Model SKS-HP

SCSI Disk Subsystem

Technical Manual

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1272	2/27/89	RELEASE	
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Technical Manual for the SKS-HP SCSI Disk Subsystem.

PREFACE

This manual contains information regarding installation, testing, and operation of the ZETACO SKS-HP SCSI Disk Subsystem. It has been written with the following assumptions in mind: 1) You have a working knowledge of Data General (DG) minicomputers, operating systems, and diagnostic and utility software; 2) you have access to full hardware and software documentation for your particular system; 3) you are familiar with standard installation, power, grounding, and peripheral cabling procedures.

The information in this manual is organized into three major sections:

SECTION 1.0	PRODUCT OVERVIEW - Describes the SKS-HP Subsystem features, capabilities, specifications, power, and interface requirements.
SECTION 2.0	INSTALLATION PROCEDURES - Describes and illustrates the procedures required to install the SKS-HP Subsystem.
SECTION 3.0	TROUBLE-SHOOTING - Contains information useful in analyzing subsystem problems, and how to get help.
SECTION 4.0	USAGE GUIDELINES - Contains specific information regarding aspects of usage of removable or fixed drives and the SCZ-3 Controller.

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1.0 PRODUCT OVERVIEW

1.1 GENERAL DESCRIPTION

The SKS-HP series subsystems combine a high performance controller with high capacity and performance disk drives.

The disk drives are able to operate in the synchronous mode delineated in the Small Computer System Interface (SCSI) specifications because the SKS-HP controller negotiates for this type of transfer. By doing this, the subsystem takes full advantage of the higher speed burst data transfers possible with synchronous mode enabled.

When two or more drives are used, the controller makes efficient use of overlapped seeks, enhanced further by a data buffering feature on the drives, to reduce rotational latency.

At the system level, the SKS-HP controller effectively utilizes Data General 6236/6239 driver capabilities to store and retrieve data from the drives. Both mirroring and mapping are supported.

In addition, the drive packaging options provide flexibility by allowing a choice of removable modules, internally fixed drives or a combination of both. Both styles are rack-mountable.

Note that all SKS-HP Subsystems are integrated at the factory as a complete unit. The components have been designed and tested together, and none should be substituted with any other type or brand of component, however similar; if substitutions are made, ZETACO cannot guarantee the proper functioning of the Subsystem.

1.2 FEATURES AND ADVANTAGES

* The Subsystem interfaces to DG's high speed BMC bus on Eclipse and MV Series processors running unmodified AOS or AOS/VS. Refer to SKS Integration Guide for tested CPUs.

* The Controller supports simultaneous control of up to seven SCSI Disk Drives, for a total of 2.1 gigabytes of on-line data.

* The Controller Device code is easily selected, even after installation, via switches accessible at the board edge.

* The Subsystem contains a user-friendly software configuration.

* Removable Disk Drive Module option to ensure secure data.

1.3 SPECIFICATIONS

1.3.1 SCZ-3 CONTROLLER

Drives per Controller:	Up to 7 SCSI targets.
Recording Format:	Media format is drive vendor unique.
Data Transfer Rate:	Up to 4.7 MB/second burst (Sync.) Up to 3 MB per second (Async.)
Maximum Capacity:	The theoretical maximum capacity supported by a single SCZ-3 is 17 gigabytes.
Device Code:	Switch selectable.
Interrupt Priority Mask Bit:	Bit 7
Bus Load:	1 unit load (any "I/O ONLY" slot).
Data Channel Interface:	Not supported.
Burst Multiplexor Channel Interface:	
	Less than 1 STTL load
	64ma drive at 0.7v
	Supports selectability of any of the 8 priority requests
	Selectable burst rates of 1 to 256, 16 bit words/access
	Selectable break count from 1 to 255 sync clock periods

	Maximum allowable BMC latency is 30ms (to achieve maximum performance, system overhead including BMC latency should not exceed one disk sector time).
	Support BMC transfer rates equal to the fastest available BMC computers.
Data Buffering:	Two 256-word BMC buffers in a ping-pong configuration. 32K buffer for SCSI I/F data.
Memory Address:	21 bits
Indicator Lights:	RED (Right) Self-Test (HOST) RED (Left) Self-Test (SCSI) GREEN (Right) Controller Busy (HOST) GREEN (Left) SCSI Busy YELLOW (Right) BMC Active YELLOW (Left) SCSI Bus Fault

1.3.1.1 COMPUTER INTERFACE

The SCZ-3 is designed to operate only with the BMC and must be installed in an "I/O ONLY" slot of an MV or Eclipse computer. Table 2.1 lists the Data General computers in which the SCZ-3 will function, along with corresponding "I/O ONLY" slot numbers.

1.3.1.2 BMC BUS CABLES

Two 40-conductor flat ribbon cables, with a single socket on one end and multiple sockets (for multiple controllers), are required for BMC operation.

1.3.1.3 DISK DRIVE INTERFACE

Functional:

- SCSI interface single-ended or differential; Asynchronous or Synchronous

Cabling:	CHASSIS WITH BULKHEAD
	INTERNAL: Included 50-conductor flat ribbon cable with D connector on one end that mounts in the computer EMI/RFI backpanel. The other end plugs into the A paddleboard. See Figure 2.1.
	NON-BULKHEAD CHASSIS
	EXTERNAL: Contact ZETACO with your cabling requirments.

NOTE: The maximum cumulative length allowable for external cables is 18 feet, for single-ended interface and 83 feet for differential interface.

1.3.1.4 MECHANICAL

Dimensions:	15" x 15" x 1/2"
Shipping Weight:	10 pounds - includes controller, paddleboard, internal cable, software tape and documentation.
Paddleboard:	SINGLE-ENDED: Passive backplane paddleboard with one 50-pin cable connector ("A" backplane).
	DIFFERNTIAL: Active backplane paddleboard with one 50-pin cable connected ("A" backplane).

1.3.1.5 POWER REQUIREMENTS

+5 (+/- 5%) Volts DC @ 6.5 amps typical

1.3.1.6 ENVIRONMENTAL

OPERATING ENVIRONMENT:

Temperature:	0 to 55 degrees C
Relative Humidity	10% to 90% (non-condensing)

NON-OPERATING ENVIRONMENT:

Temperature:	-45 to 68 degrees C
Relative Humidity	10% to 90% (non-condensing)

Exceeds all Eclipse/MV temperature and humidity specifications.

1.3.2 DISK DRIVE MODULE - FIXED

1.3.2.1 MECHANICAL

Module Dimensions:

Width:	19 inches (48.26 cm)
Height:	3.4 inches (8.6 cm)
Length:	18 inches (45.7 cm)

Module Shipping Weight: 48 pounds (21.6 kg)

1.3.2.2 POWER REQUIREMENTS

AC Input:	120 VAC	220 VAC	230/240 VAC
Frequency:	60 Hz	50 Hz	50 Hz
Max. AC Operating Current:	4 Amps	2 Amps	2 Amps
Fuse:	6 1/4 Amp Slo-Blo	3 Amp Slo-Blo	3 Amp Slo-Blo

1.3.2.3 ENVIRONMENTAL

OPERATING ENVIRONMENT:

Temperature:	+10 to +38 degrees C
Relative Humidity:	+10% to +80% (non-condensing)
Altitude:	-1000 to +10000 feet

NON-OPERATING ENVIRONMENT:

Temperature:	-10 to +54 degrees C
Transit:	-40 to +70 degrees C
Relative Humidity:	8% to +90% (non-condensing)
Altitude:	-1000 to +40000 feet

1.3.2.4 CABLING

1.3.2.5 INTERNAL

Paddleboard: Active backplane paddleboard with one 50-pin cable connector ("A" backplane)

Cable: 50-conductor flat ribbon cable

1.3.2.6 EXTERNAL

Cables:

- Five-foot, 50-conductor shielded round cable connecting backpanel to Drive Enclosure
- One-foot, Optional 50-conductor shielded round cable(s) connecting additional Drive Enclosures
- Non-bulkhead installation kit

The maximum cumulative cable length allowable for a fully populated subsystem is:

Single-Ended	6 meters (19.68 feet)
Differential	25 meters (83 feet)

Contact ZETACO for optional cable lengths.

1.3.3 DISK DRIVE MODULE - REMOVABLE

1.3.3.1 MECHANICAL

Module Dimensions:

Width:	17 inches (43.20 cm)
Height:	5.25 inches (13.30 cm)
Length:	20.70 inches (52.60 cm)

Module Shipping Weight: 35 pounds (15.75 kg) with two cannisters installed.

1.3.3.2 POWER REQUIREMENTS

	100-120 VAC Nominal	200-240 VAC Nominal
AC Input:		
Frequency:	47-1000 Hz	
Maximum AC Operating Current:	3 Amp	1.5 Amp
Fuse:	5 Amp	2.5 Amp

1.3.3.3 ENVIRONMENTAL

OPERATING ENVIRONMENT:

Temperature:	+10 to +40 degrees C
Relative Humidity:	+10% to +80% (non-condensing)
Altitude:	-200 to 10,000 feet

NON-OPERATING ENVIRONMENT:

Temperature:	-10 to +70 degrees C
Relative Humidity:	+10% to +90% (non-condensing)
Altitude:	-1000 to 40,000 feet

1.3.3.4 CABLING

1.3.3.5 INTERNAL

Paddleboard:	Passive backplane paddleboard with one 50-pin cable connector ("A" backplane)
Cable:	50-conductor flat ribbon cable

1.3.3.6 EXTERNAL

Cables:

- Five-foot, 50-conductor shielded round cable connecting backpanel to drive enclosure.
- One-foot, optional 50-conductor shielded round cable(s) connecting additional drive enclosures.
- Non-bulkhead installation kit.

The maximum cumulative cable length allowable for a fully-populated subsystem is 6 meters (single-ended) or 19.68 feet.

Contact ZETACO for optional cable lengths.

2.0 INSTALLATION

2.1 BEFORE YOU BEGIN

This section contains procedures to:

1. Prepare the controller and physical environment.
2. Install a fixed drive.
3. Install a removable drive.
4. Prepare the controller logical environment.
5. Prepare the disk drive(s) (removable or fixed) off-line.
6. Bring the subsystem on-line.

Please read through all applicable portions before beginning the installation process, then refer to them as you work.

You will need the following tools to install the SKS-HP Subsystem:

1. A Phillips screwdriver
2. A set of nut drivers
3. A small straight-blade screwdriver
4. A large straight-blade screwdriver

You may also find a flashlight and needlenose pliers helpful for installing jumpers and the paddleboard in the computer backplane.

2.1.1 UNPACKING AND INSPECTION

The SKS-HP Subsystem consists of the following parts:

QTY	DESCRIPTION
1	SCZ-3 Disk Controller
1	Disk Drive Module (single-ended or differential)
1	Disk Drive Cannister*
1	'A' Paddleboard (single-ended or differential)
1	Internal Cable
1	External SCSI Cable 5'
1	BMC Terminator Block
2	BMC Bus Cable
1	Software Support Package
1	SKS-HP Technical Manual

* Used in removable subsystem only.

Upon receipt of the SKS-HP Subsystem from the carrier, inspect the shipping cartons immediately for any evidence of damage or mishandling in transit.

If the shipping cartons are water stained or damaged, contact the carrier and shipper immediately, specify the nature and extent of the damage and request that the carrier's agent be present when the cartons are opened.

ZETACO'S warranty does not cover shipping damage.

For repair or replacement of any ZETACO product damaged in shipment, call ZETACO to obtain return authorization instructions. See Section 3.7.

2.2 PREPARE THE PHYSICAL CONTROLLER ENVIRONMENT

Some care must be taken to integrate the SCZ-3 properly into a system. The following sections discuss slot selection and backplane priority.

2.2.1 SYSTEM HARDWARE REQUIREMENTS

a) Eclipse or MV Family CPU with minimum 32K words memory
b) Magnetic Tape Subsystem
c) Console on Device 10/11
d) Printer at Device 17, in order to print a copy of your configuration facts and log any errors

2.2.2 SLOT SELECTION

The SCZ-3 must be installed in an "I/O ONLY" slot. Consult Table 2.1 to determine which slots are correct for your particular computer.

==========

CAUTION: THE SCZ-3 MUST BE PLUGGED INTO AN "I/O" ONLY" SLOT OR COMPONENT DAMAGE WILL RESULT. ZETACO'S WARRANTY IS VOID IF A SLOT OTHER THAN "I/O ONLY" IS USED.

==========

TABLE 2.1 "I/O ONLY" Slot Selection

CPU MODEL	I/O ONLY SLOT NUMBERS
S/140	12-16
S/280	11-20
MV/4000	12-20
MV/6000	2-16 (I/O Expansion Chassis)
MV/7800	(See Note 1, below.)
MV/8000	29-42, 48-56
MV/8000II	9-21
MV/8000C	13-20
MV/10000	13-24, 26-36
MV/15000	6-12
MV/20000	19-38

NOTE 1: The MV/7800 CPU can be installed in a number of different chassis. The SCZ-3 may ONLY be installed in an "I/O ONLY" slot for that type of chassis.

2.2.3 PRIORITY SELECTION

The Controller must receive two priority signals from the Data General minicomputer backplane: DCH Priority In (Pin A94), and Interrupt Priority In (Pin A96). If there are vacant slots between the SCZ-3 and the processor, or between the SCZ-3 and another controller already installed in the chassis, jumper wires must be installed to obtain priority continuity. To "jumper across" unused slots, connect DCH Priority Out (Pin A93) to DCH Priority In (Pin A94) and Interrupt Priority Out (Pin A95) to Interrupt Priority In (Pin A96). See Figure 2.3.

2.3 PREPARE THE CONTROLLER

To prepare the controller for installation you will need to establish proper BMC bus termination and select the Device Code.

2.3.1 BMC BUS TERMINATION

If there is more than one BMC device daisy-chained on the BMC bus, then the BMC controller at the end of the bus must have the bus terminators installed. If the SCZ-3 is to be installed as the last (or only) BMC controller, then make sure the bus terminator is installed in the middle cable header on the front edge of the SCZ-3. Refer to Figure 2.2.

NOTE: The SCZ-3 is shipped from the factory with the terminator installed unless otherwise specified.

2.3.2 DEVICE CODE SELECTION

The standard Primary device code for the SCZ-3 is 24 octal; the Secondary is 64 octal. However, any Data General device code can be selected, as long as there is not already a controller in the system with that device code.

There is a set of Device Code switches on the edge of the board that allow you to easily set the device code. Switches 3 through 8 specify device code. Switch 1 is reserved and should be placed in the "DOWN" position. Refer to Figures 2.2 and 2.4 for switch location and proper selection.

If, at a later date, you wish to change the device code for the SCZ-3, you need not remove the board from the computer chassis. Simply set the switches accordingly and press RESET on the computer. The new device code will then be operative.

2.3.3 EEPROM WRITE DISABLE

Switch position 2 (see Figure 2.4) is used to disable writing of the EEPROMs. This switch, when in the DOWN (closed) position, disables writing while the UP (open) position allows writing. To configure the controller, this switch must be in the UP position. It is recommended that the switch be closed at all other times to prevent accidental writing to the EEPROMs.

2.3.4 PADDLEBOARD EXTERNAL TERMINATOR POWER JUMPER

Jumper W1-1 on the paddleboard is used to enable or disable the controller from receiving or providing terminator power over the SCSI bus. External terminator power is provided for situations where it is critical that the SCSI bus be kept properly terminated if a device at one end of the cable is shut down. An example of this is a dual-port configuration where SCSI devices are shared by two controllers, each at opposite ends of the SCSI cable and terminated.

It is recommended that this jumper be left open, or placed over one pin only if not required. If external terminator power is a requirement, the jumper must be placed over BOTH pins (closed).

On subsystems with differential drives, the termination system requires that this jumper be installed.

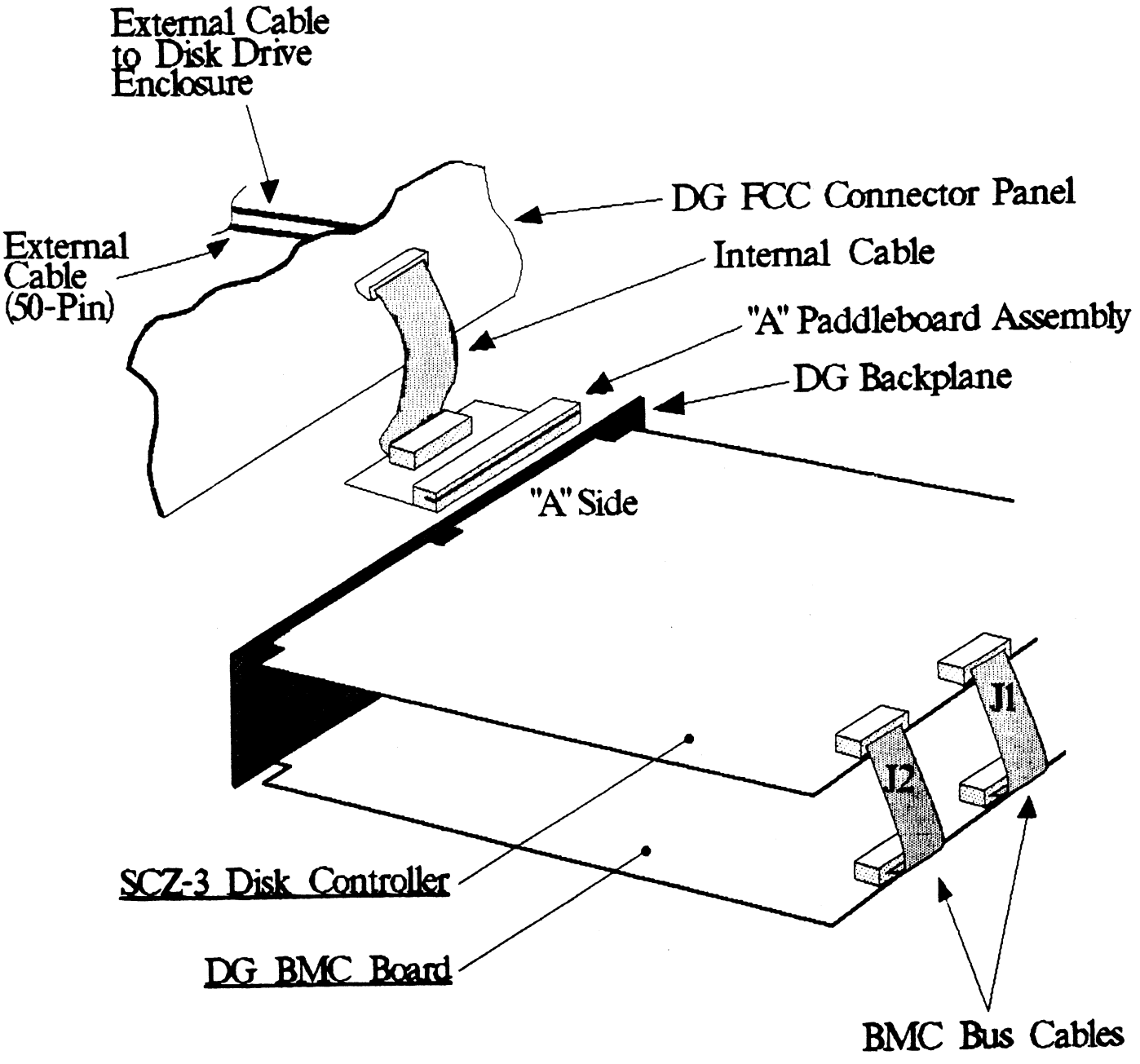
2.3.5 BMC BUS CABLING

The two BMC bus cables provided have a single 40-pin connector on one end and a group of connectors on the other end (4-connector P/N 300-038-01; 6-connector P/N 300-131-01; or 8-connector P/N 300-132-01).

These cables daisy-chain from the computer's BMC interface to the multiple BMC peripheral controllers. The controller at the end of the chain must have its BMC terminators installed, the others must have them removed. Refer to Section 2.4.1 for BMC terminator installation.

Install the BMC bus cables as shown in Figure 2.1 by plugging the single-plug end of the cables into the Data General BMC board, and the multiple-plug end of the cables into the SCZ-3 and other BMC peripheral controllers.

Figure 21 SCZ-3 Cabling Diagram



2.4 INSTALL THE CONTROLLER AND PADDLEBOARD

First, pull out the lock tabs on the two front corners of the board as far as they will go. Next, carefully guide the Controller board into the "I/O ONLY" slot you selected in Section 2.2.2. When the board engages the backplane connectors, gently press the lock tabs in to provide insertion leverage. Use equal pressure on both lock tabs until the board seats firmly into the backplane connectors.

2.4.1 PADDLEBOARD INSTALLATION

The computer backplane, viewed from the rear, has the "A" side pins on the left. (On computers with vertically mounted circuit boards, the "A" side pins are on the top.)

Locate the two rows of pins on the "A" side of the backplane for the slot containing the Controller. Ensure that no pins are bent. Position the "A" paddleboard connector block so that it covers all 100 pins of the "A" backplane. Be sure that the component side of the paddleboard is facing up. Press the connector securely over the pins, making sure all pins insert and do not bend, until the connector block is flush with the backplane. See Figure 2.3.

CAUTION: COMPONENT DAMAGE MAY OCCUR IF PADDLEBOARD IS MIS-ALIGNED. MAKE SURE THE BLOCK IS NOT SHIFTED RIGHT OR LEFT BY CHECKING FOR NON-INSERTED PINS ON BOTH ENDS. DOUBLECHECK THAT THE BLOCK IS POSITIONED OVER THE CORRECT TWO ROWS OF PINS, AND NOT BETWEEN SLOTS. IT MAY BE NECESSARY TO COUNT PAIRS OF ROWS TO DETERMINE CORRECT POSITIONING.

Figure 2.2 SCZ-3 Board Layout

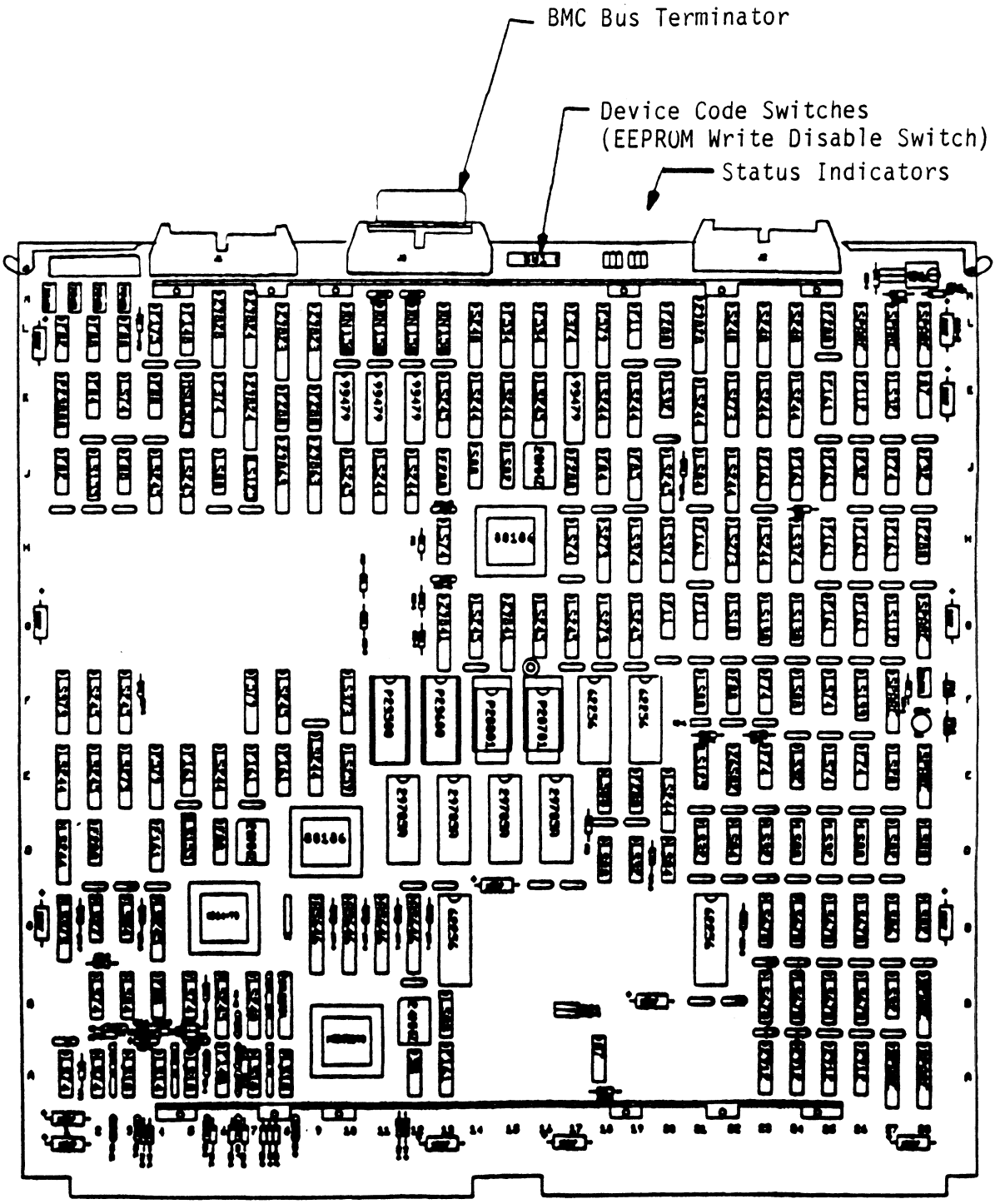


Figure 2.3 Backplane Priority Jumpers

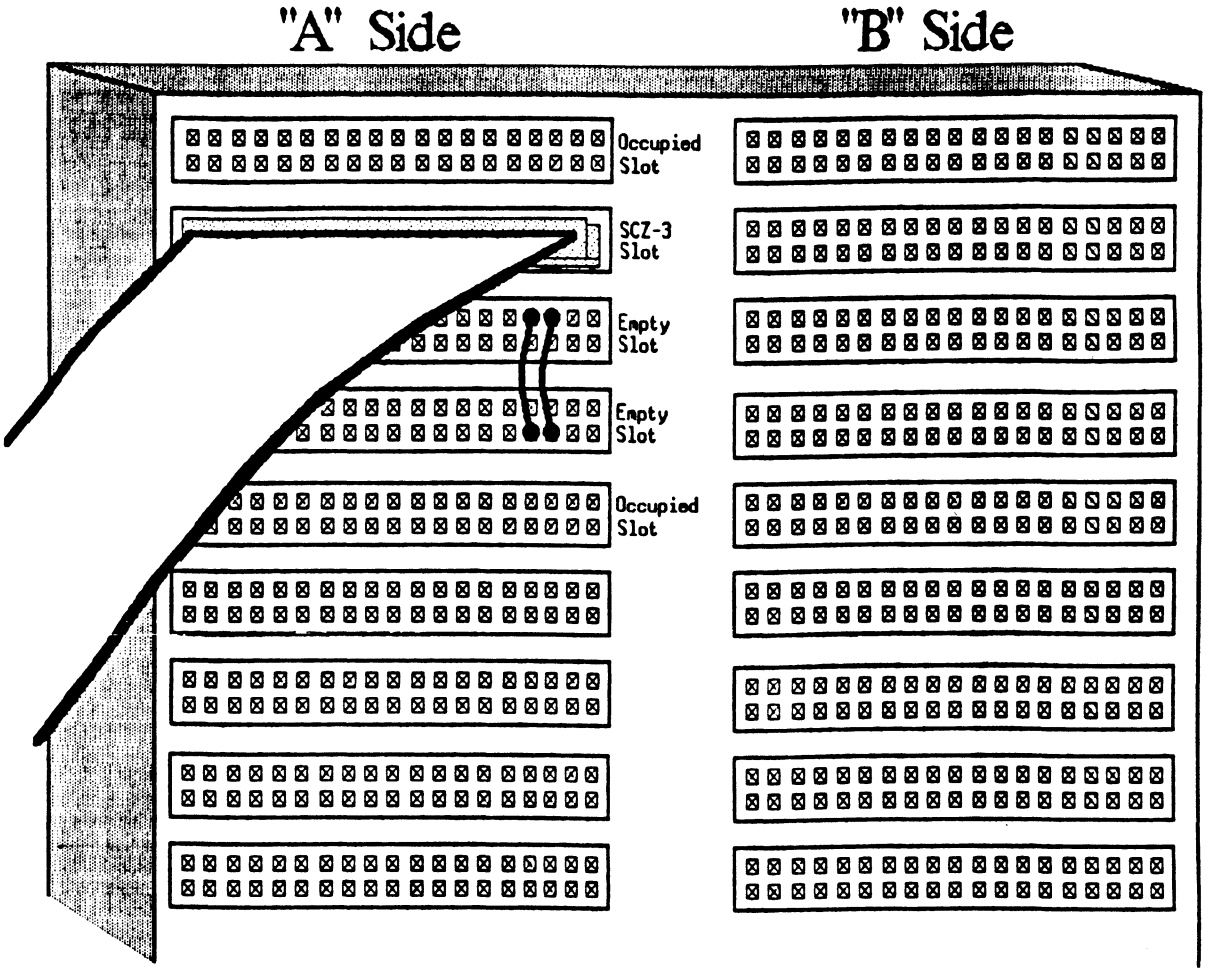
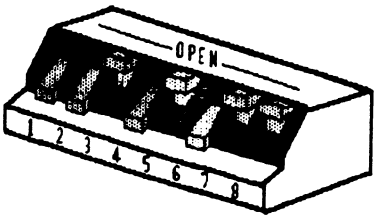


Figure 2.4 Device Code Switches



Note:

Switch Down = Binary 1
Switch Up = Binary 0
Switch 3 = Most Significant Bit
Device Code = 24 Octal is Shown
Switch 2 = EEPROM Write Disable (DOWN)

Device Code	S1 Reserved	S2 EEPROM Write Disable	S3 DS0	S4 DS1	S5 DS2	S6 DS3	S7 DS4	S8 DS5
0X			UP	UP	UP			
1X			UP	UP	DOWN			
2X			UP	DOWN	UP			
3X			UP	DOWN	DOWN			
4X			DOWN	UP	UP			
5X			DOWN	UP	DOWN			
6X			DOWN	DOWN	UP			
7X			DOWN	DOWN	DOWN			
X0						UP	UP	UP
X1						UP	UP	DOWN
X2						UP	DOWN	UP
X3						UP	DOWN	DOWN
X4						DOWN	UP	UP
X5						DOWN	UP	DOWN
X6						DOWN	DOWN	UP
X7						DOWN	DOWN	DOWN

2.5 FIXED DISK DRIVE MODULE INSTALLATION

This section details the procedure for installing a fixed drive. If your drive is removable, proceed to Section 2.6. Come back to this section if you add on a fixed drive.

There are two slide assemblies for each Disk Drive Module (See Figure 2.5). Each slide assembly consists of an OUTER SLIDE MEMBER that attaches to the vertical mounting rails in the cabinet and an INNER SLIDE MEMBER that attaches to the module itself. See Figure 2.5a. For the Disk Drive Module, each slide assembly requires one L-shaped slotted-hole bracket for attaching the OUTER SLIDE MEMBER to the rear vertical rails. Mounting hardware is included.

The Disk Drive Module is shipped from the factory with the slide assemblies attached. To complete the installation of the module into a standard 19" RETMA rack:

1. Attach the L-bracket to the rear end of each OUTER SLIDE MEMBER. On the inside of each L-bracket there is a quarter-turn fastener that mates with a receptacle in the rear of the module. Insert this fastener and turn it so that the L-bracket is locked to the module. Then attach the L-bracket to the OUTER SLIDE MEMBER using the supplied hardware. See Figure 2.5b and c. At this point, the screws should only be "finger tight."

2. Unlock the fasteners at the rear of the module and disconnect the OUTER SLIDE MEMBER from the INNER SLIDE MEMBER of each slide assembly by fully extending the slides and then pressing the release clips.

3. Mount the OUTER SLIDE MEMBERS to the vertical rails on both sides of the cabinet, sliding the L-brackets forward or backward as necessary to span the distance between the front and rear rails. Leave the screws holding the OUTER SLIDE MEMBERS to the vertical rails "finger tight," but at this time fully tighten the screws attaching the L-brackets to the OUTER SLIDE MEMBERS.

4. Extend the slides of both OUTER SLIDE MEMBERS until they have reached their maximum position. Lift the module and carefully guide the INNER SLIDE MEMBERS into the OUTER SLIDE MEMBERS, adjusting the OUTER SLIDE MEMBERS towards or away from the module as required to obtain accurate alignment.

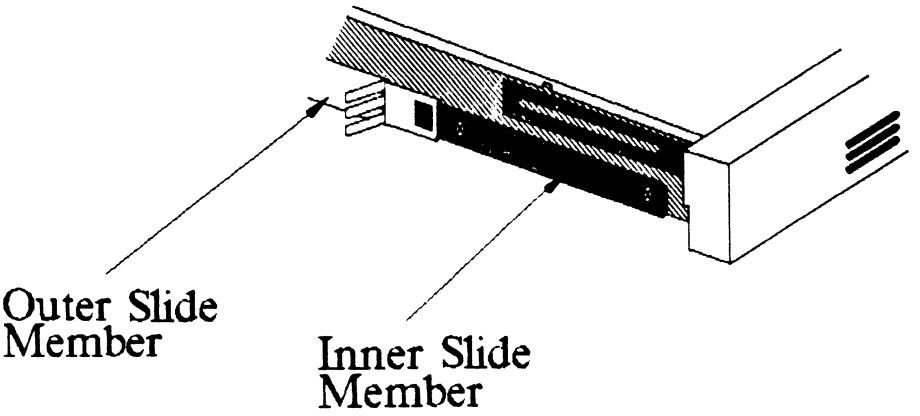
Slowly slide the module into the cabinet a few inches, taking care that the slides travel smoothly. When satisfied, and while CONTINUING TO SUPPORT MOST OF THE WEIGHT OF THE MODULE, fully tighten the OUTER SLIDE MEMBERS to the vertical rails.

5. Slide the module fully into the cabinet and again be sure it travels smoothly. Finally, extend it fully, allowing its full weight to be supported by the slides. If all motion is free and easy, slide the module back into the cabinet and turn the fasteners in the back to lock the unit in place. The installation is now complete.

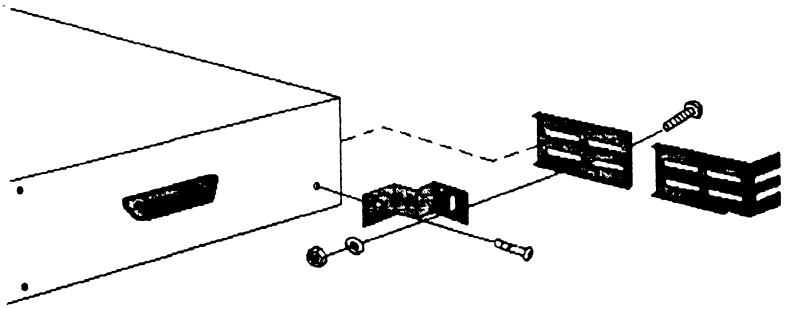
6. At this point, power-up the disk module to check for problems. If the front panel busy LED flashes or the rocker switch does not illume, go to Section 3.1.1. Otherwise, continue with Section 2.7.

Figure 2.5 Fixed Disk Drive Module Slide Assembly

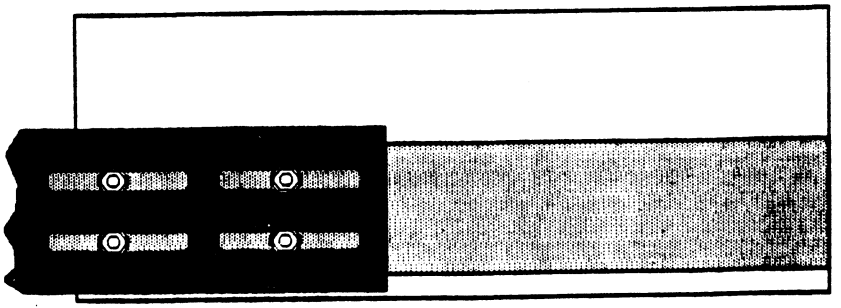
(a)



(b)



(c)



2.5.1 CONNECT THE CABLES

The inter-module cabling scheme for the SKS-HP Subsystem consists of two parts: an internal cable, and a set of external cables.

2.5.2 INTERNAL CABLING

The Internal Cable is a flat 50-conductor cable with a socket connector on one end and a "D" connector on the other. As shown in Figure 2.1, the socket connector plugs into the "A" paddleboard. The other end of this cable (the "D" connector) mounts on the computer bulkhead.

To mount the "D" connector on the bulkhead, first remove the cover from the desired mounting hole, and the hex bolts, washers, and nuts from the connector. Then, insert the connector into the hole in the bulkhead from the inside, insert the hex bolts from the outside, and secure the connector to the bulkhead.

If the computer chassis is not FCC-compliant and therefore has no bulkhead, fasten the "D" connectors of the Internal and External cables together using the non-bulkhead installation kit. Attach non-bulkhead mounting bracket to nearest vertical rail.

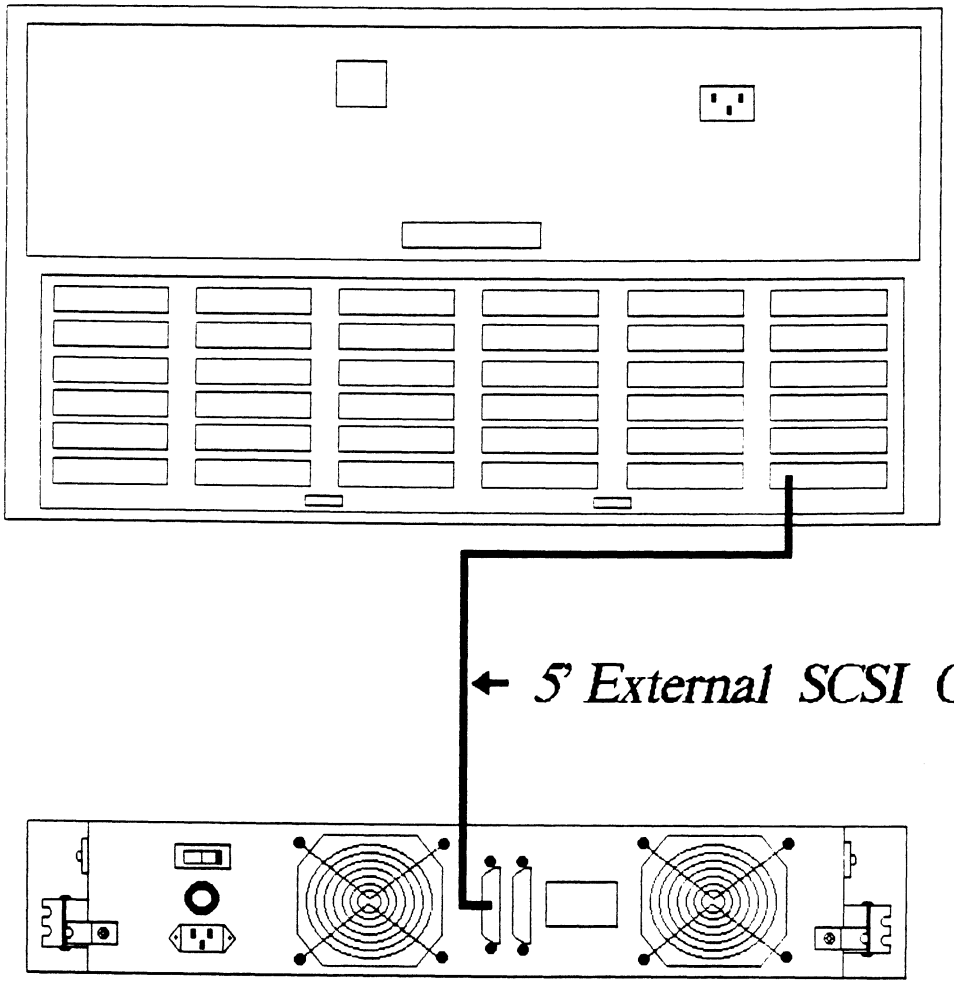
2.5.3 EXTERNAL CABLING

One external cable is required to operate the SKS-HP Subsystem in its basic configuration. The External SCSI cable for a fixed drive subsystem has, at both ends, a 50-pin "D" connector. The "D" connector ends are interchangeable. The 5' cable is connected from the computer bulkhead to the connector labeled "SCSI IN" on the rear panel of the drive module.

Figure 2.6 illustrates this connection scheme.

If you are installing multiple fixed drive modules at this time, see Section 4.0, "Usage" for the expanded cabling scheme and additional drive preparations. See Appendix C for information on cabling fixed and removable type enclosures together.

Figure 2.6 Cabling for SKS-HP Fixed Drive Subsystem (One Drive Module; Rear View)



2.6 REMOVABLE DISK DRIVE MODULE INSTALLATION

There are three parts to the removable disk subsystem: the chassis, the canister(s) and the mounting brackets. The canister(s) are shipped from the factory separate from the chassis. The chassis should be installed into the rack before the canisters are placed inside.

To install the chassis in a rack:

1. Attach both angle brackets to the rack. To do this, adjust the end pieces to fit, then bolt in place. It may be more convenient to remove the front expansion brackets and side-mount the front of the angle brackets. This is because the chassis front panel has 4 screw mounts that need to be fastened within the same area. See Figure 4.7.

2. Rest the chassis on top of the installed angle brackets and push all the way back.

3. Fasten the chassis to the rack by tightening the screws attached to the front panel.

4. At this point, install the canister(s) and power-up the drive module to check for problems. If the green LED does NOT illume, go to Section 3.1.2. Otherwise, proceed with the next section.

2.6.1 CONNECT THE CABLES

The inter-module cabling scheme for the SKS-HP Subsystem consists of two parts: an internal cable, and a set of external cables.

2.6.2 INTERNAL CABLING

The Internal Cable is a flat 50-conductor cable with a socket connector on one end and a "D" connector on the other. As shown in Figure 2.1, the socket connector plugs into the "A" paddleboard. The other end of this cable (the "D" connector) mounts on the computer bulkhead.

To mount the "D" connector on the bulkhead, first remove the cover from the desired mounting hole, and the hex bolts, washers, and nuts from the connector. Then, insert the connector into the hole in the bulkhead from the inside, insert the hex bolts from the outside, and secure the connector to the bulkhead.

If the computer chassis is not FCC-compliant and therefore has no bulkhead, fasten the "D" connectors of the Internal and External cables together using the non-bulkhead installation kit. Attach non-bulkhead mounting bracket to nearest vertical rail.

2.6.3 EXTERNAL CABLING

One external cable, going from bulkhead to the drive, is required to complete connection of the basic configuration. The external SCSI cable for a removable drive subsystem has 50-pin D-connectors at both ends; one has pins, the other is socket-type.

The pin end goes to J1 on the drive enclosure. The other end fits to the bulkhead. Figure 4.8 illustrates this connection.

For information on installing multiple removable drive modules, see Section 4.2, "Usage". See Appendix C for information on adding fixed and removable type enclosures together.

2.7 LOGICAL PREPARATION OF SUBSYSTEM

The following sections discuss use of the programs found on the software support tape to complete the subsystem installation.

2.7.1 COMPUTER POWER-UP

Once your drive module(s) have been turned on and are ready for operation, you can power-up the computer. After you press the computer's power switch, you will notice that some of the LEDs on the front edge of the controller will be active. They are indicating the status of the board's automatic Self-tests.

At the end of the sequence all LEDs should be off. This indicates that the Controller has successfully passed its Self-tests and is ready to receive commands from the system.

2.7.2 CONTROLLER SELF-TEST

To find out the basic status of the controller upon power-up, observe the LEDs at the front edge of the board. Their meanings from left to right are as follows:

RED	SCSI SLFTST - Indicates SCSI microprocessor is executing Self-test.
GREEN	SCSI BUSY - Indicates the SCSI microprocessor is busy executing a disk command.
YELLOW	SCSI BUS FAULT - Indicates a SCSI bus fault has been detected by the controller.
RED	HOST SLFTST - Indicates Host Processor is executing Self-test diagnostics.
GREEN	HOST BUSY - This LED indicates the Host is executing one of the READ/WRITE commands.
YELLOW	BMC ACTIVE - Indicates BMC activity level.

Self-test takes 15 seconds to complete. At that point all LEDs should turn OFF and remain off. If they do not, or if they blink, a Self-test has failed. See Section 3.0 for assistance.

2.7.3 USING THE SOFTWARE SUPPORT TAPE

All disk drives and the computer should be powered on and ready, with no error conditions. The next step is to use the Zetaco Software Support Tape to prepare the subsystem. At this juncture, the users of a fixed subsystem versus removable subsystem need not follow separate instructions. Logically, they are the same.

The Bootstrap Procedure for the Software Support Tape is:

1. Mount the Software Support Tape on a tape drive and put it on-line. Be sure that the BPI setting matches that specified on the tape label.

2. Execute a "Program Load." The Program Load procedure is different for different computers. Consult the Operator's Manual for your computer to determine the correct one.

3. The Software Support Tape menu will be displayed:

```
FILE #          PROGRAM
 2              SCZ3 CONFIGURATOR
 3              SCZ3 INITIALIZER
 4              SCZ3 RELIABILITY
 5              DUMP FILES FOR SCZ3

FILE NUMBER?

2
```

You should enter the number of the program you wish to execute.

2.7.4 THE SOFTWARE SUPPORT TAPE

The programs on the Software Support Tape have been written by ZETACO specifically for the SKS-HP-HP Subsystem. You will use these programs to configure the SCZ-3 Controller, format the disk, install Controller microcode onto the disk, trouble-shoot the system if necessary, and manage its resources.

NOTE: THIS TAPE CONTAINS YOUR ONLY PERMANENT COPY OF THE CURRENT REVISION OF THE SCZ-3 MICROCODE.

The Software Support Tape is structured so that the programs on Files 2 through 4 can be loaded and executed directly from the tape. Each is a stand-alone program; this means that they do not need, and cannot have, an operating system running when they are executed.

Files 0 and 1 contain the software that enables you to boot from the tape and select the particular program you want to load into the system.

At several points in the installation procedure you will find sample dialogues for the programs. In these samples, the lines that the computer prints will be shown entirely in upper case letters. The sample user responses will be on the next line below, indented. The CARRIAGE RETURN response will be designated by "<cr>". Comments and suggestions, which do not appear in an actual session and are here provided for clarification, will be preceeded and followed by the characters "***".

The recommended order in which to run the programs is as follows:

STEP 1 CONFIGURATOR - Stores subsystem information for future use by the controller.

STEP 2 RELIABILITY - This program exerts the subsystem to test for problems.

STEP 3 INITIALIZER - This step is performed at the Zetaco factory and is not required unless excessive soft errors occur in Step 2.

2.8 CONFIGURATOR PROGRAM

It is easy to use this program because it has friendly on-line HELP. The following items should be checked for accuracy:

* BMC Priority
* BMC Burst Rate and Break Count
* Physical to Logical Drive Mapping Information
* Controller SCSI ID
* Data Byte Order

The command menu looks like this:

```
                    COMMAND MENU
                    ------------

A - CHANGE ALL FACTS
B - BMC PRIORITY
D - DESCRIBE/EDIT ANY OR ALL DISK DRIVES
E - CONTROLLER SCSI ID
J - SCSI BUS RESET
F - THROTTLE BURST RATE
G - BREAK COUNT
H - HELP - OPERATIONS
W - HELP - WHAT TO DO
L - LIST ALL CONFIGURATION FACTS
N - START LOGGING TO PRINTER
O - STOP LOGGING TO PRINTER
U - UPDATE EEPROM
Q - QUIT THE PROGRAM

ENTER COMMAND (? TO SEE CHOICES):  D
```

The BMC priority, burst rate, break count and SCSI ID can all be changed by issuing separate commands from the menu. To change the drive information or byte order information, the D command must be used. The "Change All Facts" command (A) will walk through all choices.

The Configurator requires that you enter facts for each individual drive attached to the SCZ-3. If the subsystem consists of two drives, packaged together, each is treated separately even though they share a box.

For more information about logical drives vs. physical, see Section 4.3.7.

2.9 RUN RELIABILITY TO VERIFY THE INSTALLATION

At this point, run Reliability to verify that the subsystem is operational. To do so, boot the Software Support tape and load file #4.

The Reliability program consists of two basic modules.

NOTE: The controller microcode must have already been installed on the disk drive in order to run the Reliability program. This is done using the Initializer program and should already have been done at the factory.

The first is the Random RELI. In this module, the disk transfer addresses and size are selected at random. The data type will be selected by the user, but if ALL PATTERNS is selected the pattern will be selected randomly as well. In Random RELI, sixteen device control blocks will be active and distributed randomly between the devices that are currently active. In the Random mode, the program will run until stopped.

The second choice is Sequential Reliability testing. In this mode, the disk is accessed incrementally through all addresses. The program stops itself when finished.

Run the Reliability utility for thirty minutes in Random mode, running all patterns. The following section walks through the program set-up.

2.9.1 SAMPLE DIALOGUE FOR RELIABILITY PROGRAM SET-UP

```
SCZ3 RELIABILITY UTILITY

ENABLE MAPPING (YES,[NO]):
<cr>
```

```
EXECUTION MODE:
[R]ANDOM RELIABILITY      [S]EQUENTIAL RELIABILITY
ENTER YOUR CHOICE [R]:
<cr>
```

Choose Random reliability to test varietal addresses in a shorter time.

From the command menu, choose option [E]. Other options, like [M] to change the block counts to hexidecimal, might make sense to use also. See Appendix A for more detail on all the commands.

```
SCZ3 RELIABILITY UTILITY
REV. X.XX

COPYRIGHT 19XX, ZETACO, INC.

COMMAND LIST

[E]NTER A DEVICE          [D]ELETE A DEVICE
[S]TART A DEVICE          [H]ALT A DEVICE
[R]ESTART THE PROGRAM     [L]IST ERROR TOTALS
[C]OMMAND LIST            [P]RINTER CONTROL
[F]LAGS                   [M]ODE OF DISPLAY
[Q]UIT

ENTER A COMMAND SELECTION (C=CMD LIST):
E
ENTER THE DEVICE CODE [24]:
<cr>
```

24 is the primary device code. If the controller is set up for the secondary device code of 64, enter that number here.

```
START INITIALIZATION OF CONTROLLER
CONTROLLER MICROCODE REV: X.XX
END INITIALIAZATION OF CONTROLLER
```

This is telling you that the Reliability Program is loading the microcode onto the SCZ-3 from the disk. The revision number is also displayed.

```
UNIT 0. IS READY; SELECT (YES,[NO]):
<cr>
```

The Reliability Program has looked at the SCZ-3 and found that UNIT 0 is ready. It then asks you if you want to use UNIT 0. If you do then you would type "YES". If you do not, then type <cr> and the Program will go on to the next ready unit.

```
     THE DISK SIZE IS XXX. MB
     WRITE ONLY (YES,[NO]):
     <cr>
     READ ONLY (YES,[NO]):
     <cr>
     VERIFY DATA ([YES],NO):
     <cr>
     SELECT DATA TYPE:

0 - LOGICAL BLOCK ADDRESS     1 - FLOATING ZERO
2 - FLOATING ONE              3 - ALTERNATE ZEROS (52525)
4 - ALTERNATE ONES (125252)   5 - ALL ZEROS
6 - ALL ONES                  7 - RANDOM
8 - ROTATING (125252)         9 - DO ALL PATTERNS
SELECT DATA TYPE [0.]:
9
```

Choose to write, read, verify all patterns for maximum test benefit.

```
          UNIT 0. IS SELECTED
          UNIT 1. IS NOT READY
          UNIT 2. IS NOT READY
          UNIT 3. IS NOT READY

          SCZ3 RELIABILITY UTILITY
                  REV. X.XX

        COPYRIGHT 19XX, ZETACO, INC.

                  COMMAND LIST

     [E]NTER A DEVICE          [D]ELETE A DEVICE
     [S]TART A DEVICE          [H]ALT A DEVICE
     [R]ESTART THE PROGRAM     [L]IST ERROR TOTALS
     [C]OMMAND LIST            [P]RINTER CONTROL
     [F]LAGS                   [M]ODE OF DISPLAY
     [Q]UIT

     ENTER A COMMAND CHOICE (C=CMD LIST):
     S
     START ALL ENTERED DEVICES ([YES],NO):
     <cr>
```

At this point the device is entered and running. The green LEDs on the front of the controller board should now be ON (they are actually flashing very rapidly), signifying that the controller is active. You may at any time initiate another command from the list simply by typing its letter.

```
     L
```

```
RUN TIME 0. HRS. 20. MIN. 3. SECS.
DEVICE CODE 24 UNIT NUMBER 0. MAPPING NOT ENABLED
  DEVICE STATE:
MODES:  RANDOM, R/W, DATA CHECK-ADDRESS
# SECTORS WRITTEN    451.      # OF SECTORS READ      451.
TOTAL ERRORS :   0.

     ENTER A COMMAND SELECTION (C=CMD LIST):
```

**Selecting List prints out the system's activity status. In this case, there are no errors logged. If you select List again, you should see that the number of sectors written and read has increased; this confirms that the subsystem is operational. Data compare errors will require further trouble-shooting. For trouble-shooting help, see Section 3.0. We recommend that you run this for at least thirty minutes.

2.10 INITIALIZE THE DISK

The preparatory work necessary for proper subsystem functioning was performed before shipping, using the Initializer Program. This preparation includes formatting of the drive(s), error log set-up and bad sector relocating, plus microcode installation. It will be necessary to use this program again for one of the following reasons:

1. As a regular maintenance plan to perform periodic formats and/or analyze functions that assure continued subsystem integrity.

2. To map soft errors that occur during Reliability testing at initial installation.

3. As they occur, to relocate sectors flagged by the soft error logging feature and revealed through the on-line utilities, or through use of the program to check for them and relocate.

The Initializer Program (File #3) consists of five modules:

1. ANALYZE DISK
2. RELOCATE BLOCKS
3. MICROCODE INSTALL ONLY
4. FORMAT ONLY
5. ZDKINIT ONLY

The ZDKINIT ONLY module performs the Zetaco DKINIT function necessary for RDOS systems. Running it does not affect disks intended for AOS or AOS/VS systems because the process of DFMTR writes over the information installed with ZDKINIT. (Although the SKS-HP subsystems work with some versions of RDOS, it is not currently supported. Call Zetaco for more information.)

The FORMAT ONLY module allows drive formatting to occur with the choice to retain previously relocated sectors. NOTE: This module does not analyze the disk. If disk analysis is desired, run ANALYZE DISK module.

Use the MICROCODE INSTALL ONLY module to install microcode updates or put microcode on a disk that doesn't have it.

The RELOCATE BLOCKS module provides a means of saving data that is deteriorating as shown by entries into the controller soft error log and also allows any physical block address to be mapped out.

The ANALYZE DISK module provides options to 1) format a disk with or without retaining previously flagged sectors, 2) run a "read only" analyze that dynamically relocates data if possible or 3) run a "read/write" analyze that uses up to 5 data patterns. This module also installs microcode, initializes the soft error log if it doesn't exist and performs DKINIT.

The following section provides an example of the program set-up to be used to run a read/write analyze of a newly installed disk getting soft errors from the Reliability program.

2.11 SAMPLE DIALOGUE FOR INITIALIZER PROGRAM SET-UP

The main menu of this program duplicates the Reliability program main menu:

```
                SCZ3 DISK INITIALIZER
                      REV. X.XX
              COPYRIGHT 19XX, ZETACO, INC.

                    COMMAND LIST

[E]NTER A DEVICE              [D]ELETE A DEVICE
[S]TART A DEVICE              [H]ALT A DEVICE
[R]ESTART THE PROGRAM         [L]IST ERROR TOTALS
[C]OMMAND LIST                [P]RINTER CONTROL
[F]LAGS                       [M]ODE OF DISPLAY
[Q]UIT

ENTER A COMMAND SELECTION (C=CMD LIST):
```

** Type E to begin the process of selecting the device and options desired. **

```
E
ENTER THE DEVICE CODE [24]:
<cr>
```

24 is the primary device code. If the controller is set up for the secondary device code of 64, enter that number here.

```
START INITIALIZATION OF CONTROLLER
MICROCODE REV: X.XX
END INITIALIZATION OF CONTROLLER
```

** For the SCZ-3 to operate properly, it must have its microcode loaded into the onboard RAM. This program contains a copy of the microcode, which is used to initilize the controller at this point. Other programs (such as Reliability) rely on finding the microcode installed on the disk drive. The initializer program performs this installation. **

```
UNIT  0.  IS READY; SELECT (YES, [NO]):
YES
```

** The initializer program polls for units ready on the SCSI bus and then allows the user a choice of selecting each one individually. Unit 0 is the one to be worked on in this example, so YES is the proper response. Answering NO here will result in the program moving to the next ready unit (if there is one) to allow work to be done on it. Up to seven drives may be ready to be worked on in this manner. The program allows selection of any or all of them. After a ready unit is selected, the following command menu appears. **

```
COMMAND CHOICES

[A]NALYZE DISK (ANALYZE, ZDKINIT, INST UCODE, INIT
SOFT LOG)
[R]ELOCATE BLOCKS
[M]ICROCODE INSTALL ONLY
[F]ORMAT ONLY
[Z]DKINT ONLY (ZDKINIT, INSTALL MICROCODE, INIT
SOFT LOG)

ENTER YOUR SELECTION [A]:
<cr>
```

** Follow this path to analyze the disk and find additional bad blocks. **

```
FORMAT ([YES] NO):
NO
```

** It is not desirable at this point to re-format the drive since that has been newly done. The next choice for program set-up involves running analyze in a read-only or a read/write mode. (If YES is answered here, a choice is given first on whether to retain previously relocated sectors.) **

READ ONLY ANALYZE

```
WHEN THE SECTORS ARE TO BE RELOCATED THE PROGRAM
WILL PRESERVE THE DATA.  IF THE DATA CANNOT BE READ
THE SECTOR WILL NOT BE RELOCATED AND WILL BE
FLAGGED IN THE LOG WITH AN "F" FOLLOWING.
DO YOU WISH TO RUN IN READ ONLY MODE ([YES],NO):
NO
```

** Answering NO puts the program in read/write mode. This is okay because there is no significant data on the newly installed disk. (If there was data to be preserved, answering YES would instruct the program to do its best to relocate DATA that is becoming marginally readable. This process would catch sectors going bad that may not have been accessed and put in the soft error log.) When in the read/write mode the initializer program now offers the choice of up to 5 patterns to be written and read on the media. It is a good idea to run them all. **

```
THE DATA PATTERNS LISTED BELOW ARE USED IN THE
ORDER LISTED.
  AAAA   2525   5555   1F1F  FFFF
  0000   F6F6   5252   F1F1  6F6F
ENTER THE NUMBER OF PATTERNS TO RUN [5.] (DEC):
<cr>
```

** If a soft error log entry exists for UNIT 0, the program reports next that it will be relocated. When in the ANALYZE mode no choice on this is given. (NOTE: The physical block number(s) will be reported in whatever numbering system the program has been told to report them in. This can be changed back at the main menu using the [M] command. Default value is octal.) **

```
THESE SECTORS ARE IN THE SOFT ERROR LOG AND WILL BE
RELOCATED.

      BLOCK_LOG

PHYSICAL BLOCK :          504025

      END_OF_BLOCK_LOG

ENTER ANY KEY TO CONTINUE:
<cr>
```

** At this juncture the program set-up for UNIT 0 is complete and the program moves on to the next ready unit for set-up on it. In this example, two drives are attached to the controller, but only UNIT 0 is to be worked on. **

```
UNIT  0.  IS SELECTED
UNIT  1.  IS READY; SELECT (YES, [NO]):<cr>
UNIT  2.  IS NOT READY
UNIT  3.  IS NOT READY
UNIT  4.  IS NOT READY
UNIT  5.  IS NOT READY
UNIT  6.  IS NOT READY
UNIT  7.  IS NOT READY

**** NOTE **** YOU MUST ENTER [S]TART IN ORDER TO
HAVE THE SELECTED OPERATION ACTUALLY TAKE PLACE.
ENTER A COMMAND SELECTION (C=CMD LIST):
S
```

** Since the program doesn't begin its work until given the START command, all program options can be explored without harming the subsystem. After issuing the START command, it is possible to examine the subsystem activity by using the LIST command. This command is non-detrimental and can be freely used. Also, when the program has finished its tasks, it will report that it is done. **

2.12 "GEN" IN THE NEW DEVICE

Before going on-line, you must introduce the new device into your operating system configuration. To do this, start up your operating system and run the AOSGEN program (or VSGEN for AOS/VS). Specify the device name as "DPJx", where x is the number of the device. At the device code of 24 recommended in Section 2.3.2, this number can be 0 (for Unit 0 at that device code) through 3 (for Unit 3 at that device code).

If you need assistance running the GEN programs, consult your system management documentation.

2.13 RUN DFMTR ON THE SUBSYSTEM

When you run DFMTR, the program will ask you whether you want to do a Surface Analysis. You must answer NO to this question.

2.14 STORE THE SOFTWARE SUPPORT PROGRAMS ON YOUR SYSTEM DISK

The Software Support tape contains a file that, in turn, contains the Configurator, Initializer and Reliability programs in .SV file format. This is the standard system DUMP format for AOS and AOS/VS.

Once your basic system has been built, you can load this file onto your disk for quick access. To load files from File 5, use the standard CLI command for loading from tape.

```
AOS:
SUPERUSER ON
DIR :
LOAD_II/R/V @MTA0:5
REW @MTA0
SUPERUSER OFF

AOS/VS:
SUPERUSER ON
DIR :
LOAD_II/R/V @MTC0:5
REW @MTC0
SUPERUSER OFF
```

NOTE: ALTHOUGH YOU NOW HAVE YOUR UTILITY PROGRAMS SAVED ON DISK, IT IS IMPORTANT TO RETAIN THE SOFTWARE SUPPORT TAPE. THIS CONTAINS YOUR ONLY COPY OF THE CONTROLLER MICROCODE.

3.0 TROUBLE-SHOOTING

The SKS-HP Subsystem is supported by ZETACO in the following ways:

* Microprocessor-based Self-test of the Controller each time it is powered up, with an LED status report.

* Utility programs on 9-track tape for use during installation and trouble-shooting.

* Customer Support Hotline, manned from 8:00 a.m. to 5:00 p.m. (Central Time) to answer your questions.

* Quick turnaround on subsystem components returned to the factory for repair or replacement.

* Warranties on workmanship and materials

3.1 PHYSICAL POWER/SPIN-UP PROBLEMS

3.1.1 FIXED DISK DRIVE MODULE POWER-UP

When the fixed drive is powered-up:

* the on/off rocker switch LED should illume
* the fans should rotate quietly and steadily
* the front panel "Drive Busy" LED(s) should illume and then go out some time later.

If the LEDs don't illuminate and the fans don't turn:

* Check the power cord, wall receptacle and enclosure fuse. (Replacement fuse for 120VAC is ONLY 6.25 AMP Slo Blo, for 220-240VAC, ONLY 3 AMP Slo Blo.)

* If problem still exists, the unit is defective.

If the drive front panel "Busy" LED does not illume and the rocker switch does:

* Open the enclosure and check the power connections to the drive.

* Retry power-up. If no change, drive is defective.

If the front panel LED flashes continually:

* Retry power-up sequence.
* If no change, the drive is defective.

When problems are isolated to defective equipment, call the Zetaco Customer Support Hotline or your Maintenance Organization for return information.

WARNING: DO NOT OPERATE THE UNIT WITH BOTH FANS DEFECTIVE.

3.1.2 REMOVABLE DISK DRIVE MODULE POWER-UP

Before powering up the module, be sure to install the canister(s). On power-up:

* Either the green or red front panel LED for each unit should illume. Green if no drive is present; red if a drive is present and spinning up.

* Air from the internal fans should be flowing through the rear grille.

If the LEDs don't illume and the fans don't turn:

* Check the power cord, wall receptacle and enclusive fuse. (Replacement fuse for 115VAC is 5A, for 220-2.5A ONLY.)

* If problem persists, unit is defective.

If canisters are present but front panel LED remains green:

* Push button to spin up drive. The LED should go red indicating spin-up.

* Power the unit down, reseat the cannister and retry power-up.

* If no change, cannister is defective.

3.1.3 CONTROLLER SELF-TEST ON POWER-UP

Self-test is designed to check-out the most critical functions of the Controller once every time power is applied. Self-test is actually composed of 2 independent modules, each of which is associated with a group of three LEDs on the front of the board. The LEDs are grouped according to which "side" of the board they are reporting on. See Figure 2.2.

SCSI Module.....Leftside LEDs
HOST Module.....Rightside LEDs

The entire test takes approximately 15 seconds to execute. Once Self-test has passed, all LEDs will go out.

If a failure is detected in either the SCSI or HOST module, an error code pattern will flash to indicate the subtest that failed. Tables B.1 and B.2 in Appendix B identify the subtests for the SCSI and HOST modules.

IF both red LEDs remain steadily lit:

* Re-seat the controller or install into a different slot. (See Section 2.2.3 if priority needs to be rearranged.)

* Check backplane 5 volt supply. If more than 5.5V or less than 4.5V, board may not function.

* If no change, controller is defective.

IF either or both sets of LEDs flash an error code:

* Record code flashed; reinstall controller and retry power-up.

* If no change, controller is defective.

Call the Zetaco Customer Support Hotline or your Maintenance Organization for return instructions and authorization.

3.2 TROUBLE-SHOOTING THE NEW INSTALLATION

After power-up and successful completion of Self-test, problems that occur while using ZETACO programs to prepare the subsystem will fall into the following areas:

1. Controller Selection
2. Drives Not Ready
3. Errors During Program Operation

In the following sections, some causes and possible solutions are discussed. In these discussions it is assumed that backplane and BMC priorities are correct, the controller is installed in a good slot, and no problems exist with the computer or other peripherals.

3.2.1 CONTROLLER DOES NOT RESPOND TO SELECTION

If a problem selecting the controller exists, it likely will be found while using the Configurator Program; the first program that needs to be run on the Subsystem.

Possible Solutions:

* Check the device code settings and retry at correct device code.
* Load system microcode, if not already done, and retry.
* Reseat the controller into its slot and retry.
* If no change, consider the controller defective; if possible, try a different controller.

3.2.2 DRIVES APPEAR NOT READY

This problem could be seen when using the Initializer program or Reliability program. In both programs, at the [E]nter Device command, the controller goes through an initialization process that polls all drives for which it is configured.

The programs will report all drives that are ready to be selected, giving the user a YES/NO choice on whether to do it. When a drive appears not ready to the controller, either program will report it as such and not give the user a choice to select.

Possible Solutions:

* Check configuration facts, using Configuration Program, to verify that the proper data is stored in EEPROM.
* Check/replace cables to drive.
* Check/replace paddleboard.
* Check position of paddleboard in relation to controller slot.
* Check SCSI drive ID jumper settings (you must open fixed drive enclosure) or switch settings (behind the cannister on removable type modules).

* Check that drives are powered on.

* Check termination.

If the wrong device appears ready:

* Check configuration facts for accuracy.

* Check SCSI drive ID jumper (for fixed drive) or switch (for removable type) settings.

* Check termination.

* Check that all drives are powered on.

3.2.3 ERRORS DURING PROGRAM OPERATION

There are two types of commands, CB and PIO, that are issued to the SCZ-3 controller through the Argus driver protocol used with the Initializer and Reliability programs. Each command type has status returned at command completion. When either the Initializer or Reliability program receives a command completion status, CB or PIO, containing an error condition, a common format for each command type is used to report the error.

Additionally, each program has an error type to report that is unique to the function of that program: Data Compare error in Reliability and Relocation error in Initializer.

All of these error types are described in the following sections.

3.2.3.1 PIO ERROR DESCRIPTION

PIO errors look like this:

PIO status type errors...

```
Run time  0.hrs.  4.mins.  7.secs.  4.tenths.
Device Code 64    Unit number  0.    Mapping NOT enabled
     State: ***Active***
Modes :RANDOM, READ/WRITE, DATA CHECK-ADDR
                 REG A    REG B    REG C
OPERATION           0    11554       73
STATUS              0       10   144073
Device state      : Fully Initialized
CB Buffer state   : Not Full
Execution status  : Execution error
Command           : Get unit info
Unable to Get unit information.
```

It is not necessary for the user to look up the meaning of the status returned in the PIO registers because the meanings are interpreted by the program and listed as shown.

If a PIO command never completes, the controller will never issue an interrupt to report completion and the following error message will result.

Timeout type errors...

```
Run time  0.hrs.  0.mins.  44.secs.  2.tenths.
Device Code 64    Unit number  0.    Mapping NOT enabled
     State: ***Active***
Modes :RANDOM, READ/WRITE, DATA CHECK-ADDR
                 REG A    REG B    REG C
OPERATION           0    11554       73
STATUS              0        0        0
Device state      : Reset in progress
Timeout waiting for interrupt.
Unable to Get unit information.
```

Timeout errors are generally fatal and will likely cause other unrelated errors to occur. A cause of a timeout situation could be no microcode loaded by the controller.

3.2.3.2 CB ERROR DESCRIPTION

CB errors look like this when reported by ZETACO programs:

```
RUN TIME 0. HRS. 20. MINS. 3. SECS.
DEVICE CODE 24  UNIT NUMBER 0.  MAPPING NOT ENABLED
STATE: **ACTIVE**
MODES: - ANALYZE - INSTL UCODE - INSTL MAP - ZDKINIT
PHYSICAL BLOCK  124532  SECTOR COUNT  1240
MEMORY ADDRESS   64321  COMMAND       WRITE ONE/WORD
PAGE TABLE ADDRESS   0  RETURNED XFER COUNT  22
PHYSICAL BLOCK: 124554 =CYLINDER: 123 HEAD: 3 SECTOR: 34
ACTIVE DATA   AAAA
ASYNC STATUS:  3
     CB EXECUTION ERROR : HARD ERROR
CB STATUS    : 100001
     ANY CB HARD EXECUTION ERROR
     CB DONE BIT
CB ERROR     : 1
     HEADER NONCOMPARE
CB UNIT STATUS : 24000
     READY
     PORT RESERVED BIT 1
DISK ERROR   : 17000
```

The physical block shown at the top is the starting physical block and the erroring physical block is shown below with the cylinder, head, and sector. For further description of the error status, refer to Data General Programmer's Reference Series: Models 6236/6237 and 6239/6240 Disk Subsystems.

The above status is from the Initializer program and following is from Reliability. This can be determined by the "modes" portion of the status. Each program has different modes to operate in.

```
RUN TIME 0. HRS. 20. MINS. 3. SECS.
DEVICE CODE 24  UNIT NUMBER 0.  MAPPING NOT ENABLED
STATE: **ACTIVE**
MODES: - RANDOM, R/W, DATA CHECK - ADDR
LOGICAL BLOCK   124532   SECTOR COUNT  4
MEMORY ADDRESS   64321   COMMAND       WRITE
PAGE TABLE ADDRESS   0   RETURNED XFER COUNT  0
PHYSICAL BLOCK: 125452 =CYLINDER: 123 HEAD: 3 SECTOR: 34
ACTIVE DATA TYPE:  -ALLO
```

```
ASYNC STATUS  :  3
     CB EXECUTION ERROR : HARD ERRORS
CB STATUS     : 100001
     ANY CB HARD EXECUTION ERROR
     CB DONE BIT
CB ERROR      : 1
     HEADER NONCOMPARE
CB UNIT STATUS : 24000
     READY
     PORT RESERVED BIT 1
DISK ERROR    : 5000
```

3.2.3.3 DATA COMPARE ERRORS REPORTED BY RELIABILITY PROGRAM

When the verify option of the Reliability program is selected, the program writes data, reads it back and compares the data read into memory with what should have been written. If the data doesn't compare correctly, the following error is reported.

```
***** DATA COMPARE ERROR *****

DEVICE CODE 24  UNIT NUMBER 0.  MAPPING NOT ENABLED
STATE:  **ACTIVE**
MODES:  RANDOM, R/W, DATA CHECK - ADDR
LOGICAL BLOCK        :  2345  SECTOR COUNT       :    3
PAGE TABLE ADDRESS   :     0  LOGICAL XFER ADDRESS: 56271
PHYSICAL XFER ADDRESS: 56271
EXPECTED    RECEIVED    OFFSET
165346       165347         1
165346       165347         3
165346       165347         5
TOTAL ERROR COUNT:  384.
RUN TIME   0.hrs.   5.mins.   12.secs.   7.tenths.
```

Since data lines on the controller are tested during Self-test, this type of error indicates a failure with the drive or media.

Possible Solutions:

* Check cable
* Check/replace paddleboard
* Run Initializer program, if not already done
* Replace drive

3.2.3.4 RELOCATION ERRORS REPORTED BY THE INITIALIZER PROGRAM

One portion of the function of the initializer program is to analyze the disk media for bad sectors. When one is found, a relocation process ensues. When this process runs into snags, the program responds with a detailed message instructing the user response. Briefly, this involves two types of flags used to inform about whether data is recoverable in the problem sector.

3.3 SYSTEM ERRORS

If no errors have occurred while using the ZETACO off-line utilities, the integrity of the subsystem installation is almost assured.

If errors do appear while on-line, use the status notes included in the Usage section of this manual to isolate the problem. Note that the off-line utilities will not diagnose conflicting BMC priorities or help to fine tune break counts and burst rates.

3.4 TESTING A DISK WITH DATA ON IT

Occasionally you may wish to run off-line tests on your disk even though you have current data stored on it. This section briefly describes the way to do this using the Reliability program.

The whole disk may be tested, but in a READ-ONLY mode. Although it does not test write capability, it can be useful for testing the Controller's ability to seek, read data from the disk, and transfer data on the BMC.

Boot the program and respond to its questions as outlined in Section 2.9.1, with two exceptions: 1) When it asks, "READ ONLY (YES/[NO]):", answer YES. 2) When it asks, "VERIFY DATA ([YES]/NO):", answer NO. Now start the Reliability program with the "S" command.

3.5 CUSTOMER SUPPORT HOTLINE

ZETACO, Inc. provides a Customer Support Hotline to answer technical questions and to assist with installation and trouble-shooting problems. The Hotline is manned by a technical team from 8:00 a.m. to 5:00 p.m. (Central Time) Monday through Friday. Within the U.S., dial 800-537-5292. From outside the U.S., dial 612-941-5825.

3.6 WARRANTY INFORMATION

The SKS Disk Drive Modules are warranted free from manufacturing and material defects, when used in a normal and proper manner, for a period of six months from date of shipment. The SCZ-3 Controller is warranted free from manufacturing and material defects, when used in a normal and proper manner, for a period of two years from date of shipment.

EXCEPT FOR THE EXPRESS WARRANTIES STATED ABOVE, ZETACO DISCLAIMS ALL WARRANTIES INCLUDING ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS. THE STATED EXPRESS WARRANTIES ARE IN LIEU OF ALL OBLIGATIONS OF LIABILITIES ON THE PART OF ZETACO FOR DAMAGES, INCLUDING BUT NOT LIMITED TO, SPECIAL, INDIRECT OR CONSEQUENTIAL ARISING OUT OF OR IN CONNECTION WITH THE USE OR PERFORMANCE OF ZETACO'S PRODUCTS.

If a part is no longer under warranty, or if the problem is not warranted (as set forth above), then repair will be billable to the customer.

3.7 PRODUCT RETURN AUTHORIZATION

All possible effort to test a suspected malfunctioning component of the SKS-HP Subsystem should be made before returning it to ZETACO for repair. However, if controller or module malfunction has been confirmed using the tests outlined in Sections 3.1 through 3.4, you should return the part to ZETACO, Eden Prairie, MN, freight prepaid.

A Return Material Authorization (RMA) number is required before shipment and should be referenced in all future correspondence about the part in question. RMA numbers are obtained by calling the Customer Support Hotline (see Section 3.5). To ensure prompt response, the information outlined in the Material Return Information form on the following page should be gathered before calling the ZETACO Hotline for the RMA number. Please include a completed copy of the Material Return Information form with the product. Each product to be returned requires a separate RMA number and Material Return Information Form.

Upon ZETACO's verification of defect, defective parts shall be repaired or replaced, and returned surface freight prepaid to the customer. In most cases, Disk Drive Modules will be returned within thirty working days, and the Controller within two working days.

To safeguard the product during shipment, please use packaging that is adequate to protect it from damage. Mark the box "Delicate Instrument" and indicate the RMA number(s) on the shipping label. We recommend you retain the original ZETACO packaging for this purpose.

Material Return Information

The speed and accuracy of a product's repair is often dependent upon a complete understanding of the user's checkout test results, problem characteristics, and the user system configuration. Use the form below to record the results of your trouble-shooting procedures. If more space is needed, use additional paper.

TEST RESULT

Power-up Self-test _____

_____

Other tests performed (system operation, errors, etc.):

Please allow our service department to do the best job possible by answering the following questions thoroughly and returning this information with the malfunctioning board.

1. Does the problem appear to be intermittent or heat sensitive? (If yes, explain.)

2. Under which operating system are you running? (AOS, AOS/VS) Include revision number.

3. Describe the system configuration (i.e.; peripherals, controllers, model of computer, etc.)

4. Has the unit been returned before?
   Same problem?

To be filled out by CUSTOMER:

Model # :_____
Serial #:_____
RMA # :_____ (Call ZETACO to obtain RMA number.)

Returned by:

Your name:_____ Firm:_____
Address: _____
Phone: _____

4.0 USAGE GUIDELINES

Contained in the following sections is specific usage information on the fixed drive subsystem, the removable drive subsystem and the SCZ-3 controller.

4.1 THE FIXED DRIVE OPTION

4.1.1 OVERVIEW

SCSI specifications stipulate two types of interface implementation: differential or single-ended. Both are available in the fixed drive module option.

Operationally there are no differences between the two types. However, the differential interface signal drivers and receivers allow longer cable lengths than single-ended, which also causes incompatibility between the two types.

Differential and single-ended drives and drive modules must never be mixed. Signal line designations are different. Each uses a different backplane paddleboard. Interface termination methods for each type of Zetaco disk module are different.

The following sections explain for differential and single-ended modules:

* Adding additional drive module enclosures
* SCSI addressing and termination
* Preventive maintenance

4.1.2 ADDING MORE FIXED (DIFFERENTIAL OR SINGLE-ENDED) MODULES

A maximum of seven drives may be controlled by one SCZ-3 controller. This section details how to add another module to an existing subsystem. Instructions for Differential and Single-ended are different. DO NOT MIX the two types.

Removable type disk modules implement only single-ended drives. These may be added on to single-ended fixed drive modules. See Appendix C for cabling information.

SINGLE-ENDED

Step 1 Determine the order in which the modules will be daisy-chained. The new module may be installed before or after the existing one. Check the unit select jumpers on all modules to insure all SCSI ID's are different. See Figure 4.4. Physical placement has no impact on unit number.

Step 2 Check the SCSI bus termination. The single-ended drive modules are terminated via DIP socketed terminators on an internal PCB located at the rear of the module. The cover must be removed to get access. See Figure 4.2. The module that will be last in the chain must have the terminator packs installed. All others must have them removed.

Step 3 Cable the modules together. The first module should receive a cable from the HOST computer bulkhead to the SCSI IN port on the back of the box. The next module should be cabled from the SCSI OUT port of the first module to its own SCSI IN port and so on. Figure 4.1 demonstrates this.

Step 4 Add the new drive(s)to the configuration facts for the SCZ-3 controller using the Configurator program. If facts exist for additional drives already, be sure they are accurate; the SKS-HP subsystem is available with various drive capacities.

DIFFERENTIAL

Step 1 Arrange order of boxes so that the add-on module is positioned to be cabled before the original module. Differential drive modules do not use a termination PCB for SCSI bus termination. Instead, the drive on the SCSI OUT side of the standard differential module has its termination packs installed. The other drive in the module and both drives in add-on modules have their packs removed. For this reason, all add-on differential modules should be installed between the original box and the HOST computer. Doing this preserves the last drive in the chain as the terminated one without having to install or remove any termintor packs. See Figure 4.2. If order is not preserved in this way, correct termination must be achieved by moving terminators.

Step 2 Set drives to different SCSI ID unit numbers. Unit numbers need not be sequential or follow the physical drive ordering. See Figure 4.4 for information on unit selection jumpering.

Step 3 Cable the modules together. The first module should receive a cable from the HOST computer bulkhead to the SCSI IN port on the back of the box. The next module should be cabled from the SCSI OUT port of the first module to its own SCSI IN port and so on. Figure 4.1 demonstrates this.

Step 4 Add the new drive(s) to the configuration facts for the SCZ-3 controller using the Configurator program. If facts exist for additional drives already, be sure they are accurate; the SKS-HP subsystem is available with various drive capacities.

Figure 41 Multiple Drive Enclosure (Rear View)

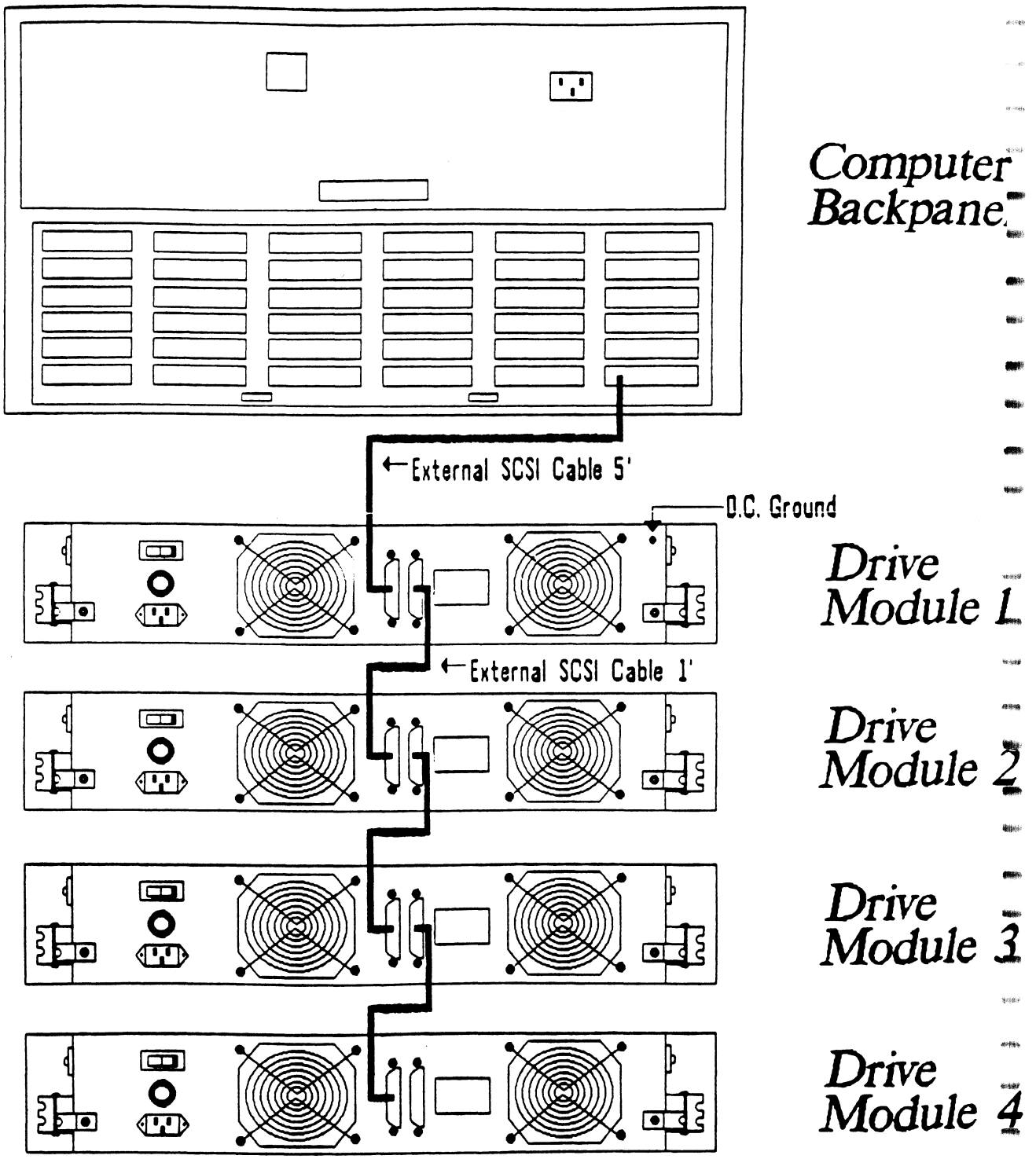
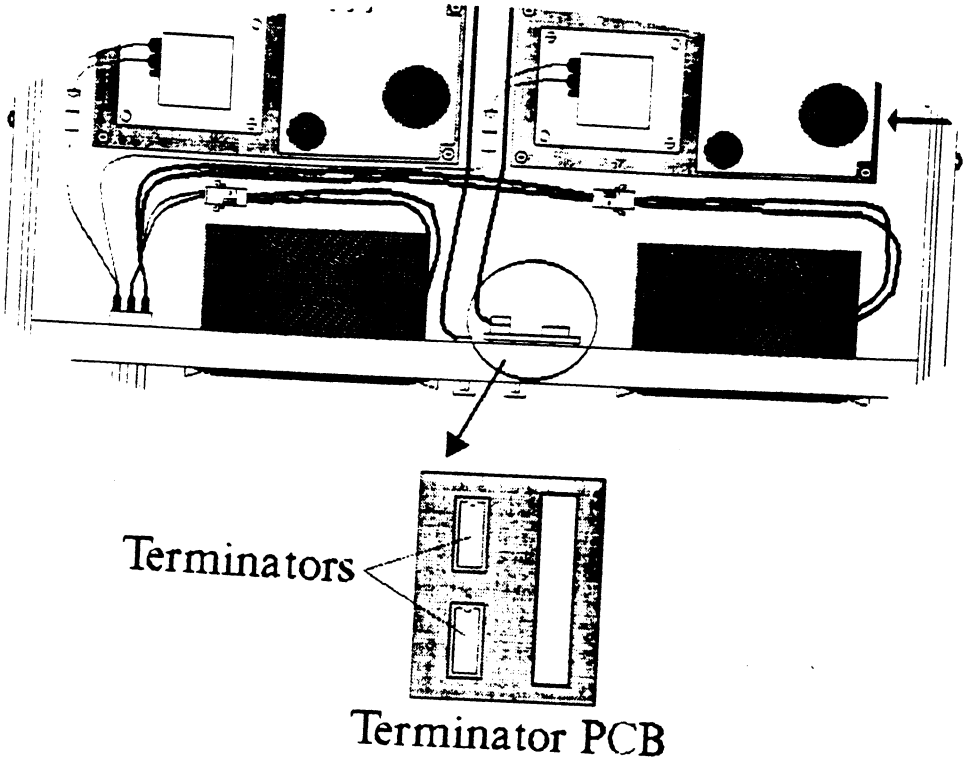


Figure 4.2 SCSI Interface Terminators

Single-Ended



Differential

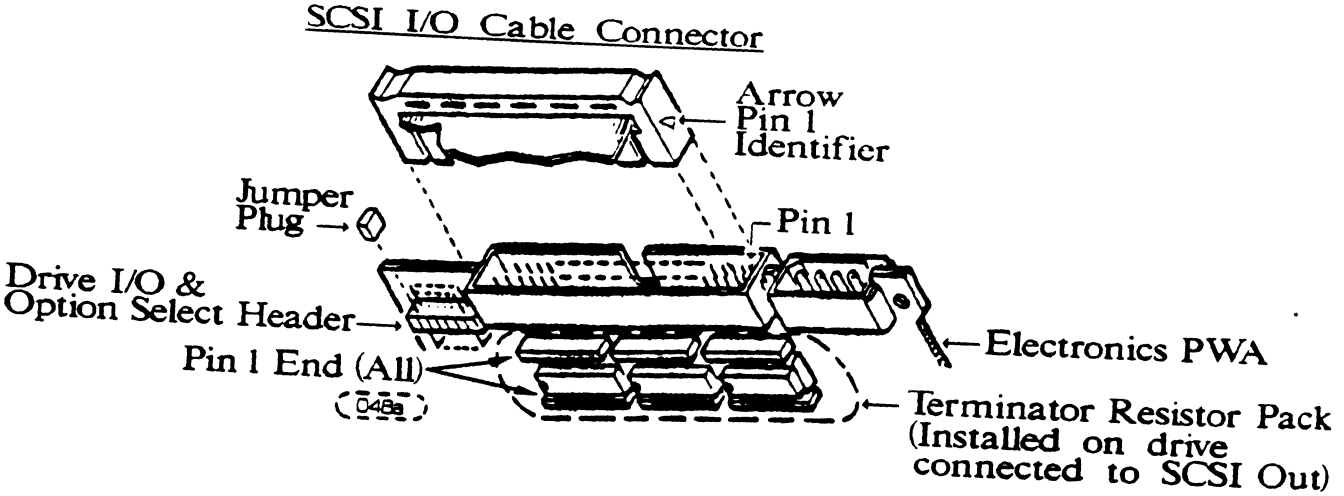
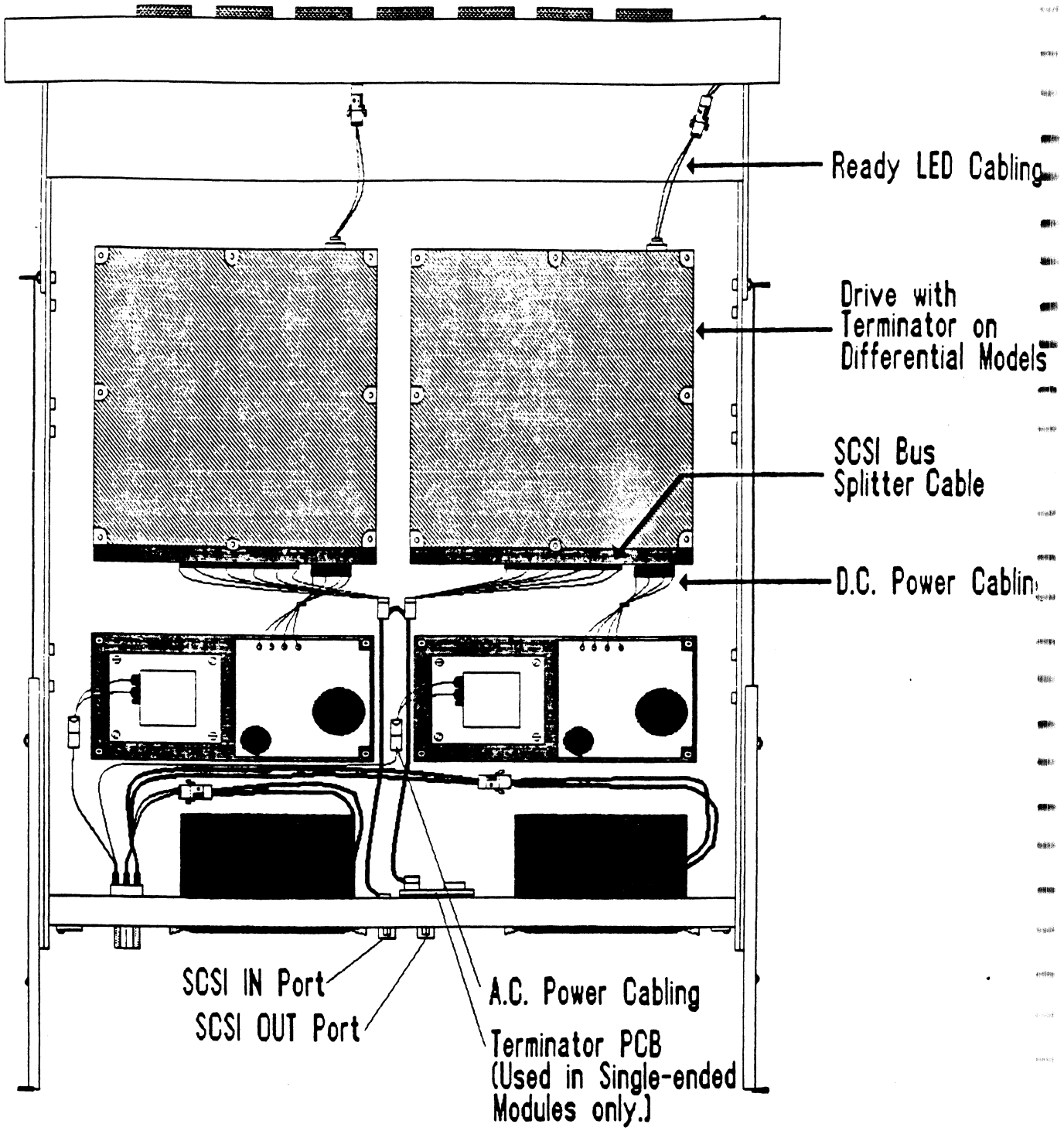


Figure 4.3 Internal View of Fixed Drive Module



4.1.3 PREVENTIVE MAINTENANCE

4.1.3.1 INSPECT THE DISK DRIVE MODULE FANS

This should be done at least every month. The fans are located in the rear panel of the unit. If the fans are not turning, are turning very slowly, or making noise, you will need to replace the bad fan module(s).

WARNING: DO NOT OPERATE THE UNIT IF THE FANS ARE NOT WORKING PROPERLY. SEVERE COMPONENT DAMAGE MAY RESULT.

4.1.4 SCSI UNIT ADDRESSING

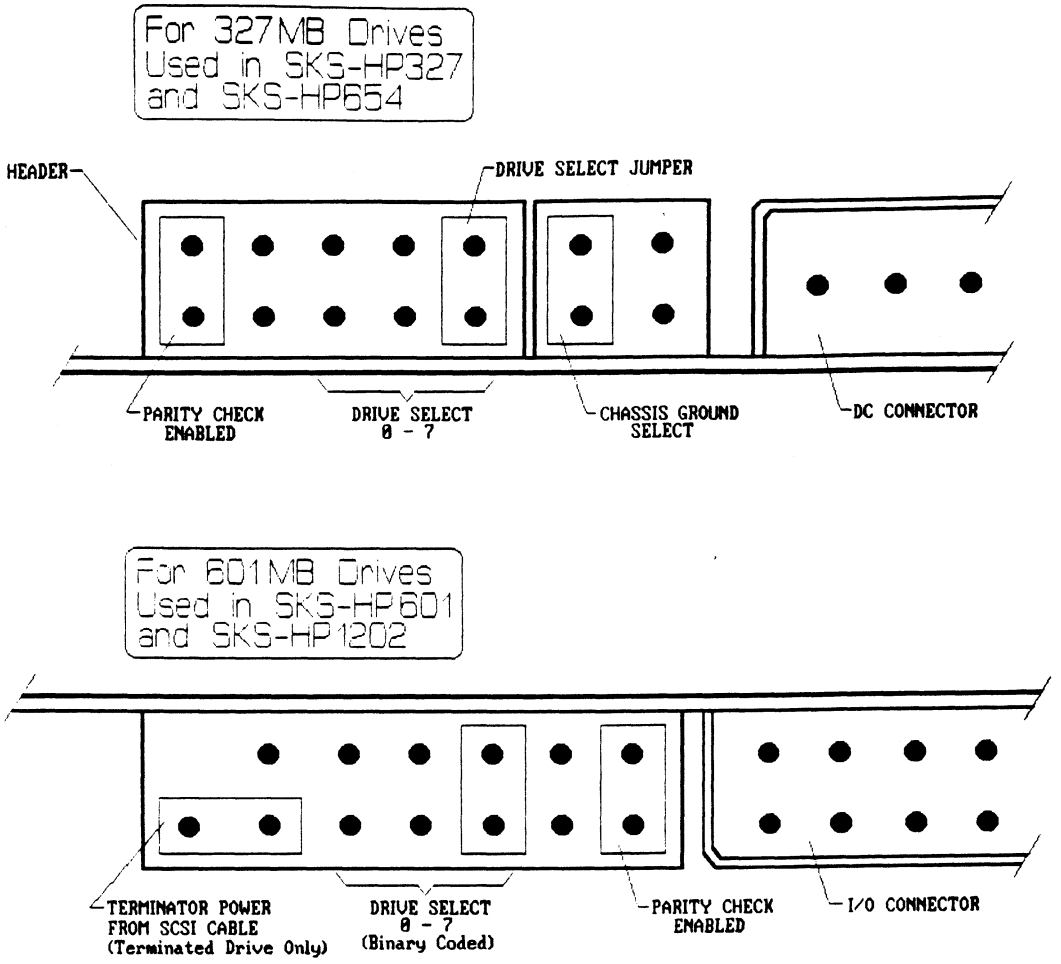
The factory default SCSI Unit Addressing has been set as follows unless otherwise specified:

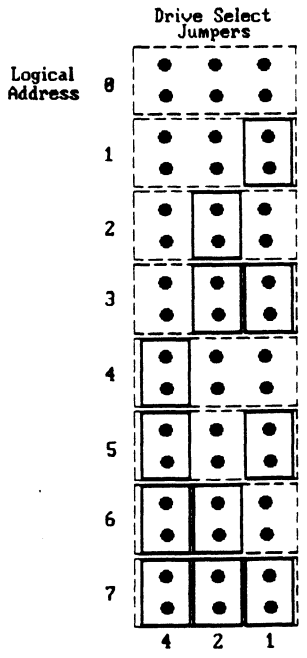
Single Drive Unit	-	SCSI Address 0
Double Drive Unit	-	SCSI Address 0,1
Add-On Drives	-	Per Order

See Figure 4.4 for information on how to physically change and/or set the Unit Address.

SCSI Unit Addressing is accomplished through the use of binary coded jumper positions (most significant bit on left), i.e., jumper in position 0 would signify drive unit address 1, no jumpers would signify address 0.

Figure 4.4 SCSI Unit Addressing





4.2 THE REMOVABLE DRIVE OPTION

4.2.1 OVERVIEW

The removable drive option is a single-ended Winchester disk subsystem that incorporates one or two disk canisters, easily removable from the rack-mountable chassis. Internal to each canister, the 5.25 inch winchester is shock-mounted to protect the drives during removal, handling and storage.

There are no cables to disconnect when removing a disk canister. Instead, low insertion force (LIF) connectors link the removable canisters to the chassis. These connectors will accomodate 25,000 insertions without loss of integrity.

Each canister has a separate power switch. This allows the user to continue to operate one disk while changing the other.

The removable drive option conveniently provides a means of information exchange between systems as well as a simple method for removing sensitive data to a secure area when necessary.

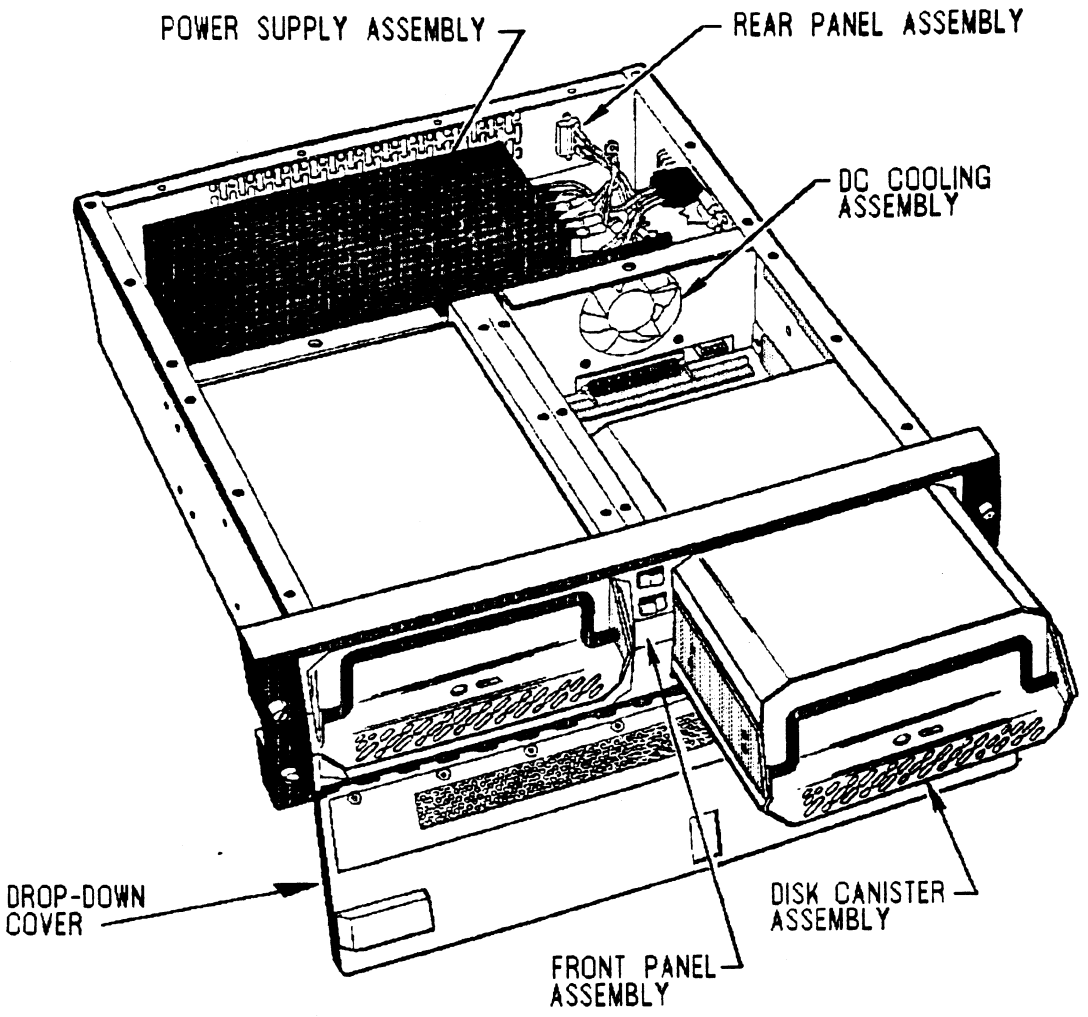
The following sections will provide detail on:

* Fitting the parts together
* Logical unit switch settings
* LEDs and indicators
* Rules for canister insertion/removal
* Usage guidelines and precautions
* Termination and daisy-chaining

4.2.2 FITTING THE PARTS TOGETHER

The subsystem is composed of five assemblies, as shown in Figure 4.5. The front panel drops down to provide access to the disk canisters inside. When pushed all the way back, the canisters automatically connect to the chassis bus board, which is cabled to the SCZ-3 Controller. The DC cooling assembly works through vents in the back of the canister. The logical address of the unit is assigned by the switches next to the LIF connector.

Figure 45 Removable Drive Option Assembly



4.2.3 LOGICAL UNIT NUMBER SWITCHES

The only switches on the subsystem that may need to be changed are the address settings that determine the logical unit number. Once these switches are set, the canister unit number is assigned BY ITS PLACEMENT IN THE CHASSIS. Any drive installed at one or the other location will become the unit number assigned to that location by the switch settings.

The switches are located near the LIF connectors that interface the canister to the chassis. The canisters must be removed to access the switches.

Figure 4.6 shows the unit select switches and their default (from the factory) settings. SW1, for the left-hand unit, is set to unit 0 and SW2 is unit 1. See Table 4.1 to determine how to change these for other unit addresses.

NOTE: Only S1, S2 and S3 of switchpacks SW1 and SW2 are used for logical unit address settings. S4, S5, S6 and S7 must remain in the position shown in Table 4.1 and Figure 4.6 for the unit to operate properly.

4.2.4 FRONT PANEL INDICATORS AND SWITCHES

The front panel contains two momentary switches with LED indicators to monitor and control the state of the disk canister DC power.

RED LED — When illuminated, indicates that a drive canister is present and powered-up in the respective drive slot and should not be removed.

GREEN LED — When illuminated, indicates that DC power is not present in the respective drive slot and that it is safe to remove or install a canister.

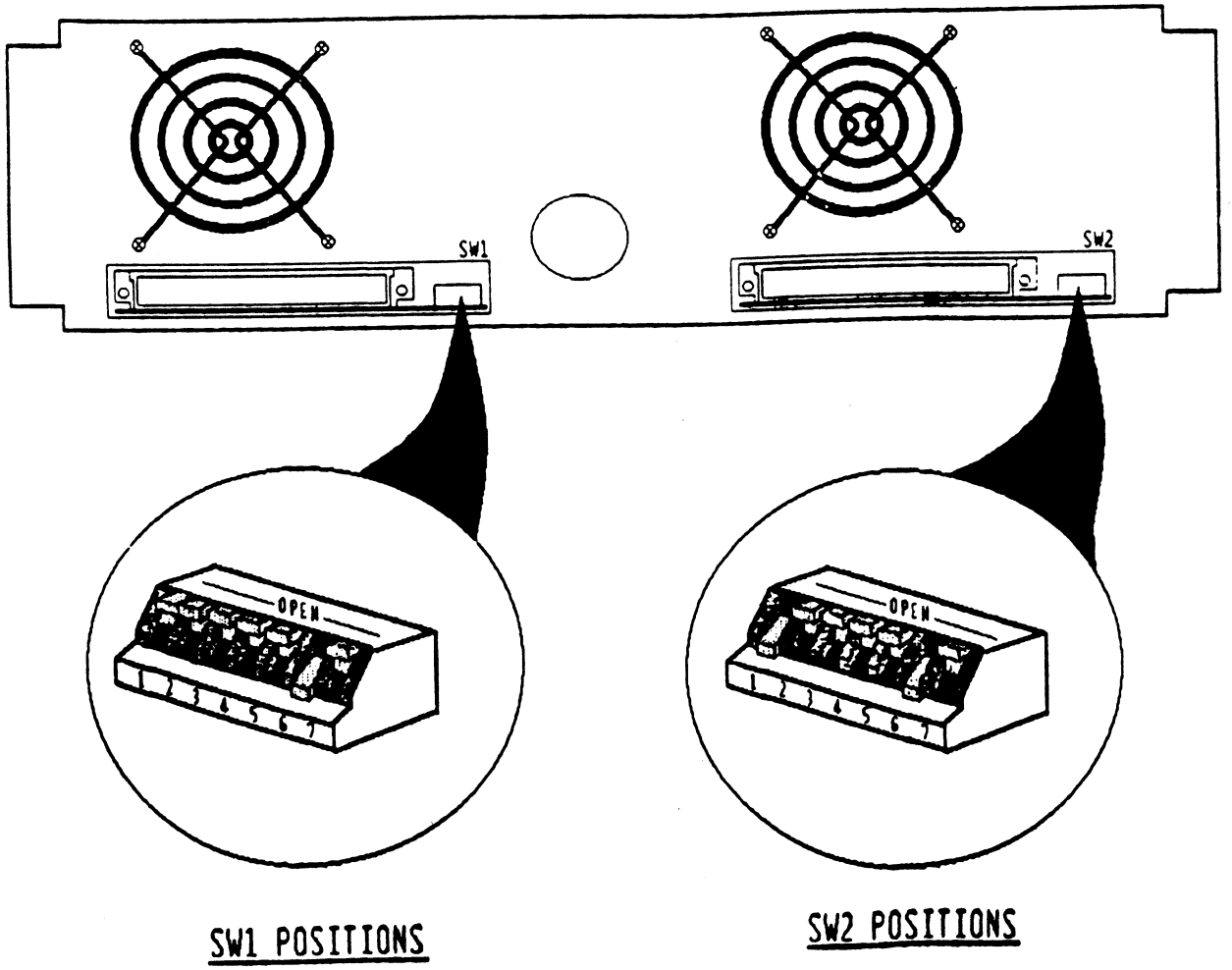
AC power is present within the chassis if any of the LED indicators (red or green) are illuminated. Figure 4.7 illustrates the front panel switches and indicators.

Depressing the top power switch will power up/down drive zero. The bottom power switch performs the same for drive one.

4.2.5 CANISTER SWITCHES AND INDICATORS

Each individual canister has a GREEN LED that indicates the drive is selected, spun-up and ready when illuminated. The switch next to the LED is not used.

Figure 4.6 Location of Logical Unit Address Switches



SW1 POSITIONS

SW2 POSITIONS

Table 41 SW1/SW2 Positions 1, 2, 3 Set-up (SCSI)

S3	S2	S1	Function
Open	Open	Open	SEL SCSI Unit 0
Open	Open	Closed	SEL SCSI Unit 1
Open	Closed	Open	SEL SCSI Unit 2
Open	Closed	Closed	SEL SCSI Unit 3
Closed	Open	Closed	SEL SCSI Unit 4
Closed	Open	Closed	SEL SCSI Unit 5
Closed	Closed	Open	SEL SCSI Unit 6
Closed	Closed	Closed	SEL SCSI Unit 7

Table 4.2 Switch 1 & Switch 2 Set-up for SCSI Drives

Switch	Position	Switch	Position
SW1 S1	*	SW2 S1	*
SW1 S2	*	SW2 S2	*
SW1 S3	*	SW2 S3	*
SW1 S4	Open	SW2 S4	Open
SW1 S5	Open	SW2 S5	Open
SW1 S6	Closed	SW2 S6	Closed
SW1 S7	Not Used	SW2 S7	Not Used

** Refer to SCSI Unit/Address Selection, Section 6.13.1.*
NOTE: The switch is UP in the OPEN position.

Figure 4.7 Front Panel Switches & Indicators

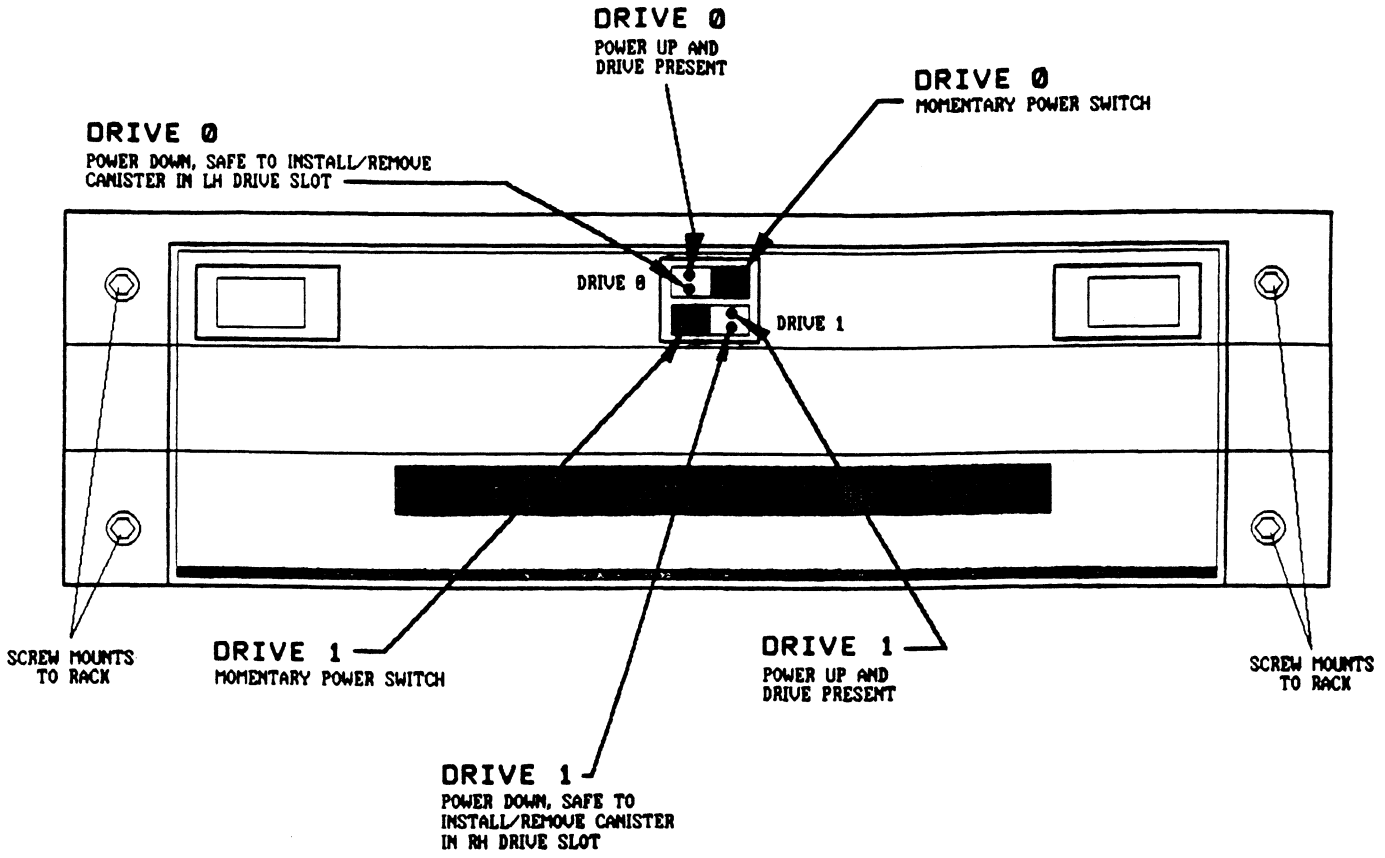
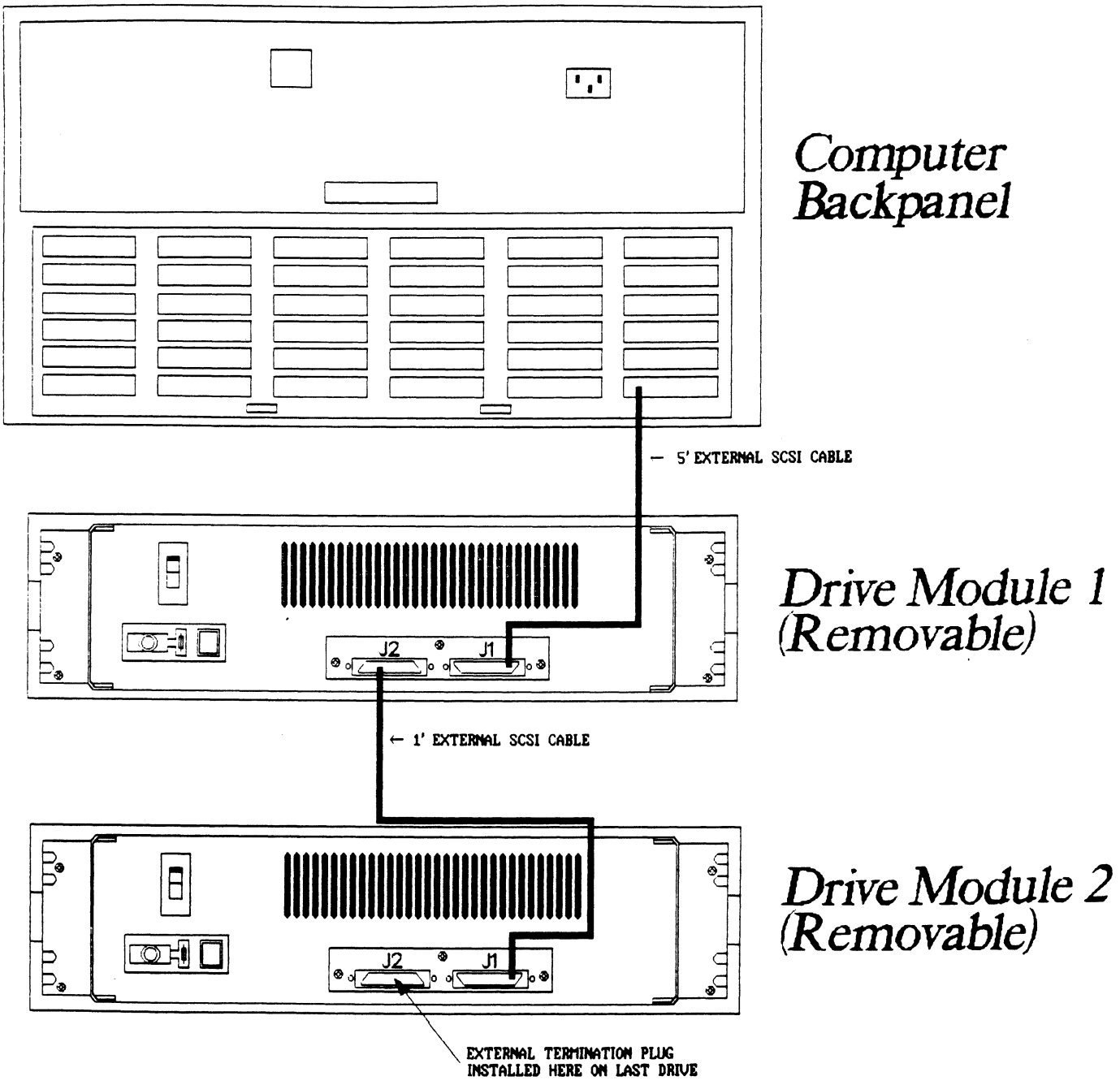


Figure 4.8 Typical SCSI Daisy-Chain Configuration



4.2.6 DISK CANISTER INSTALLATION & REMOVAL

To install or remove the disk drive canisters use the following procedures:

INSTALLATION

1. Open front access door.
2. Insert drive into left or right-hand disk drive slot.
3. Close front access door.
4. Press Drive 0 or Drive 1 power switch. Red LED should illuminate.

If the red LED does NOT illuminate after pressing the respective drive power switch, verify that the canister is installed and seated correctly.

REMOVAL

1. Press Drive 0 or Drive 1 power switch. Green LED should illuminate.
2. Open front access door.
3. Remove disk drive canister.
4. Close front access door.

4.2.7 USAGE GUIDELINES AND PRECAUTIONS

The removable disk subsystem is designed to be easy to use and provide system flexibility. However, some caution must be taken when using removable disk subsystems.

To ensure reliable operation of the subsystem, the following precautions should be taken:

* Prior to removing a disk drive, the operator should issue a RELEASE command to close off any pending operations on the unit being removed.

* After installing a new drive in the chassis, the operator must issue an INIT command to ensure that AOS/VS reads the new disk structure.

* The disk drive canister should not be set on end to avoid damage to the interface connector.

* If the MB capacity of drives installed into the chassis vary from the values stored by the SCZ-3 for each unit number, a system crash could occur. When switching between drives of different capacity, the ZETACO Configurator program must be used to update the controller-per-unit information. The best precaution against this occurrence is to only order and use canisters of the same capacity.

WARNING: DO NOT INTERCHANGE DRIVE CANISTERS OF DIFFERING MEGABYTE CAPACITY.

4.2.8 REAR PANEL ASSEMBLY

The power ON/OFF switch providing input line voltage is located on the left side of the chassis (viewed from the rear). It consists of an AC power connector with integrated fuse drawer and line voltage select switch. If the line voltage is changed, the fuse must be replaced with one rated for 2.5 Amps.

The input/output connectors for interface to the host controller module are located on the right side of the chassis (as viewed from the rear). Figure 4.9 illustrates the REAR PANEL assembly.

4.2.9 SUBSYSTEM TERMINATION AND DAISY-CHAINING

A terminator plug is used to terminate the SCSI bus on the last unit of the chain. If only one unit is used, the host cable goes to J1 and the terminator is inserted at J2.

NOTE: J1 is a 50-pin FEMALE subminiature D-connector. J2 is a 50-pin MALE D-connector.

See Figure 4.8 for an illustration of the daisy-chain configuration. Additional units may be added to the SCSI bus at any point. The following should be kept in mind, however:

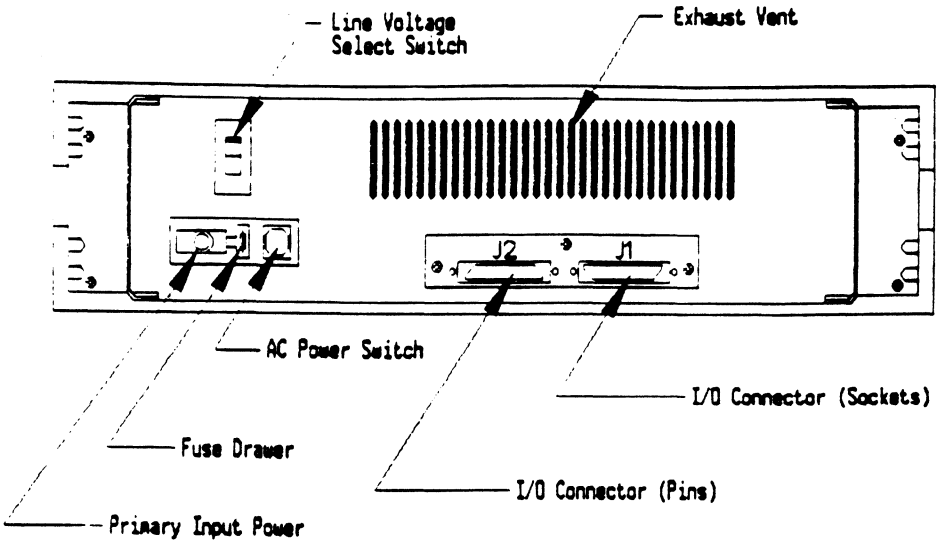
* The last drive on the SCSI bus must be terminated.

* Use correct cable for additional units. (The 1' add-on cable, must have a male D-connector on one end and a female D-connector on the other end.)

* Be sure the logical unit address switches are set to select a unit number not already used.

* The physical ordering of the drives does not relate to the logical address set with the logical unit address switches. (i.e., The first physical drive need NOT be set for logical unit 0 and the second need NOT be logical unit 1, etc.)

Figure 4.9 Rear Panel Assembly



4.3 CONTROLLER USAGE

4.3.1 ABOUT THE CONTROLLER

The SCZ-3 uses a state-of-the-art programmable gate array and several microprocessors to provide effective communication between the Data General Argus driver and the SCSI interface. This section provides detail on:

* SCSI Performance Features
* Byte Swapping Option
* Soft Error Logging/On-Line Utilities
* Configurable Reset Option
* Host Commands and Status Conformity

4.3.2 SCSI PERFORMANCE FEATURES

The SCZ-3 Controller is the brain of the SKS-HP subsystem series. It is designed to utilize SCSI interface features to enhance performance. One such feature is the synchronous data transfer mode available with SKS-HP SCSI drives. By negotiating for this mode, the controler assures data transfer bursts of 4.75 MB/sec.

Another performance advantage, achieved by using the SCSI disconnect protocol, is most noticeable in subsystems of two or more drives. To utilize the common SCSI bus to best advantage, the SCZ-3 instructs each drive receiving a command to disconnect from the bus while the drive is preparing for a data transfer. This has the effect of allowing the SCZ-3 controller to instruct several drives to prepare for their work in tandom, while the controller waits to be interrupted and service whichever drive finishes first.

4.3.3. BYTE SWAPPING

An added feature of the SKS-HP subsystems is the ability to configure the byte order of data stored to disk. This can have an impact when data on one disk may be shared between disparate systems.

The byte-order choice can be selected through the Configurator Program before storing any data.

4.3.4 AUTOMATIC SOFT ERROR LOGGING

The SCZ-3 will log certain soft errors, and can log up to 80 erroring blocks per unit.

These logged blocks can, at a convenient time for the user, be relocated on the disk drive. To do this, the user must run the SCZ-3 Initializer and choose the "R" option for Relocating Blocks. The Initializer will then READ the blocks that were logged and relocate them on the disk drive.

4.3.5 AOS, AOS/VS ON-LINE UTILITIES

After following the procedure in Section 2.13, two directories will be loaded onto your disk. These are called AOS and AOS/VS. Delete the one that does not pertain to your system. DIR into the one you have kept. Inside you will find the PR files. SCZ0RI.PR is an install program for the SCZ0R.PR Program.

This program will allow examination of the soft error log from your disks. In order to use them, you must first run the installation program. This program will create a file called SCZ0RL.TX, which will contain all of the legal disk names for use in the display program (SCZ0R.PR). Type X SCZ0RI.

Enter all the DPJ device names that are SCZ3 devices.

Enter a <cr> when you are finished. Now type X SCZ0R. Enter the DPJ name that you want to examine. The program will only allow the names that were entered in with the install program (SCZ0RI.PR).

This program can be run at any time on any SCZ-3 disk.

NOTE: IT IS IMPORTANT NOT TO ENTER ANY DG ARGUS DEVICE IN THE INSTALL PROGRAM. RUNNING THE DISPLAY PROGRAM CAN CRASH THE SYSTEM IF RUN ON AN ARGUS DEVICE.

4.3.6 CONFIGURABLE RESET OPTION

A choice is offered in the Configurator program to reset the SCSI bus whenever a system I/O reset is given to the controller or only when a hard reset occurs. The default is to match SCSI bus resets to I/O resets, but in a dual initiator environment this would cause problems. In the case of two systems accessing one drive (dual initiator) this option must be configured to pass only hard resets.

4.3.7 SCSI DEVICE SELECT PROTOCOL

Up to eight SCSI devices can be connected to the SCSI bus, including the SCZ-3. Each SCSI device has a SCSI ID assigned to it.

Communication on the SCSI bus is allowed between only two devices at a time; one acts as an initiator and the other acts as a target. The initiator (typically a controller such as the SCZ-3) originates an operation and the target performs the operation.

For the SCZ-3 controller, the Configurator program is used to select its SCSI ID. Choose option E from the main menu. The SCZ-3 can be configured for any ID number, 0 to 7. The ID numbers are weighted, with more priority going to the higher number during certain SCSI bus phases. Any number can be effectively used as the controller ID when it is the only initiator. When two different Host computers share the same disk module, the ID selection of each separate controller must be considered more carefully. SCSI ID 7 is recommended for single initiator environments. SCSI IDs 6 and 7 are best for dual initiator set-ups.

Assignment of a SCSI ID to a drive is done by connecting the proper drive unit select jumpers on a fixed type of disk module or setting the appropriate unit select switches for a removable type disk module. See sections 4.1.5 and 4.2.3, respectively, for more information on how to do this.

NOTE: Make sure that none of the devices on the interface have the same address as any other.

4.3.8 HOST COMMANDS AND STATUS

In accordance with Argus 6236/39 driver/hardware conventions, the SCZ-3 has programmable I/O registers and uses appropriate data structures for transferring commands, data and status information. Control blocks specify drive operations and data transfers.

Information blocks specify drive and controller options and, when an error occurs, status information. Use of PIO registers, flags and pulses is common to all Data General disk subsystems. Control and information blocks are concepts recently introduced to their product line. Special addressing conventions and interrupt schemes for handling the blocks were required.

Following is information about the SCZ-3 implementation of the Data General Argus protocol; commands implemented differently and the meaning of status returned. For more specific information about programming, see the Argus Programmer's Reference Guide.

4.3.8.1 COMMAND INFORMATION

Other Data General disk controllers use PIO to exchange both commands and status information. The Argus controller protocol, however, uses PIO to define and transfer Control Block and mapping information. To perform a certain controller operation, a Control Block is built and stored in host memory. The address of the CB is passed to the controller as a PIO command argument. To perform multiple operations, linked lists of CBs can be created and executed by passing subsequent addresses via a link address contained in each CB.

PIO Commands Implementation

The following list includes PIO commands implemented in a different manner from DG protocol and the result of executing the command.

PIO COMMAND	RESULT OF EXECUTION
Sysgen	NOP
Extended Status - Unit 0	Returns ZETACO microcode revision number in DIA and DIB.
Extended Status - Unit 1	NOP
Extended Status - Unit 2	NOP
Extended Status - Unit 3	NOP
Start List High Priority	Start List
Cancel List	NOP

Control Block Command Implementation

Some CB commands that are redefined by the SCZ-3 are listed below with the result of execution.

CB COMMAND	RESULT OF EXECUTION
Read/Verify	NOP
Read Raw Data	Illegal CB
Read Headers	Illegal CB
Write/Verify	Write
Write/Verify/Single Word	NOP

4.3.8.2 STATUS INFORMATION

At the conclusion of command processing, there are two types of interrupts to the host that can be generated by the SCZ-3 following Argus protocol: synchronous and asynchronous. An asynchronous interrupt occurs when the controller completes a CB or CB LIST, or when an error occurs during CB EXECUTION. A synchronous interrupt, when enabled, occurs after a PIO command executes.

Synchronous interrupts have priority over asynchronous interrupts. If a synchronous interrupt occurs, synchronous return information will replace asynchronous return information in the status registers.

The status words produced by the various reporting mechanisms are:

* Control Block - CB status, error status, unit status.
* Status Register - Command status (execution state and Start List), command completion status, and asynchronous interrupt code.
* Command Status - Begin, Get and Set, Get List Status, Program Load, Reset and Unit Status.

PIO Register Status Implementation

Asynchronous interrupt codes are written into bits 6-15 of status register C. The codes and their meaning reported by the SCZ-3 are as follows:

ASYNCHRONOUS INTERRUPTS

OCTAL CODE	INTERRUPT NAME
0	Null interrupt
1	Not used
2	CB Execution error; soft
3	CB Execution error; hard
4	CB Complete; Ibit set
5	CB Complete; no errors
6	Not used
7	Soft error; Sbit set
10	Status word not zero
11	Ilegal CB command
12	Not used
13	Illegal unit number
14	Not used
15	Illegal page address
16	Illegal memory transfer address
17	Not used
20	Unreadable CB
21	Unwritable CB
26	Soft error o mirrored pair

When a PIO command execution error occurs after issuing a Get or Set or Program Load command, status register B will contain a word with the following bit meanings from the SCZ-3.

PIO Register B Status

DIB BIT	MEANING
0 - 6	Not used
7	Ending memory address error
8 - 11	Not used
12	BMC error
13 - 15	Not used

CB Status Implementation

There are two parts to a control block: Host-supplied (command) information and Return/error information. There are three words in the controller Return/error section of a CB returned by the SCZ-3. They are: CB status in word 11, Error status in word 14, and Unit status in word 15.

The CB status word provides an overall view of operation. Its bit meanings can be interpreted as:

CB STATUS WORD BIT	MEANING
0	CB hard execution error
1	CB interpretation error
2	Soft error while executing CB
3	Not used
4	ECC correction used to recover
5	ECC correction tried but failed
6	Sector relocated
7-14	Not used
15	CB done

The CB error word describes the condition of the controller and drive interface. Its bit meanings are:

CB ERROR WORD BIT	MEANING
0	Not used
1	Drive interface fault *
2,3,4	Not used
5	Drive error **
6	BMC Timeout error
7	Ending memory address error
8,9,10	Not used
11	Verify error
12	BMC error
13	Not used
14	ECC detected
15	Header error

* This error can be caused by:

BMC error during sector transfer
Illegal unit
Illegal logical block
Bad sector log not terminated by -1
Any hard error on relocation log read
Any hard error on read/write of a relocated sector

** This error can be caused by:

No unit response
Seek error
Cylinder address error
No headers found
Unit faulted
Clock error (servo or read)

The Unit status word is used to report the condition of the drive. The bit meanings are:

UNIT STATUS WORD BITS	MEANING
0,1	Not used
2	Drive Ready
3,4,5	Not used
6,7	Unit number
8-15	Not used

APPENDIX A

A.0 UTILITY PROGRAMS

A.1 THE CONFIGURATOR

A.1.1 RUNNING THE PROGRAM

In Section 2.14 you loaded SCZ-3 software onto your system disk. Therefore, you will probably want to load the program from your system disk, rather than from the Software Support Tape. To do so, you must first shut down the operating system according to standard AOS or AOS/VS practice.

Once this has been accomplished, do a "Program Load" to your system disk. This procedure differs for the various Data General computers; if you are unsure of the procedure for your system, consult your Data General system documentation. When the system finally prompts for a filename, enter "CFSCZ3.SV".

If you do wish to load from tape, mount the Software Support Tape on your magnetic tape drive and do your "Program Load" to that device instead of the system disk. When the Software Support Tape menu appears on your screen, enter the number of the CFSCZ3S program.

A.1.2 THE PROGRAM OPTIONS

The following is a complete list of available program options, with comments where they are pertinent.

1. CHANGE ALL FACTS

   This option automatically presents all of the configurable features available in the main menu for modification. These are the BMC Priority (#2), Throttle Burst Rate (#3) and Break Count (#4). After all values have been entered, a List (#7) is run so that you can verify the configuration.

2. BMC PRIORITY

This value determines the level of BMC bus priority given to this Controller for data transfer. Each controller in the system MUST have a different priority. The controller in the system with the highest priority will be serviced first; the one with the lowest will be serviced last. Usually, the controller communicating with the system disk is assigned the highest priority.

3. THROTTLE BURST RATE

This term describes the number of words transferred to/from system memory to the Controller on each bus access. If the value is set too low, subsystem performance may be slow. If it is set too high, you may see "data late" errors reported from other peripherals on the system. The recommended value is 16.

4. BREAK COUNT

The Break Count interval is defined as the period of time that the Controller is off the BMC bus. This period is a multiple of the BMC Sync Clock period, which in turn varies from computer to computer. A Break Count interval setting of 0 is equal to one Sync Clock period.. The maximum setting is 256. A setting of 4 is recommended.

If there are other BMC devices present, it may be desirable to increase this count to allow more time for the other devices to access the bus. If the Break Count is set too large, slow disk performance may result. A larger Break Count also allows the CPU more memory time.

5. CONTROLLER SCSI ID 0-7

The SCSI bus supports up to 8 devices (targets or initiators) and each must have a unique SCSI ID code. The possible values are 0-7, with device 0 having the lowest priority and device 7 the highest. If 2 controllers are to be on the same bus, make sure they are configured for different ID codes.

6. HELP - OPERATIONS

This option provides on-screen help with operational details of the program such as default entries, exiting from a question, how to get help with a specific question, and how the EEPROM (Electrically Erasable Programmable Read-Only Memory) works.

7. HELP - WHAT TO DO

This option briefly illustrates a sample session with the Configurator program.

8. LIST ALL CONFIGURATION FACTS

This selection presents on-screen information about the drives in the system, and shows the configured values of the BMC Priority, Throttle Burst Rate, and the Break Count. Once you are satisfied with your configuration, print a hard copy (see below) and retain it for future reference.

9. START LOGGING TO PRINTER

This option sends information on the screen to the system printer. The printer must be on-line and ready to receive data.

10. STOP LOGGING TO PRINTER

This option stops sending information to the printer.

11. UPDATE EEPROM

This command stores the configuration information in the EEPROM on the Controller. You must execute it before you exit from the program in order to preserve your configured values.

12. QUIT THE PROGRAM

This option provides for an orderly termination of the program. If you have changed the configuration but forgotten to update the EEPROM, you will be reminded to do so at this point. You will also be reminded that you must press the RESET switch on the computer Operator Panel in order to actually re-initialize the Controller with the new configuration.

A.2 THE RELIABILITY UTILITY

This program is useful as a subsystem excerciser. In Section 2.11 it was used to verify that the installation was successful. This section will discuss the program operation in more detail, some ways to use its various options, and the ways it reports errors.

In order to run the program, the magnetic disk drive must have been previously formatted, and the controller microcode mst have been loaded onto the disk.

The Reliability Utility is a stand-alone program, which means that it does not need, and cannot have, an operating system running when it is executed. It has been written by ZETACO specifically for the SKS-HP Subsystems. DATA GENERAL RELIABILITY, DIAGNOSTIC, AND MVSYSTEMX PROGRAMS WILL NOT WORK ON THIS SUBSYSTEM. All of ZETACO's software has been designed to be as "user-friendly" as possible. Messages about many of the options and program features are displayed on-line, expected or possible responses are suggested, commands are shortened for quick entry. The discussion of the Reliability program that follows is intended as a companion to your on-screen display.

A.2.1 GLOBAL PARAMETERS

These are the over-all operating conditions of the program under which the specific tests for each device must run. Choices are for: mapping enable and program execution mode. These choices are made only once, after the program is loaded and before the main menu comes up.

1. The MAPPING features are defined in the DATA GENERAL Programmer's Reference Series: Models 6236/6237 and 6239/6240 Disk Subsystems. Enabling this feature allows the Reliability program to test some of the mapping functions the SCZ-3 is responsible for.

NOTE: Due to CPU differences, DO NOT enable this mode if running in an MV/7800 or MV/4000 system.

---

2. The two PROGRAM EXECUTION MODES are Random and Sequential. In Random Mode, the program issues random disk addresses for reading and writing data, while in Sequential Mode, the addresses increment serially. Note that you cannot run random data patterns in your tests if you choose Sequential Mode.

Random Mode is primarily intended for exercising the subsystem. It is difficult to use for trouble-shooting because it involves many variables. For example, CB commands are stacked and continue to execute even after the program halts to report an error. Therefore, if you were to enter the Debugger and examine the register contents, the reported values might not reflect the current state of the controller.

Sequential Mode, on the other hand, offers a more tightly controlled environment.

A.2.2 THE COMMAND LIST

Basically, when you run the program, you:

1. Select some global program parameters.
2. Enter the devices you want to test and the test specifics for each of them.
3. Run the tests.
4. Examine the status of each drive.

The following is a complete list of available program commands, with comments where they are pertinent.

1. ENTER A DEVICE

This command does several things:

A. Initializes the Controller - Prior to running this program, the microcode for the controller must have been installed on the disk drive. At this time, the program instructs the controller to load the microcode into its memory. Messages are printed on the screen by the program indicating that initialization is occuring and when it is finished.

B. Looks for Ready Units - The program will allow the user to operate on any drive ready to the system. It reports, starting with unit 0, that a drive is ready and allows a YES/NO choice for selection.

C. Sets Test Parameters - For each ready unit, (after answering YES to selection) the program accepts YES/NO choices for Write Only, Read Only and Verify Data; additionally, it allows choice of nine different data types.

After each ready unit has its test parameters defined, the program returns to the command prompt.

NOTE: To actually begin testing, the [S]tart command must be issued.

2. START A DEVICE

This command gives you the option of starting the test on all entered devices, or on any combination of them. The program does not verify that the tests are running, but simply returns to the command list. You can verify that they are running by 1) monitoring the drives and the GREEN LEDs on the controller, and 2) doing a LIST command. This command will return a status report for each entered device (see below).

3. LIST ERROR TOTALS

The resulting display actually gives status information on the device as well as error totals. You can list a device at any time, whether it is running or not. This is useful if you want to be sure you've entered only what you want entered. However, if you list a newly entered device before it has been run, the mode information displayed will be valid, but the runtime, blocks written and read, and number of errors will not.

4. COMMAND LIST

This command allows you to display the program's menu of commands.

5. HALT A DEVICE

You can halt any device or combination of devices without affecting testing on the other ones.

6. DELETE A DEVICE

Once a device is halted, you can delete it, even while other devices are running. Deleting one device does not affect testing on the other entered devices.

7. PRINTER CONTROL

This command allows you to enable or disable your printer during program operation. For example, if you are going to let the program run unattended, you may want to enable the printer to record error messages.

You can use the command at any time without affecting tests in progress. However, note that the Restart command (see below) will override this command and automatically disable the printer.

8. RESTART THE PROGRAM

The important point to note about this command is that it completely re-initializes the program. You will have to select your operating mode, enter devices, and if you want a printout, re-enable your printer.

9. FLAGS

Flags are, in effect, "switches" that allow you to alter the flow of the program depending on specific conditions encountered during execution.

The flag available in the Reliability program gives you the choice of whether to halt the program when an error is encountered, or simply log the error and continue with the test. If you choose the default response you will have chosen to log the error and continue. If you choose to halt, the program will do so, log the error, and jump to the Debugger. To leave the Debugger and restart the program, type "RT".

The flag can be changed while the program is running.

10. QUIT

This command allows you to leave the Reliability program.

11. MODIFY DISPLAY MODE

This allows choice of which numerical system (i.e., octal, hex, decimal) should be used for program input and display.

APPENDIX B

B.0 LED ERROR CODES

There are two sets of LEDs that reflect the status of the two parts of the board. The rightmost LEDs status the HOST (DG Argus driver responsive) logic and the leftmost correlate to the logic controlling the SCSI disk drives. Each reports the Self-test and operational errors differently, as described in the following sections.

B.1 HOST SIDE ERROR DECODING

When the Hostside logic errors during Self-test the red LED on the leftside flashes. The number of times it flashes between pauses corresponds to the number of the error. Table B.1 gives the meaning of the error code being flashed.

Table B.1 Host Module Error Codes

CODE	TEST
9	EEPROM CHECKSUM
10	DUAL PORT RAM
11 - 20	FLASHING IN DECIMAL THE SCSI SIDE ERROR CODES

B.2 SCSI SIDE ERROR CODES

The error codes for SCSI side Self-test are two digit octal values that are indicated via the 3 leftmost LEDs on the front of the controller. To decode the value follow these steps:

1. Watch for all three LEDs to illume in sequence right to left. This indicates that the next LED to illume is the Most Significant (leftmost) digit of the octal error code.

2. Observe which LED illumes next, to determine the Most Significant octal digit. (Since the error codes only go to 24 octal, this will only ever be the green or red LED.)

3. After a pause, the next LEDs to illume will indicate the octal value of the Least Significant (rightmost) octal digit. (If none illume, this indicates a zero value, if all illume, its a seven.)

4. After a pause, the three LEDs illume in sequence again, right to left to indicate a repeat of the code.

Use the chart in Section B.3 to help decode the LED values obtained by this process or go straight to the error code messages in Table E.2 to find the meaning of the code.

B.3 DECODING THE SCSI SIDE LEDS

If the 1st LED to illume is:	and if the 2nd group of LEDs to illume are:		then the error code is:
RED	GREEN, RED	(3)	13
	YELLOW ONLY	(4)	14
the Most Significant octal digit is a -1	YELLOW, RED	(5)	15
	YELLOW, GREEN	(6)	16
	YELLOW, GREEN, RED	(7)	17
GREEN	NONE ILLUME	(0)	20
	RED ONLY	(1)	21
the Most Significant octal digit is a -2	GREEN ONLY	(2)	22
	GREEN, RED	(3)	23
	YELLOW ONLY	(4)	24

Table B.2 SCSI Side Error Code Meanings

13 Error programming the programmable gate array.

14 Error reading back/verifying the programmable gate array.

15 Static RAM test failed.

16 BMC buffer test failed.

17 BMC buffer parity error.

20 Test of DMA transfer counter failed.

21 Test of DMA address counter failed.

22 Test of 80186 timer failed.

23 Test of SCSI control chip registers failed.

24 SCSI hang timer test failed.

B.4 SCSI SIDE OPERATIONAL ERROR CODES

In addition to errors that occur during Self-test, there are a few errors that can occur during system operation that are reported via the same means. Use the procedure in Section B.3 to decipher the meanings. The only difference is that the Most Significant digit of the octal value will always be seven.

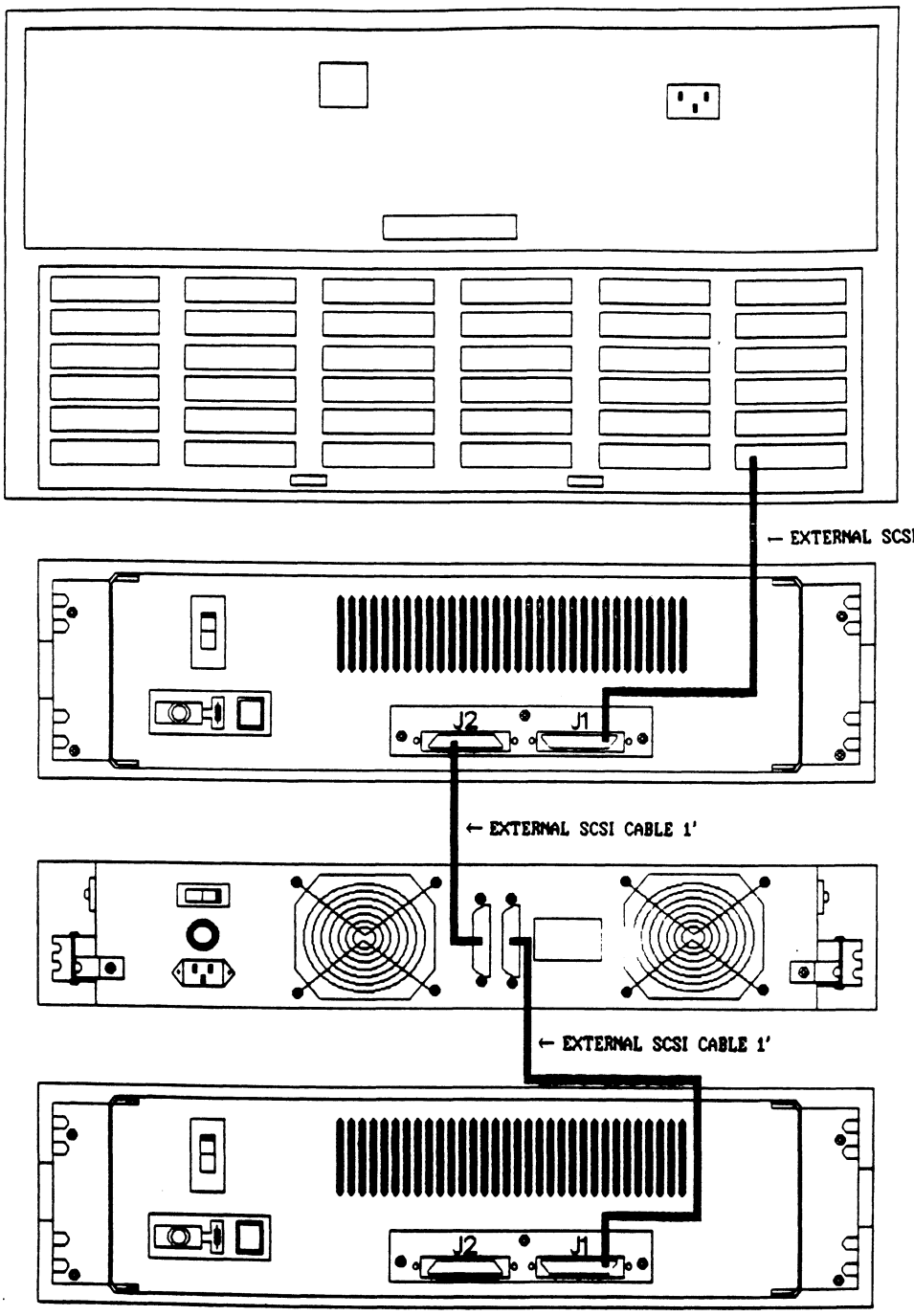
If 1st all SCSI-side LEDs illume:	and the next LED(s) to illume are:		then the error code is:
the code is an operational error.	YELLOW, GREEN	(6)	76
	YELLOW, GREEN, RED	(7)	77

Table B.3 SCSI Side Operational Error Codes

OCTAL VALUE	MEANING
76	ILLEGAL 80186 INTERRUPT
77	SCSI SIDE MEMORY FAULT
Also, if the YELLOW LED alone remains steadily lit, the error indicated is:	DRIVE INTERFACE FAULT

Appendix C

Cabling Fixed & Removable Enclosures Together



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