down.
2. Test T 00: Drive spin up.

Figure 4–1   Test Selection Flowchart

* Indicates Flashing Readout

A
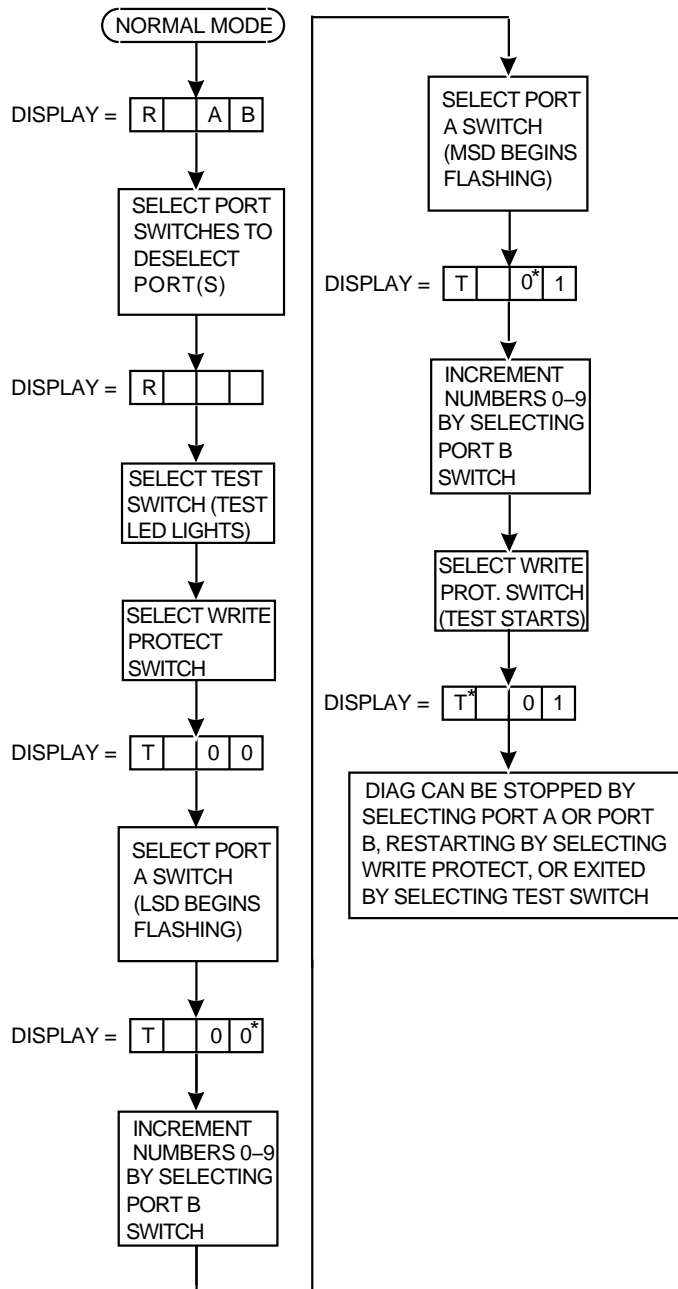
Customer Equipment Maintenance

This appendix will assist customers in maintaining their equipment to ensure the highest level of equipment performance and reliability. Specifically, this appendix addresses the maintenance of SA6xx/SA8xx storage array cabinet systems.

A.1 Customer Responsibilities

The customer is directly responsible for:

- Supplying accessories, including storage racks, cabinetry, tables and chairs, as required.

- Making the appropriate documentation available in a location convenient to the system.

- Obtaining cleaning supplies specified in this appendix.

- Performing the specific equipment maintenance described in this appendix.

A.1.1 Cleaning Supplies

To properly maintain the equipment, the customer must acquire the following items and supplies:

- Vacuum cleaner with flexible hose and nonmetallic, soft-bristle brush attachment

- Isopropyl alcohol (at least 91%) (PN 29-19665)

- Lint-free tissues or cloths

- All-purpose spray cleaner

_____ Caution _____

When using spray cleaner, do not spray the cleaner directly into computer equipment. This could adversely affect equipment reliability or damage electrical components.

_____

Customer Equipment Maintenance
A.1 Customer Responsibilities

A.1.2 Ongoing Equipment Care

Routine care of the equipment should be done on a regular basis:

- Keep the immediate area in front of the storage array cabinets free of obstructions.

- Keep the exterior of the cabinets and the surrounding area clean. Use a lint-free cloth and isopropyl alcohol to remove sticky residue left on painted surfaces by customer cabinet number labels, and so forth.

- Maintain the site temperature/humidity to comply with Digital's recommended environmental range (reference product-specific documentation). This will ensure that the highest product reliability and product life goals are achieved.

A.1.3 Monthly Equipment Maintenance

The following tasks should be performed on a monthly basis, or more often if environment warrants:

_____ **Caution** _____

Avoid touching the operator control panel switches during cleaning operations. The state of the drives could change and affect the operation of the subsystem.

_____

- Vacuum and/or wipe top of storage array cabinet with a lint-free cloth.

- With a soft-bristle brush attachment, vacuum the air vent grill on the front door of the storage array cabinet. Leave the front door assembly attached to the storage array cabinet while vacuuming.

A.1.4 Maintenance Records

Digital suggests that the customer keep an accurate log of all equipment maintenance. A maintenance log form for SA6xx/SA8xx storage array cabinets is included in this appendix for customer use. This form may be reproduced and inserted in the customer's site management guide for record-keeping purposes.

Figure A–1 Customer Equipment Maintenance Log

<div align="center">

CUSTOMER EQUIPMENT MAINTENANCE LOG
FOR STORAGE ARRAY CABINETS

</div>

DATE OF SERVICE	TYPE OF SERVICE PERFORMED	CABINET S/N	CABINET S/N	CABINET S/N	CABINET S/N

CXO-2964A

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