

# **Model SKZ**

SCSI Disk Controller

## **Technical Manual**

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## PREFACE

This manual contains information regarding installation, testing, and operation of the ZETACO SKZ 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:

- CHAPTER 1**      **PRODUCT OVERVIEW** - Describes the SKZ Subsystem features, capabilities, specifications, power, and interface requirements.
- CHAPTER 2**      **INSTALLATION PROCEDURES** - Describes and illustrates the procedures required to install an SKZ Subsystem.
- CHAPTER 3**      **TROUBLE-SHOOTING** - Contains information useful in analyzing subsystem problems, and how to get help.

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## PRODUCT OVERVIEW

### 1.0 INTRODUCTION

The SKZ Series Subsystems are high capacity, digital data storage and retrieval systems, designed for interface with Data General minicomputers.

The Subsystem is composed of ZETACO's DG-emulating disk controller (Model SCZ-2), magnetic disk drive(s) with Small Computer Systems Interface (SCSI), and an enclosure for the drives and their power supplies. All components are connected by a shielded daisy-chain cabling system that is compatible with DG's shielding requirements, or its non-FCC compliant chassis.

The Controller pairs ZETACO's emulation of the DG Zebra Disk Subsystem with the SCSI peripheral interface on a single 15" x 15", 10-layer printed circuit board. Data transfers take place over the data channel (DCH) on DG's Nova and 16-bit Eclipse Series computers.

Note that your SKZ Subsystem has been integrated at the factory as a complete unit. Its 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.

### 1.1 FEATURES

- The Subsystem interfaces to DG's data channel bus on 16-bit Eclipse and Nova Series processors running RDOS or ERDOS. Refer to SKZ Integration Guide for tested CPUs.
- The Controller supports simultaneous control of up to 4 SCSI Disk Drives.
- The Controller device code and configuration facts are easily selected, even after installation, via switches accessible at the board edge.



## 1.2 SPECIFICATIONS

### SCZ-2 CONTROLLER

#### GENERAL

Drives per Controller: Up to 4 SCSI drives

Transfer Rate: Maximum SCSI burst rate of 1.5 MB/second

Indicator Lights:       Red:        Self-Test  
                              Green:     Host Busy  
                              Yellow:    SCSI Busy

Device Code Selection: Switch-selectable

#### COMPUTER INTERFACE

DG Emulation:            Zebra Disk Subsystem

Bus Load:                1 unit load (any I/O slot)

Data Channel Interface: Selectable throttle rate of 1 to 128 16-bit words/access.

#### DRIVE INTERFACE

Small Computer Systems Interface (SCSI):

- supports parity generation and checking
- complies with "Common Command Set"
- Byte-wide parallel data bus

#### MECHANICAL

Controller Dimensions:

Width:	15 inches (38.1 cm)
Length:	15 inches (38.1 cm)
Height:	0.5 inches (1.3 cm)

Controller Shipping Weight: 10 pounds (4.5 kg) - includes controller, paddleboard, cables, Software Support Tape, and documentation

### POWER REQUIREMENTS

+5 (+/- 5%) Volts DC @ 3.5 Amps typical

### ENVIRONMENTAL

#### OPERATING ENVIRONMENT:

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

#### NON-OPERATING ENVIRONMENT:

Temperature: -45 to +115 degrees C  
Relative Humidity +10% to +90% (non-condensing)

Exceeds all Eclipse and Nova temperature and humidity specifications.

### STANDARD SKZ DISK DRIVE MODULE

#### 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)

### 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	3 Amp	3 Amp
	Slo-Blo	Slo-Blo	Slo-Blo

## 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:	-34 to +60 degrees C
Relative Humidity:	5% to +95% (non-condensing)
Altitude:	-1000 to +40000 feet

## SKZ-600 DRIVE MODULE

Refer to the Sony MO Manual page 15 for all specifications.

### 1.3 CABLING

#### INTERNAL

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

#### EXTERNAL

Cables:	- Nine-foot, 50-conductor shielded round cable connecting backpanel to Drive Enclosure
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- 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.



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## INSTALLATION

### 2.0 BEFORE YOU BEGIN

This section contains the procedures necessary for proper installation of the SKZ Subsystem. We recommend that you read through it once in its entirety before you begin.

Note that each SKZ Subsystem, except for the SKZ-600, uses the same model "drive module" to hold its disk drives. The SKZ-600 however, consists of one or more Sony MO optical drives, each in its own enclosure. These enclosures are individual "table top" units. For this reason some information pertaining to rack mounting and cabling may not apply to the SKZ-600. If your subsystem is a SKZ-600 you will have been sent another manual entitled "Magneto Optical Disk Drive Subsystem" and will be asked to refer to this manual at times. We term this manual the "Sony MO Manual" for the sake of brevity. Also note that you may only use the 512 bytes/sector size disks for the SKZ-600.

The following sections, beginning with 2.2, are in order of execution. In Sections 2.2 through 2.5 you will select a slot and device code for the Controller, establish slot priority, and install the controller and paddleboard. Sections 2.6 and 2.7 cover rack-mounting of the enclosure and cable connections. Section 2.8 details the power-up sequence.

In Sections 2.9 through 2.12 you will use programs on the Software Support Tape (the 1/2" magnetic tape reel shipped with the SKZ Subsystem) to complete the installation. Finally, you will run ZSDKINIT on the subsystem and bring it into full system operation.

You will need the following tools to install the SKZ 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 UNPACKING AND INSPECTION

The SKZ Subsystem consists of the following parts:

QTY	DESCRIPTION
1	SCZ-2 Disk Controller
1	Disk Drive Module or Sony MO (magneto optical) drive
1	MO disk cartridge (optional)
1	'A' Paddleboard
1	Internal Cable
1	External SCSI Cable 9'

Also shipped with the SKZ Subsystem are:

- 1 Software Support Tape  
(9-track magnetic tape, 1600 BPI)
- 1 Subsystem Manual
- 1 Magneto Optical Disk Drive Subsystem manual (optional)

Upon receipt of the SKZ 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 3.11

### SYSTEM HARDWARE REQUIREMENTS

- a) Eclipse or Nova CPU.
- b) Magnetic Tape Subsystem
- c) Console on Device 10/11

## THE SOFTWARE SUPPORT TAPE

The programs on the Software Support Tape have been written by ZETACO specifically for the SKZ Subsystem. You will use these programs for Media Formatting (if necessary), Diagnostic, Reliability, and RDOS Initialization. DG's CORRESPONDING PROGRAMS MAY NOT WORK ON THIS CONTROLLER.

The Software Support Tape is structured so that the programs on Files 2 through 5 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. The boot procedure is detailed in Section 2.9.

### 2.2 SELECT A SLOT FOR THE CONTROLLER

The Controller may be installed in any I/O or I/O-MEM slot. Consult the hardware manuals for your particular computer to identify the appropriate slots.

### PRIORITY SELECTION

The Controller must receive two priority signals from the DG minicomputer backplane: DCH Priority In (Pin A94), and Interrupt Priority In (Pin A96). If there are vacant slots between the Controller and the processor, or between the Controller 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 (Pin A96). See Figure 2.2.

### 2.3 PREPARE THE CONTROLLER

#### CONTROLLER CONFIGURATION SWITCHES

The controller is shipped pre-configured based on the subsystem ordered. The switches (defining the subsystem configuration) are located on the front edge of the board (see Figure 2.1). Check to make sure the switches have



not been altered during shipment. To do this, first locate the subsystem model number within the following list (e.g., SKZ-11) and then compare the defined switch positions to the actual switches on the controller. If the subsystem switch definition does not match the physical switches then make the appropriate corrections.

The switches (SW1, SW2, & SW3) should be normally set as follows according to subsystem type:

(switch down = D, switch up = U)

a). SKZ-11

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	D	U	D	D	(POLL SINGLE TARGET)
SW2	D	D	D	D	D	D	D	U	(WREN-3 HH 94211-86)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

b). SKZ-21

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	U	U	D	D	(POLL MULTIPLE TARGETS)
SW2	D	D	D	D	D	D	D	U	(WREN-3 HH 94211-86)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

c). SKZ-13

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	D	U	D	D	(POLL SINGLE TARGET)
SW2	D	D	D	D	D	D	D	D	(WREN-3 FH 94161-156)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

d). SKZ-23

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	U	U	D	D	(POLL MULTIPLE TARGETS)
SW2	D	D	D	D	D	D	D	D	(WREN-3 FH 94161-156)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

e). SKZ-15

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	D	U	D	D	(POLL SINGLE TARGET)
SW2	D	D	D	D	D	U	D	U	(WREN-4 300)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

f). SKZ-25

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	U	U	D	D	(POLL MULTIPLE TARGETS)
SW2	D	D	D	D	D	U	D	U	(WREN-4 300)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

g). SKZ-330

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	D	U	D	D	(POLL SINGLE TARGET)
SW2	D	D	D	D	U	D	D	D	(WREN RUNNER 330)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

h). SKZ-660

	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	U	U	D	D	(POLL MULTIPLE TARGETS)
SW2	D	D	D	D	U	D	D	D	(WREN RUNNER 330)
SW3	D	D	U	D	U	D	D	D	(device code = 27 octal)

i). SKZ-600	1	2	3	4	5	6	7	8	
SW1	D	D	D	D	D	U	D	D	(POLL SINGLE TARGET - A SINGLE SONY MO DRIVE)
SW2	D	D	D	D	U	D	D	U	(OPTICAL PLATTER = 295 MB/SIDE)
SW3	D	D	U	D	U	D	D	D	(Device code = 27 octal)

NOTE - The SW2 bank of switches specifies the size available for storage per disk in the subsystem. If these switches are inadvertently set to an incorrect setting, the subsystem may appear to operate properly but some measure of disk space may be wasted by not being put to use.

### CONFIGURATION OPTIONS

The recommended configuration for the application is selected prior to shipping. Please refer to APPENDIX A if it is necessary to deviate from the recommended configuration. All optional switch settings are defined in APPENDIX A.

## 2.4 INSTALL THE CONTROLLER

FIRST, BE SURE THE COMPUTER IS TURNED OFF. Pull the lock tabs on the two front corners of the controller out as far as they will go. Next, carefully guide the controller into the I/O slot you selected in Section 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.

FIGURE 2.1 SCZ-2 Board Layout

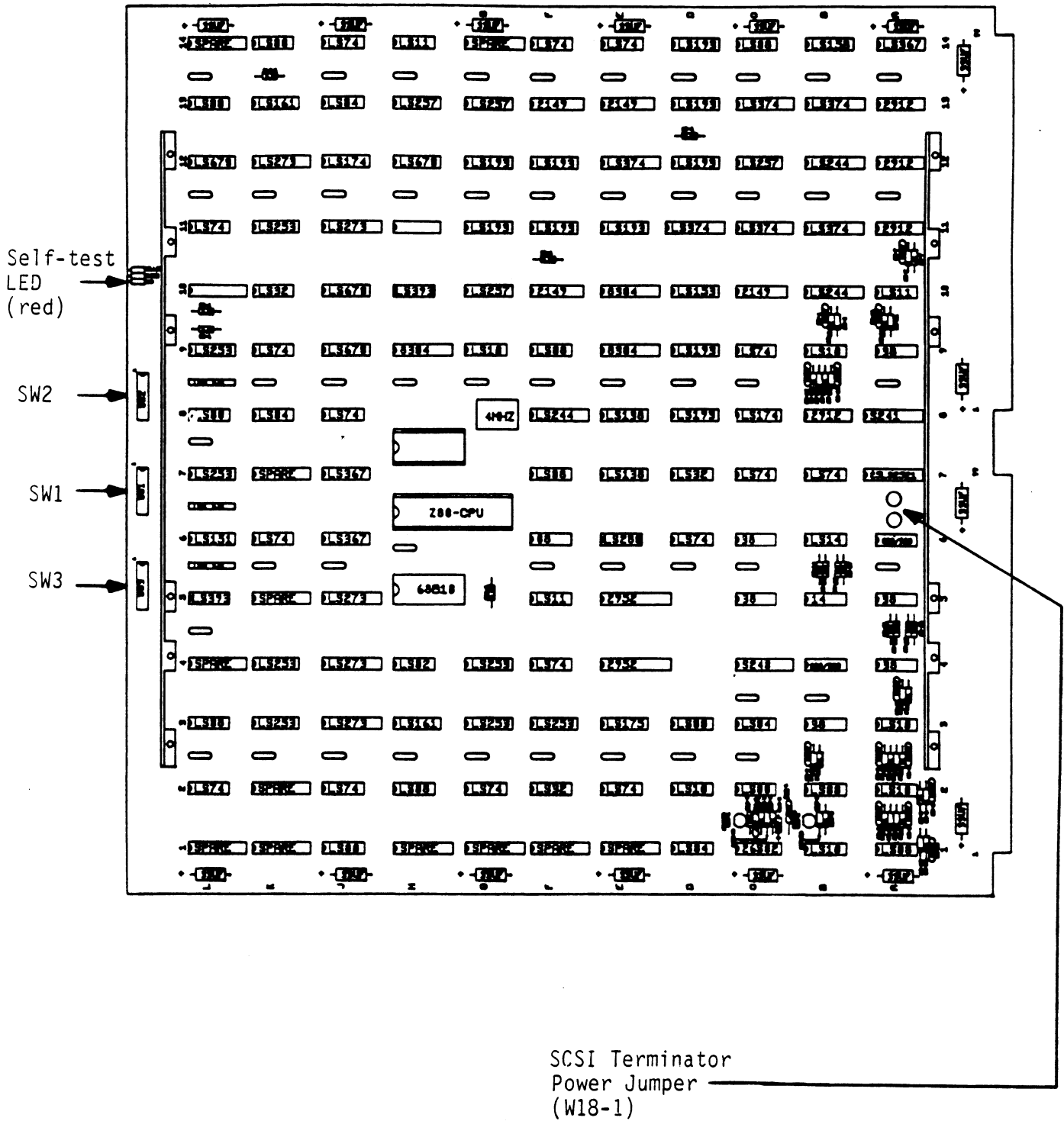
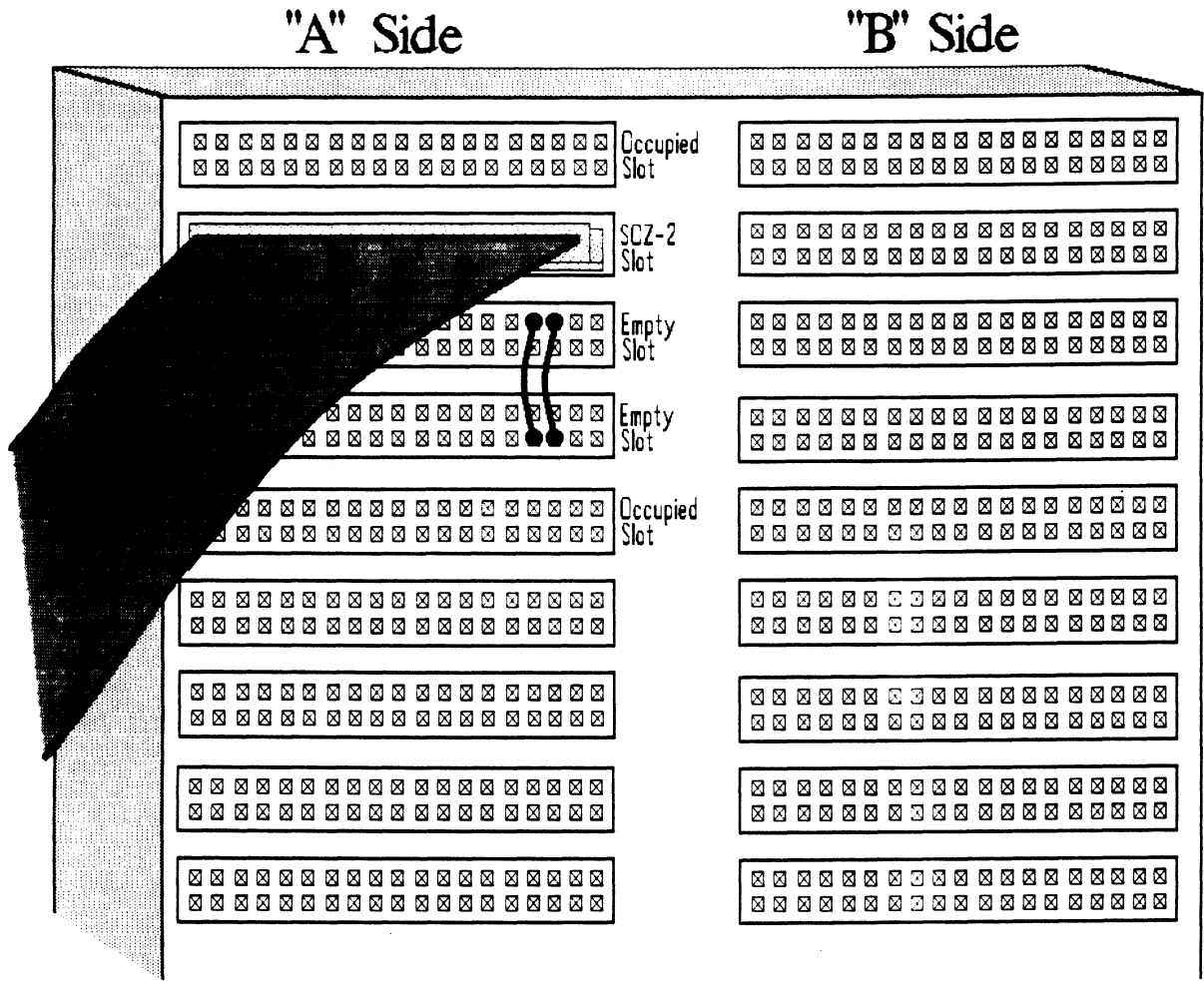


FIGURE 2.2 Backplane Priority Jumpers



## DEVICE CODE SELECTION

The recommended device code for the SKZ Subsystem Controller is 27 (octal). However, any usable device code can be selected, as long as there is not already a controller in the system with that code.

A set of switches on the edge of the board allows you to easily set the device code. Refer to APPENDIX A if an alternate device code is desired.

If, at a later date, you wish to change the device code for the Controller, 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.

### 2.5 INSTALL THE PADDLEBOARD

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.)

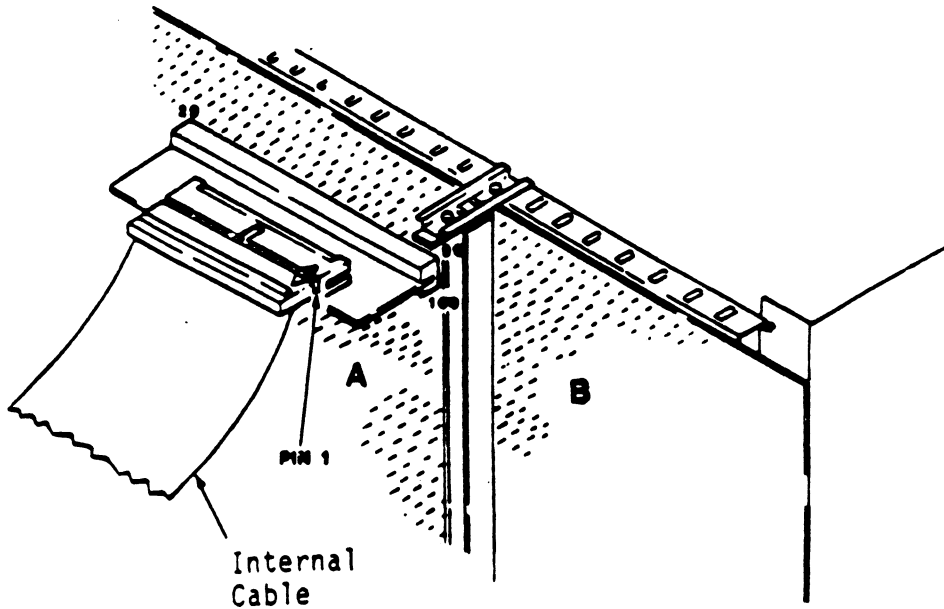
Locate the two rows of pins on the "A" side of the backplane for the slot containing the Controller. Ensure that no pins are bent. Position the "A" paddleboard connector block so that it covers the pins on the right-most end of the rows (pins 29 through 100). Be sure that the header connector on the 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 2.5.

---

CAUTION: COMPONENT DAMAGE MAY OCCUR IF THE PADDLEBOARD IS MISALIGNED. MAKE SURE THE CONNECTOR BLOCK IS NOT SHIFTED RIGHT OR LEFT. ALSO ENSURE 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 2.5 Paddleboard and Internal Cable Installation**



## 2.6 DISK DRIVE MODULE INSTALLATION

Note - This section does not pertain to the SKZ-600.

There are two slide assemblies for each Disk Drive Module (See Figure 2.6). 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 2.6a. 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:

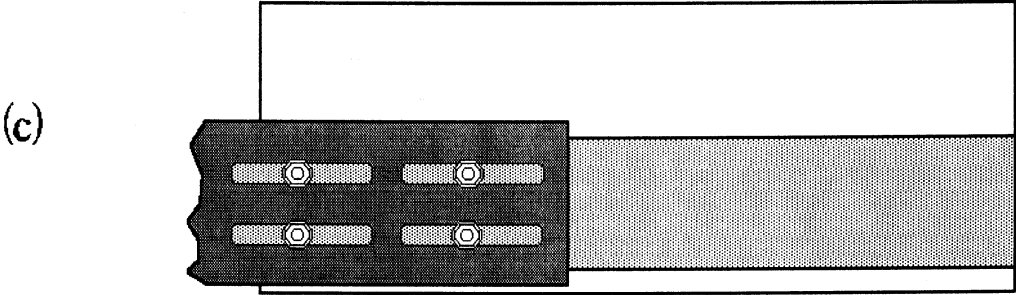
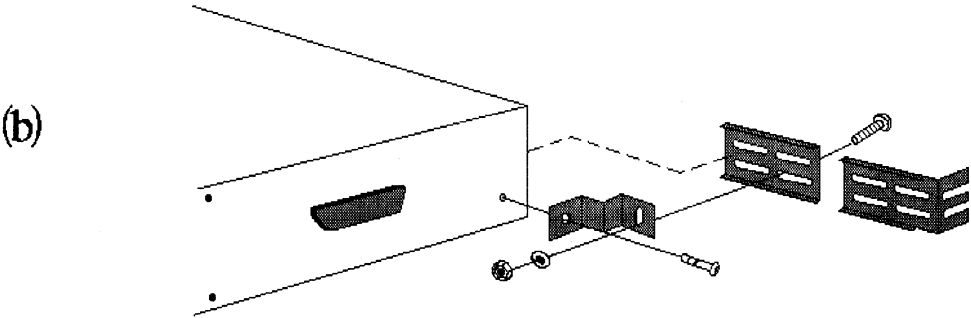
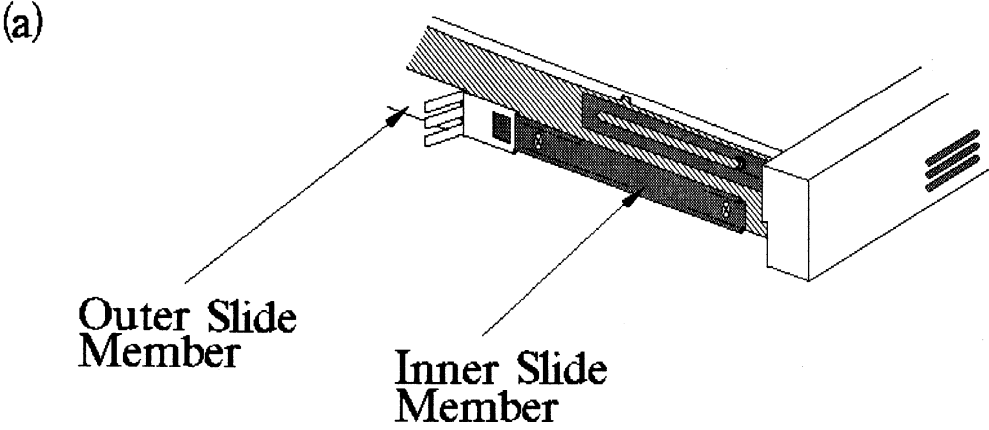
1. Attach the L-bracket to the rear end of each OUTER SLIDE MEMBER. On the inside of each L-bracket there is a quarter-turn fastener that mates with a receptacle in the rear of the module. Insert this fastener and turn it so that the L-bracket is locked to the module. Then attach the L-bracket to the OUTER SLIDE MEMBER using the

supplied hardware. See Figure 2.6b 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.



**FIGURE 2.6 Disk Drive Module Slide Assembly**



## 2.7 CONNECT THE CABLES

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

### 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 2.5, 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.

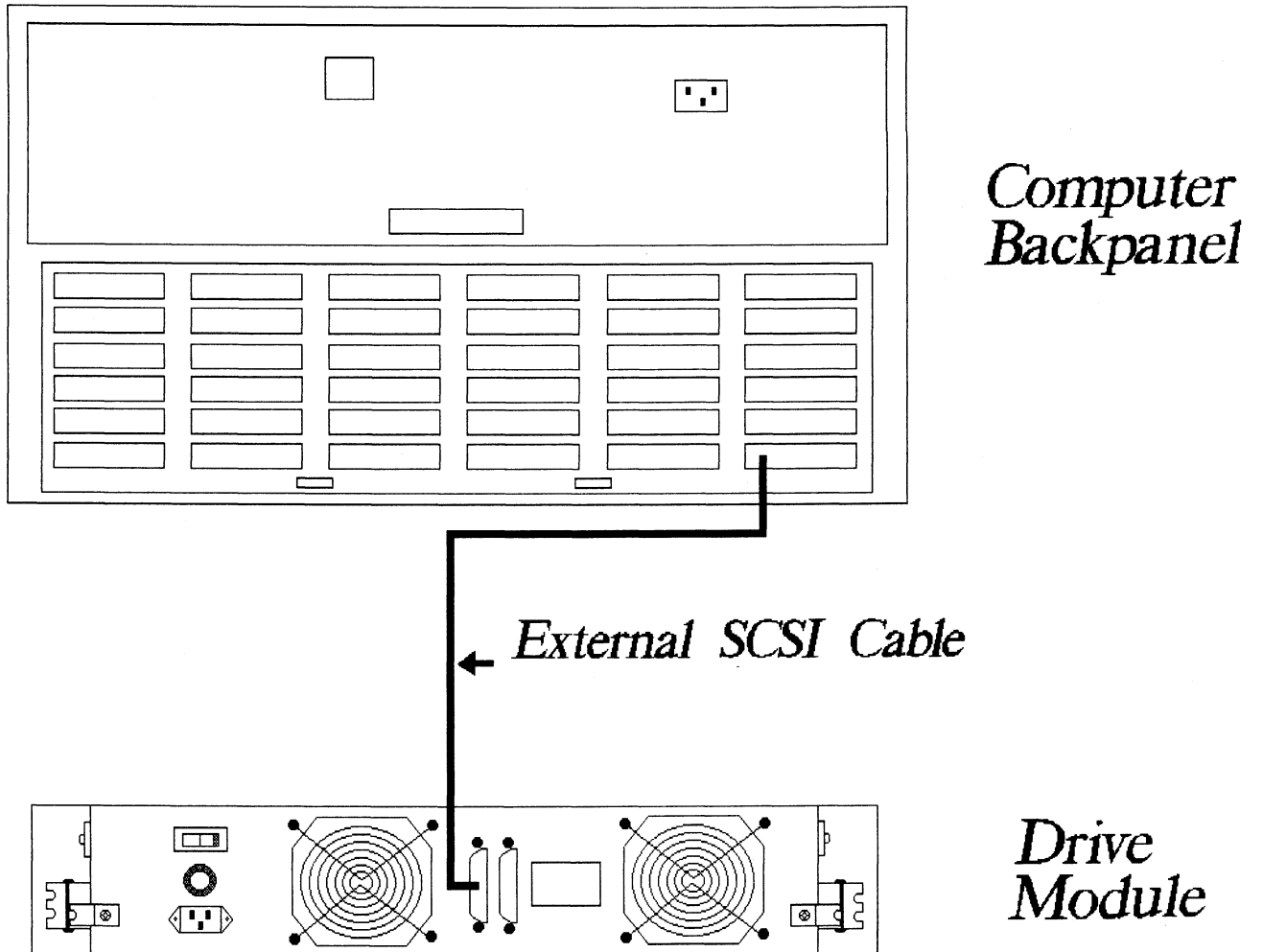
### EXTERNAL CABLING

One external cable is required to operate the SKZ Subsystem in its basic configuration. A 50-pin "D" connector is used on both ends of the external SCSI cable (the SKZ-600 external cable uses a male Champ connector at one end - other than this, the cables are identical). The 9' cable is connected from the computer bulkhead to the connector labeled "SCSI IN" on the rear panel of the drive module. Figure 2.7 illustrates this connection scheme.

For a pictorial of the SKZ-600 and cabling scheme, refer to page 9 of the Sony MO Manual.

If you are installing multiple drive modules at this time, see Appendix B for the expanded cabling scheme and additional drive preparations.

**FIGURE 2.7** Cabling for SKZ Subsystem  
(One Drive Module - Rear View)



## 2.8 POWER UP THE SUBSYSTEM

### DISK DRIVE MODULE OPERATION

The Disk Drive Module has been preconfigured at the factory and is ready for operation after cabling up. If you purchased a SKZ-600 subsystem you may wish at this time to familiarize yourself with the Sony MO Optical Enclosure by reading the Sony MO manual. Take special note of the operation of the switch pack at the rear of the enclosure. At this time insert a 512 byte/sector disk cartridge into the Sony MO drive.

Begin the power-up sequence by turning on the Disk Drive Module. You will find an ON/OFF rocker switch on the rear panel of the module; place it in the ON position. Observe that the indicator light imbedded in the switch and the READY LED on the front panel both become illuminated, and that the fans in the rear of the unit are turning.

The disk drive(s) should now be spinning. It will take approximately 35 seconds for the disk to reach full rotational speed and become ready.

### 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 the red LED on the front edge of the SCZ-2 controller will be active momentarily, indicating the status of the board's automatic Self-tests.

The red LED should be off after approximately 2 seconds. This indicates that the Controller has successfully passed its Self-tests and is ready to receive commands from the system.

The yellow DRIVE BUSY LED on the SCZ-2 controller and the BUSY LED on the drive module (Standard SKZ or Sony MO) will respond in one of two different ways, depending upon the setting of the POLL MODE switch (SW1-5) on the SCZ-2 controller:

SW1-5 UP (poll multiple targets):

- The BUSY LED on the Sony module will be out.
- The BUSY LED on the Standard SKZ module will blink.
- The yellow DRIVE BUSY LED on the SCZ-2 will blink.

SW1-5 DOWN (poll single target):

- The BUSY LED on the Sony module will be out.
- The BUSY LED on the Standard SKZ module will be on steady.
- The yellow DRIVE BUSY LED will be a steady dim.

If there are any problems at this point, see Chapter 3.

## 2.9 BOOT THE SOFTWARE SUPPORT TAPE

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.

For the S/140 virtual console, set 11A to 100022 (or 100062 for secondary tape drive). Then enter 100022L (or 100062L).

3. The software support package menu will be displayed:

FILE #	PROGRAM
2	SCZ-2 DIAGNOSTIC
3	SCZ-2 FORMATTER
4	SCZ-2 RELIABILITY
5	SCZ-2 ZSDKINIT
6	".SV & .LS" Files in RDOS DUMP Format

File Number?

Enter the number of the program you wish to execute. At this point in the installation procedure, you enter the file number, but first refer to Chapter 3 for program execution details.

## 2.10 RUN RELIABILITY TO VERIFY THE INSTALLATION

At this point, run Reliability for several minutes, just to verify that the subsystem is operating correctly. To do so, boot the software support tape and load file #4. Refer to Chapter 3 for details. If any problems are encountered, the disk Diagnostic (File #2 on tape) can be used to identify the source of the problem. We also recommend that if any errors occur during reliability you reformat the disk and run reliability again. The format procedure can be found in Chapter 3.4.

With the SKZ-600 subsystem, each disk cartridge needs to be formatted before any other disk activity is performed. If reliability fails initially, then do a format of the disk and run reliability again.

## 2.11 INITIALIZE THE DISK

The disk is now ready to be initialized for RDOS or ERDOS. Using Zetaco's initializer (FILE #5, ZSDKINIT) will insure the best drive capacity efficiency.

The sample dialogue found in Chapter 3.7 will guide you through this procedure.

## 2.12 STORE THE SOFTWARE SUPPORT PROGRAMS ON YOUR SYSTEM DISK

File 6 on the Software Support Package Tape is the RDOS dump format of all the contained programs that can be loaded on the system disk.

EXAMPLE: RDOS - Load MT0: 6

The files can now be booted from disk. Enter the appropriate filename in response to "FILENAME?".

---

## TROUBLE-SHOOTING

### 3.0 INTRODUCTION

The SCZ-2 is supported by ZETACO in the following ways:

- Microprocessor based Self-test of over 70% of the board each time it is powered up, with an LED status report.
- Reliability and Diagnostic program on 9-track tape for use during installation and trouble-shooting.
- Zetaco Authorized Distributors provide support for their customers. Your distributor is your first level of support.
- Customer Support Hotline, manned from 8:00 a.m. to 5:00 p.m. (Central Time) to answer your questions. (1-800-537-5292)
- 48-hour turn around on most factory repairs or replacement.
- Up to a two year warranty on workmanship and materials.

### 3.1 POWER/SPIN-UP PROBLEMS

#### DISK DRIVE MODULE POWER-UP

- The indicator imbedded in the ON/OFF switch on the back panel does not illuminate. (does not apply to SKZ-600)
  1. Ensure the AC power cord is firmly seated in the power receptacle on the module.
  2. Check the fuse. If replacement is necessary, use ONLY a 6 1/4 Amp Slo-Blo for 120 VAC or 3 Amp Slo Blo for 220-240 VAC.
  3. Ensure the AC wall receptacle is "live."
  4. Call the ZETACO Hotline, or your maintenance organization.

- The fans do not turn, turn slowly, or make excessive noise.
  1. Call the ZETACO Hotline, or your maintenance organization.
  2. Operation with one fan is permissible until a replacement fan has been installed, but operation over and extended period of time with one fan is not recommended.

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

### 3.2 SELF-TEST

Self-test checks out 70% of all the internal functions of the controller board once for every time power is applied to the board. The test takes approximately 2 seconds to execute.

If Self-test passed, the red LED will go out. If a failure was detected, the LED will blink a number of times which corresponds to the subtest that failed. Depressing the front panel IORESET switch will cause the LED to stay lit (no blinking) and Self-test will loop on the error.

TABLE 3.1 Self-Test Errors

CODE	TEST	POSSIBLE FAILURE
1	EPROM CHECKSUM	The data in the EPROM did not compare with expected check word. The data is the processor firmware.
2	SCRATCHPAD	Data read from RAM did not MEMORY compare with data written.
3	RAM TEST	Test patterns have determined that the buffer ram cannot support error free data handling.



### 3.3 SOFTWARE SUPPORT PACKAGE

In addition to the diagnostic functions provided by the SCZ-2 Controller via on-board Self-test, ZETACO provides Reliability and Diagnostic software. The Software Support Package on a magnetic tape included with the controller contains these programs.

Each of the programs on the Software Support Tape has been written by ZETACO specifically for the SCZ-2 Controller. You should use this tape for loading Media Formatting, Disk Diagnostic and Reliability, and RDOS initializing. DG's CORRESPONDING PROGRAMS MAY NOT WORK ON THIS CONTROLLER.

Files 0 and 1 contain the software that enables you to boot from the tape and select the particular program you want loaded into the system. The boot procedure is detailed in Section 2.9.

At several points during the installation procedure, you will find sample dialogue for the programs. In these samples, the lines that the computer prints will be 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 that do not appear in an actual session, and are here provided for clarification, will be preceded and followed by the characters "\*\*\*".

The Bootstrap Procedure for the software support tape is:

1. Mount the Software Support tape on the drive and put in on-line. Be sure that the BPI setting matches that specified on the tape label.
2. Boot the tape in your normal fashion.

For the S/140 virtual console, set 11A to 100022 (or 100062 for secondary tape drive). Then enter 100022L (or 100062L).

3. The Software Support Package menu will be displayed:

FILE #	PROGRAM
2	SCZ-2 DIAGNOSTIC
3	SCZ-2 FORMATTER
4	SCZ-2 RELIABILITY
5	SCZ-2 ZSDKINIT
6	".SV & .LS" Files in RDOS DUMP Format

File Number?

Enter the file number of the program you wish to execute.

## USING THE SOFTWARE SUPPORT PACKAGE TAPE

The Software Support Package tape is structured so that the programs on Files 2-5 can be loaded and executed directly from the tape. Files 0 and 1 contain the software that enables you to boot from the tape and select the particular program you want loaded into the system. Each of the programs on Files 2-5 is a stand-alone program. This means that they do not need, and cannot have, an operating system running when they are executed.

Programs cannot be loaded onto your disk directly from Files 0-5. File 6 for RDOS contains the programs in the standard system dump format and you can load them from this file to your disk. Even after the programs have been transferred to your disk, retain the Software Support Package tape in case of disk subsystem problems.

The following sequence of events is recommended by ZETACO. Each step is described in greater detail in the subsequent sections of this chapter.

1. Mount the Software Support Package tape and boot it.
2. Select #3 - Format the Media.
3. Select #2 - Disk Diagnostics.
4. Select #4 - Disk Reliability.

NOTE: It is not essential that you run Diagnostics or Reliability, however, they will locate disk subsystem problems. It is better that this be checked out at this point than after you have loaded your data.

5. If the controller is to run in an RDOS system, select #5 to initialize the disk.
6. You can load the programs from File 6 any time after you have built your disk.

The Bootstrap Procedure for the Software Support Package tape is:

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

2. Program Load - The method of program load varies for the different processors. Some of the possibilities are described here.

If your system has front-panel switches, set them to 100022 when loading from the primary tape drive, or to 100062 when loading from the secondary tape drive. Then press reset and the program load switch.

For the S/140 virtual console, set 11A to 100022 (or 100062 for secondary tape drive). Then enter 100022L (or 100062L).

For the S/120 virtual console, enter 22H (or 62H for the secondary tape drive).

3. The Software Support Package Menu will be displayed:

FILE #	PROGRAM
2	SCZ-2 DIAGNOSTIC
3	SCZ-2 FORMATTER
4	SCZ-2 RELIABILITY
5	ZSDKINIT-RDOS DISK INITIALIZER
6	Previous ".SV" Files in RDOS Dump Format

File Number?

Enter the file number of the program you wish to execute.

To load files from File 6, use the standard CLI Command for loading from tape.

```
RDOS: DIR %MDIR%
INIT MT0
LOAD/A/R/V MT0:6
RELEASE MT0
```

### 3.4 DISK FORMATTER

The Disk Formatter Program, contained in File #3, is a program designed to format a drive. Formatting the disk is required to prepare the media with the necessary overhead information to accept user data.

The following is a sample dialogue:

ZETACO...SCZ-2 DISK CONTROLLER FORMATTER REV. XX

STARTING ADDRESSES:

500-FORMATTER/CHECK PROGRAM  
502-ERROR LOG RECOVERY  
503-COMMAND STRING INTERPRETER

ENTER DEVICE CODE [27]: 67

SET SWPAK AS PER "HELP" OR HIT (CR) TO CONTINUE

START TIME? - MON,DAY,YR HR,MIN

UNIT	TYPE	HDS	CYLS	SEC/TRK
0	0	9	621	32

\*\* This is a list of all the ready units connected to the SCSI interface, and the parameters assigned to them. The same parameters that were configured by the board edge switches. \*\*

ENTER UNIT NUMBERS (0,1,2,3) TO RUN: 0

\*\* Enter the unit numbers of the drives you wish to have formatted. The drives will be formatted one at a time consecutively. \*\*

UNIT: 0

ENTER TYPE OF DISK: 0

\*\* Enter the TYPE that is associated with the UNIT as listed above (same line that shows the parameters). Specify UNIT: and ENTER TYPE OF DISK: will repeat for each unit number that was declared in the ENTER UNIT NUMBERS TO RUN: statement. \*\*

FORMATTING UNIT 0,

\*\* The display will freeze right here until the entire drive has been formatted. Notice (if board edge is visible) that the green LED is on and the yellow is off. The amount of time it takes to format a drive is

dependent upon size and manufacturer. In most cases it will take approximately ten minutes. \*\*

FORMATTING DONE ON ALL UNITS, NOW DOING SEEK EXERCISER.

### 3.5 DISK DIAGNOSTIC

This Diagnostic program is provided to find failures that are related to the basic operations of the disk controller. The disk diagnostic program is designed to test the basic hardware functions of the controller board and the SCSI subsystem and to indentify or help isolate any possible hardware problems.

Load the File #2 from Software Support Package tape provided. (See Using the Software Support Package Tape in Section 3.0).

The following is a sample dialogue:

...SCZ-2 DISK CONTROLLER DIAGNOSTIC REV. XX

STARTING ADDRESSES:

200-DIAGNOSTIC (INITIALIZE)

201-DIRECT ODT ENTRY

202-RANDOM SEEK EXERCISERS

SEEK EXER 1 IS A SINGLE DRIVE EXERCISER SEEK EXER  
2 IS A TWO DRIVE EXERCISER WITH SEEK OVERLAP

500-DIAGNOSTIC (RESTART)

DO YOU WANT HELP (Y/N) ? N

\*\* You may want to select Y if this is the first time you have entered the diagnostic program. The information available in the HELP section may be useful. \*\*

ENTER DEVICE CODE [27]: 27

\*\* Please enter the selected device code. Review the switch settings if necessary. \*\*

ENTER UNIT NUMBERS (0,1,2,3) TO RUN: 0

SET SWPAK AS "HELP" OR ENTER RETURN (CR) TO CONTINUE.

## TESTING UNIT 0

\*\* Will list the tests being run. \*\*

.  
. .  
. .  
. .

UNIT	HDS	CYLS	SEC/TRK
0	9	621	32

These are the units and characteristics found. Do you want to loop on reading them? Enter 1, otherwise enter Return (CR).

\*\* Normally enter Return unless instructed otherwise, due to a problem with reading the selected characteristics from the controller. \*\*

.  
. .  
. .  
. .

\*\* Listing tests again. \*\*

See Diagnostic text at the end of the manual for further details.  
TEST(S) COMPLETE.  
SEEK EXERCISER TESTS.  
PASS

## DIAGNOSTIC ERROR DESCRIPTION

When the diagnostic detects an error, it prints out the test number that failed along with what is wrong. Use the SWPACK register to help determine whether or not the error is intermittent. This is done by setting switch 3, which prints out an error percentage.

If you answer "yes" to the question "'Do you want help?", you can get to the information that describes the meaning of the bits in the SWPACK register. Depressing the M key allows you to observe the contents of the register.

### 3.6 DISK RELIABILITY

The Disk Reliability program is a maintenance program designed to exercise and test the disk subsystem. The program will test from one to four drives. Boot the Disk Reliability Program from File #4 in the Software Support Package tape.

Refer to "HELP" for invoking the command string interpreter.

The following is a sample dialogue:

ZETACO...SCZ-2 DISK RELIABILITY REV. XX

STARTING ADDRESSES:

500-RELIABILITY TEST  
501-RELIABILITY TEST WITH OPTIONS  
502-DISK ADDRESS TEST  
503-COMMAND STRING INTERPRETER  
504-ERROR COUNT/LOG RECOVERY  
505-RUN ALL TESTS  
506-SEEK EXERCISER  
507-RANDOM SEEK EXERCISER  
510-ENTER MULTIPLE DEVICE CODES

ENTER DEVICE CODE [27]: 27

STARTING ADDRESS = 505

SET SWPAK AS PER "HELP" OR HIT (CR) TO CONTINUE.  
ARE MAPS TO BE EXERCISED (YES/NO)? YES

START TIME? - MON,DAY,YR HR,MIN

UNIT	TYPE	HDS	CYLS	SEC/TRK
0	0	9	621	32
1	1	9	621	32

ENTER UNIT NUMBERS (0,1,2,3) TO RUN: 0,1

UNIT: 0

ENTER TYPE OF DISK: 0

UNIT: 1

ENTER TYPE OF DISK: 1  
TESTING UNIT 0,1

### RELIABILITY ERROR DISCRPTION

Reliability errors are displayed when they are detected. The controller status will be displayed with the particular problem spelled out below the status.

### LOSS OF READY

These errors indicate the disk unit was not ready when a command was issued. Check that the disk unit is still powered up and the cabling is intact on the disk unit.

## 3.7 ZSDKINIT - RDOS DISK INITIALIZER

(ZETACO's version of DKINIT, referred to as ZSDKINIT, is supplied on the Software Support Package tape File #5.)

Initializing a Model SCZ-2 disk:

Before you load any RDOS system onto a Model SCZ-2, YOU MUST INITIALIZE THE DISK BY RUNNING ZSDKINIT. This is a stand-alone program that performs all the functions of D.G.'s DKINIT. Please refer to D.G. manual on loading an RDOS system for full details on the functionality of disk initialization.

Remember that only ZSDKINIT will work correctly for Model SCZ-2 controllers. If you are building your system from an RDOS release tape, do NOT run File #4 on the D.G. tape after running ZSDKINIT. D.G.'s DKINIT cannot be run in expanded emulation on a SCZ-2.



## STEP 1 - LOADING

A) If loading from a Software Support Package tape:

Perform the steps described for loading the tape in Section 3.3.1

YOU RESPOND:

5

B) If loading from disk: (ZSDKINIT.SV must have been previously loaded onto the disk.

Ready the disk that contains ZSDKINIT.

Set console switches to correct device code.

Press RESET and LOAD switches.

PROGRAM DISPLAYS:

FILENAME?

YOU RESPOND:

ZSDKINIT (or DIR:ZSDKINIT, if the program file is located in directory, DIR, other than the master).

## STEP 2 - DISK TYPE

PROGRAM DISPLAYS:

DISK INITIALIZER - REV. NN.NN/with ZETACO Disk  
Support-REV. 1

DISK DRIVE MODEL NUMBER?

YOU RESPOND:

SCSI

NOTE: SCSI will instruct the initializer to read the drive characteristics that were selected by the configuration switches.

A) If the disk type is not valid-

PROGRAM DISPLAYS:

ILLEGAL DISK TYPE

Step 2 will be repeated until your response is acceptable.

### STEP 3 - DISK UNIT

PROGRAM DISPLAYS:

DISK UNIT?

YOU RESPOND:

DZx, where x indicates drive number: 0, 1, 2, or 3

A) If the disk unit is not valid -

PROGRAM DISPLAYS:

ILLEGAL DISK UNIT DECLARATION

Step 3 will be repeated until your response is acceptable.

B) If the disk unit is valid -

PROGRAM DISPLAYS:

# HEADS	# SEC/TRK	#CYLINDERS	MGB/BLK
(1)	(2)	(3)	Megabytes if disk >4000 blks. Blocks if disk <4000 blks.

(1) = the number of heads specified by the selected drive configuration switches.

(2) = the number of sectors per track specified by the drive configuration switches.

EXAMPLE: WREN-3 FH 94161-156

# HEADS	# SEC.TRK	#CYLINDERS	MGB/BLK
12	32	793	156

#### STEP 5 - COMMANDS AND SUBSEQUENT OUTPUT

The commands which can be selected are identical to those of DKINIT.

From this point on, ZSDKINIT will perform exactly as DKINIT.

### 3.8 SYSTEM ERRORS

If a system error occurs, use the User Manuals provided with the system to help determine what is wrong. For example, if a panic code is given, look up the code by referring to the D.G. User's Manual. This information could help determine how to solve the problem. Next, try to execute a similar function and see if the same results are obtained. If a burst is not working, try a dump. This could add vital information about the problem.

#### TEST PROGRAM TO USE IF THE SYSTEM IS BUILT BUT PROBLEMS HAVE ARISEN

This Section explains a test that can be done on a disk that has a system or system data on it without destroying that system or data. This provides an avenue for conditions requiring diagnostic testing, but where time does not permit the luxury of being able to rebuild a system.

This test requires that the Reliability program on the Software Support Package tape be loaded into system memory.

Answer the question "enter device code" with the correct information. Next, depress control O. An @ should be on the console.

To run the random seek test, enter a 501R after the prompt (@). Now answer the questions the program asks, as in the normal reliability testing, with the exception of one question. When the question "SET SWPAK PER "HELP" OR HIT (CR) TO CONTINUE." is asked, enter an "8" one time. This puts the program in a Read Only mode and writes will not be done. Enter an "M" to verify that switch 8 is now on; if it is not, writes

will be done, crashing the disk. The 501 will behave in the following manner:

#### A. RANDOM RELIABILITY TEST (SA 501) WITH OPTIONS

THE OPERATOR IS GIVEN OPTIONS ON DATA PATTERNS (FROM THE COMMAND STRING DATA) AND MAY CHOOSE A CONSTANT CYLINDER, HEAD, SECTOR OR # OF SECTORS. ANY LETTER RESPONSE TO CYL, HEAD ETC. GETS RANDOM FUNCTION FOR THAT VARIABLE. A CARRIAGE RETURN ONLY GETS THE RANDOM FUNCTION FOR ALL VARIABLES.

THE OPERATOR IS ALSO ASKED TO RESPOND TO JITTER OPTION (YES/NO). IF YES, A RANDOM DELAY (0-40,50MS) IS INSERTED INTO THE BACKGROUND LOOP TO CREATE A MORE ASYNCHRONOUS DISK I/O LOOP.

### 3.9 CUSTOMER SUPPORT HOTLINE

ZETACO, Inc. provides a Customer Support Hotline (800-537-5292) 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.

Please review the General Installation Checklist on page 3-15 before calling the Hotline.

Zetaco Authroized Distributors provide support for their customers. Your Distributor is your first level of support.

### 3.10 WARRANTY INFORMATION

ZETACO controllers are warranted free from manufacturing and material defects when used in a normal and proper manner for a period of up to two years from date of shipment. All drives and power supplies in ZETACO subsystems are warranted for 6 months 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 damages arising out of or in connection with the use or performance of ZETACO's products.

### **3.11 PRODUCT RETURN AUTHORIZATION**

When a controller malfunction has been confirmed using the tests outlined in Sections 3.1 to 3.6 above, the board can be returned to ZETACO for warranty repair if the product has been damaged or for time-and-material repair if it is out of warranty. A Return Material Authorization (RMA) number is required before shipment and should be referenced on all packaging and correspondence.

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.

To safeguard the controller during shipment, please use packaging that is adequate to protect it from physical and electrostatic damage. Mark the box "Delicate Instrument" and indicate the RMA number(s) on the shipping label.

## GENERAL INSTALLATION CHECKLIST

CPU \_\_\_\_\_ Operating System and Rev. \_\_\_\_\_

Is unit replacing a previously installed subsystem? \_\_\_\_\_

Device Code of New Product: \_\_\_\_\_ Any similar subsystem in the  
CPU? YES NO If yes, then its Device Code: \_\_\_\_\_

Configuration Facts \_\_\_\_\_

Problem Description \_\_\_\_\_

Problem happens where (during Dump, Reliability, etc.)? \_\_\_\_\_

Intermittent or consistent problem? \_\_\_\_\_

Does Self-test pass? \_\_\_\_\_

Priority of Board in CPU (Slot) \_\_\_\_\_

BMC Priorities of other BMC Devices (BMC Products Only) \_\_\_\_\_

Reviewed Interrupt and Priority Jumpers on Vacant Slots? \_\_\_\_\_

Tried Different Slot? \_\_\_\_\_

Cleaned gold-fingered contact points of board and reset board? \_\_\_\_\_

Supplied ZETACO 1/2" Tape "Boot" correctly? \_\_\_\_\_

Is peripheral set to correct unit number, and is terminator in? \_\_\_\_\_

For peripheral disk drives, what is Sector Switch setting? \_\_\_\_\_

Double checked PIN 1 of cable to Pin 1 of controller, backplane and peripheral?  
\_\_\_\_\_

Result of ZETACO Reliability or Diagnostics: \_\_\_\_\_

# MATERIAL RETURN INFORMATION

All possible effort to test a suspected malfunctioning controller should be made before returning the controller to ZETACO for repair. This will: 1) Determine if the board is actually defective. 2) Increase the speed and accuracy of a product's repair, which is often dependent upon a complete understanding of the user's checkout test results, problem characteristics, and the user system configuration. Test results for the SCZ-2 Controller should be obtained by performing the tests below. (Include error program counter numbers and accumulator contents if applicable). Use back of sheet if more space is needed.

FUNCTION	TEST	RESULT
Power-up Controller Sub-system	Self-test	_____
	Diagnostics	_____
	Reliability	_____

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? (ie. RDOS) Include revision number.
3. Describe the system configuration (i.e. peripherals, I/O controllers, model of computer, etc.).

To be filled out by CUSTOMER:

Model #: \_\_\_\_\_  
Serial #: \_\_\_\_\_  
RMA #: \_\_\_\_\_ (Call ZETACO to obtain an RMA number).

Returned by:

Your name: \_\_\_\_\_  
Firm: \_\_\_\_\_  
Address: \_\_\_\_\_  
Phone: \_\_\_\_\_





# APPENDIX A

## CONFIGURATION OPTIONS

The SCZ-2 Controller configuration is accomplished by three easy access DIP switches (piano key style). All three switches have eight positions. The switch positions are usually identified on the switch itself. If not, the positions are then counted left to right starting with position 1 and ending with position 8.

DIP SWITCH 1 (Silk Screen Identified as SW1)

=====

POSITION	OPTION	DEFINITION
1	not used	Switch should be DOWN.
2	DEFER	If switch is in DOWN position, actual SEEK will not take place until READ/WRITE command. Deferred SEEK is recommended for one drive per target (DOWN position).
3	not used	Switch should be DOWN.
4	not used	Switch should be DOWN.
5	POLL MODE	Poll multiple targets if UP, or poll single target and multiple logical unit numbers if DOWN. DOWN is recommended if only one target (one drive). UP is required for 2 or more targets (drives).
6-8	THROTTLE	The three throttle setting switches for controlling the number of data channel words per request.

(standard setting)

SWITCH POSITION			THROTTLE COUNT
6	7	8	# OF WORDS/REQ
down	down	down	1
down	down	up	2
down	up	down	4
down	up	up	8
up	down	down	16
up	down	up	32
up	up	down	64
up	up	up	128

NOTE: up = open, down = closed

The Throttle Burst Rate is defined as the number of word transfers that take place over the Data Channel during a single bus access by the disk controller. Throttle adjustment is dependent upon the type of system configuration in which the controller is installed. Too low a throttle setting could result in slow disk performance and too high a setting could cause a data late on another DCH device. The controller may be set to burst rates of 1, 2, 4, 8, 16, 32, 64, and 128 words per access. A burst rate of 16 is recommended for most applications.

DIP SWITCH 2 (Silk Screen Identified as SW2)

=====

POSITION	NAME	DEFINITION
1	INTLV	Sector interleave option. UP for interleave by 2. DOWN for no interleave. DOWN for most applications.
2	not used	Switch should be DOWN.
3-8	DSK PARA	These switches are set as required by the subsystem. They specify the size of the drive(s) in the subsystem.

DIP SWITCH 3 (Silk Screen Identified as SW 3)

=====

POSITION	NAME	DEFINITION
1	FMT NEW	Format new drive if DOWN; uses manufacturers defect list only. Verifies and uses grown list if UP. UP only if an older drive and soft or hard media errors are suspected when formatting a drive.
2	RETRY	Report SCSI media related retries to the system if the switch is UP. DOWN during system execution. This switch should be normally in DOWN position, it is only used during reliability program if you wish to expose any media related soft errors.
3-8	DEV SEL	Device select code switches. Primary device code = 27 (octal), secondary device code = 67 (octal).

CODE	3	4	5	6	7	8
27	up	down	up	down	down	down
67	down	down	up	down	down	down

For other selections, switch 3 is the most significant and 8 is the least.  
UP Switch = 0, DOWN Switch = 1.

The standard Primary device code for the SKZ is 27 octal; the Secondary is 67 octal. However, any DG device code can be selected, as long as there is not already a controller in the system with that device code.

If, at a later date, you wish to change the device code for the SKZ, 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.

## **APPENDIX B**

### **ADDING MORE DRIVE MODULES**

Since the controller is capable of controlling up to 4 SCSI disk drives, you may at some point wish to add more drive modules to your subsystem. This Appendix will provide you with the details to do so.

If your Subsystem is a SKZ-600, ignore this information and refer instead to the Sony MO Manual.

#### **CONNECT THE CABLES**

Install the additional drive modules and cable from SCSI OUT of the first module to SCSI IN of the second module. (Remove terminators in the module, see Section B.2.)

#### **SCSI INTERFACE TERMINATION**

Each drive module has SCSI Interface terminators. These terminators are located at the rear of the drive module on DIP sockets and must be removed for all but the last module. See Figure B.2.

#### **CHECK CURRENT CONTROLLER CONFIGURATION**

Unless, during original installation you configured for a number of drives equal to or greater than the number you now have, you will need to change that configuration fact to reflect your new drives.

#### **ADDING A SECOND DRIVE TO A SINGLE-DRIVE MODULE**

The disk drive upgrade kit includes a disk drive, power supply, 4-inch interface cable and mounting hardware. See Figure B.3 for installation location. Install the disk drive, power supply and cables per the following:

Step 1 Install the disk drive using the hardware provided.

Step 2 Connect the Ready LED cables as shown.

Step 3 Connect the 4-inch interface cable as shown.

Step 4 Install the power supply using the hardware provided.

Step 5 Connect the DC power cable to the disk drive as shown.

Step 6 Connect AC power to the power supply as shown.

Step 7 Remove identification label and replace with the one provided in the kit.

Step 8 Re-configure the controller to reflect the added disk drive.

NOTE: UPGRADED DISK DRIVE UNIT ADDRESS HAS BEEN PRE-SET AT THE FACTORY ACCORDING TO CONFIGURATION INFORMATION OBTAINED AT TIME OF ORDERING. IF ADDRESS MUST BE CHANGED, REFER TO APPENDIX D FOR UNIT ADDRESSING INFORMATION.

# APPENDIX A

## A.0 CONFIGURATION OPTIONS

Adapter configuration is accomplished by three easy access DIP switches (piano key style). All three switches have eight positions. The switch positions are usually identified on the switch itself. If not, the positions are then counted left to right starting with position 1 and ending with position 8.

### DIP SWITCH 1 (Silk Screen Identified as SW1)

=====

POSITION	OPTION	DEFINITION
1	not used	Switch should be DOWN.
2	DEFER	If switch is in DOWN position, actual SEEK will not take place until READ/WRITE command. Deferred SEEK is recommended for one drive per target (DOWN position).
3	not used	Switch should be DOWN.
4	not used	Switch should be DOWN.
5	POLL MODE	Poll multiple targets if UP, or poll single target and multiple logical unit numbers if DOWN. DOWN is recommended if only one target.
6-8	THROTTLE	The three throttle setting switches for controlling the number of data channel words per request.

(standard setting)

SWITCH POSITION			THROTTLE COUNT
6	7	8	# OF WORDS/REQ
down	down	down	1
down	down	up	2
down	up	down	4
down	up	up	8
up	down	down	16
up	down	up	32
up	up	down	64
up	up	up	128

NOTE: up = open, down = closed

#### A.1 THROTTLE BURST RATE

This is defined as the number of word transfers that take place over the Data Channel during a single bus access by the disk controller. Throttle adjustment is dependent upon the type of system configuration in which the controller is installed. Too low a throttle setting could result in slow disk performance and too high a setting could cause a data late on another DCH device. The controller may be set to burst rates of 1, 2, 4, 8, 16, 32, 64, and 128 words per access. A burst rate of 16 is recommended for most applications.

#### DIP SWITCH 2 (Silk Screen Identified as SW2)

=====

POSITION	NAME	DEFINITION
1	INTLV	Sector interleave option. UP for interleave by 2. DOWN for no interleave. DOWN for most applications.



- 2            not used      Switch should be DOWN.
- 3-8         DSK PARA    These switches are set as required by the subsystem.

DIP SWITCH 3 (Silk Screen Identified as SW 3)

=====

POSITION	NAME	DEFINITION
1	FMT NEW	Format new drive if DOWN; uses manufacturers defect list only. Verifies and uses grown list if UP. UP only if an older drive and soft or hard media errors are suspected when formatting a drive.
2	RETRY	Report SCSI media related retries to the system if the switch is UP. DOWN during system execution. This switch should be normally in DOWN position, it is only used during reliability program if you wish to expose any media related soft errors.
3-8	DEV SEL	Device select code switches. Primary device code = 27 (octal), secondary device code = 67 (octal).
	CODE 3	4      5      6      7      8
	27	up    down up    down down down
	67	down down up    down down down

For other selections, switch 3 is the most significant and 8 is the least.  
UP Switch = 0, DOWN Switch = 1.

The standard Primary device code for the SKZ is 27 octal; the Secondary is 67 octal. However, any DG device code can be selected, as long as there is not already a controller in the system with that device code.

If, at a later date, you wish to change the device code for the SKZ, 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.



## **APPENDIX B**

### **B.0 ADDING MORE DRIVE MODULES**

Since the controller is capable of controlling up to 4 SCSI disk drives, you may at some point wish to add more drive modules to your subsystem. This Appendix will provide you with the details to do so.

### **B.1 CONNECT THE CABLES**

Install the additional drive modules and cable from SCSI OUT of the first module to SCSI IN of the second module. (Remove terminators in the module, see Section B.2.)

### **B.2 SCSI INTERFACE TERMINATION**

Each drive module has SCSI Interface terminators. These terminators are located at the rear of the drive module on DIP sockets and must be removed for all but the last module. See Figure B.2.

### **B.3 CHECK CURRENT CONTROLLER CONFIGURATION**

Unless, during original installation you configured for a number of drives equal to or greater than the number you now have, you will need to change that configuration fact to reflect your new drives.

### **B.4 ADDING A SECOND DRIVE TO A SINGLE-DRIVE MODULE**

The disk drive upgrade kit includes a disk drive, power supply, 4-inch interface cable and mounting hardware. See Figure B.3 for installation location. Install the disk drive, power supply and cables per the following:

Step 1 Install the disk drive using the hardware provided.

Step 2 Connect the Ready LED cables as shown.

Step 3 Connect the 4-inch interface cable as shown.

Step 4 Install the power supply using the hardware provided.

Step 5 Connect the DC power cable to the disk drive as shown.

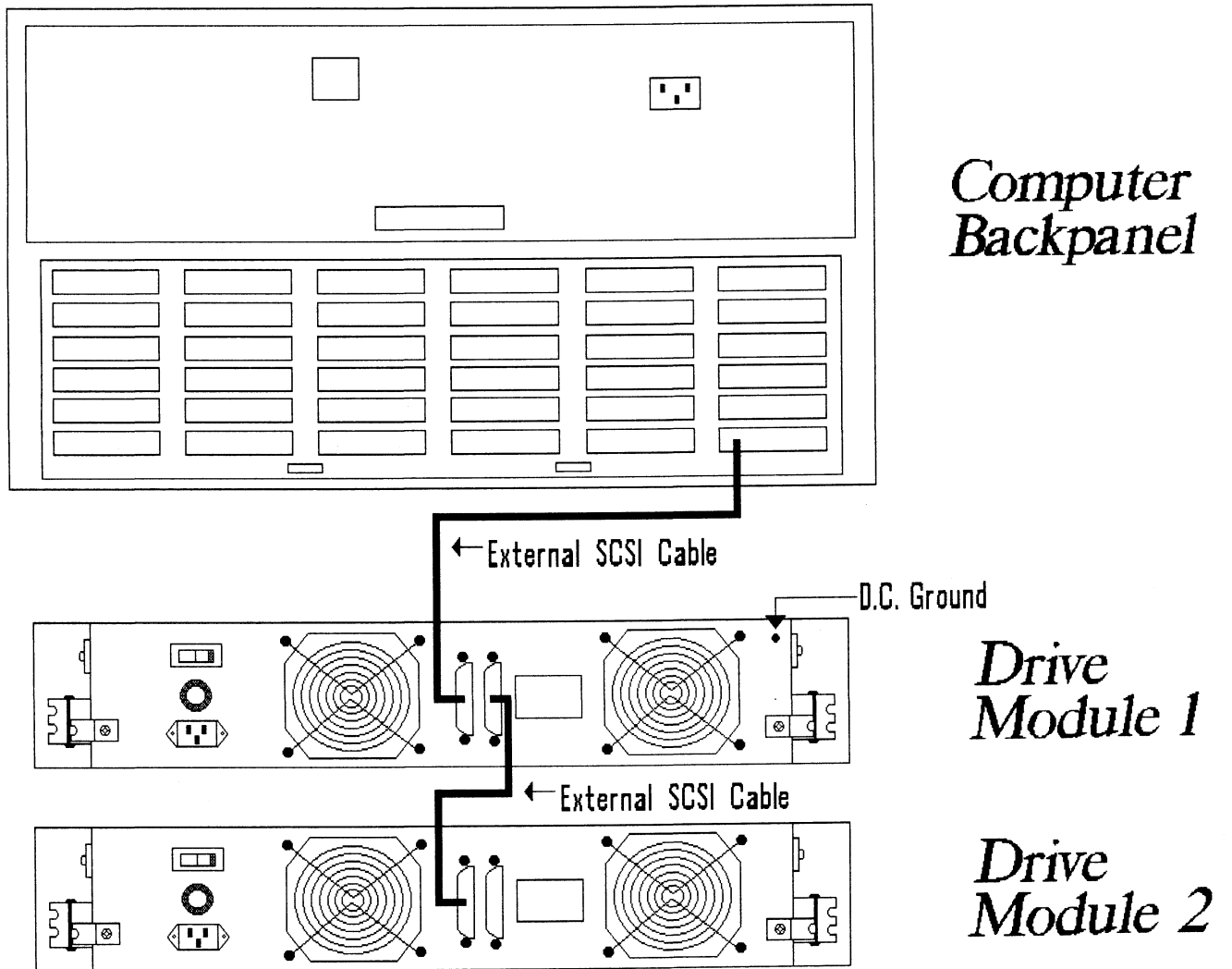
Step 6 Connect AC power to the power supply as shown.

Step 7 Remove identification label and replace with the one provided in the kit.

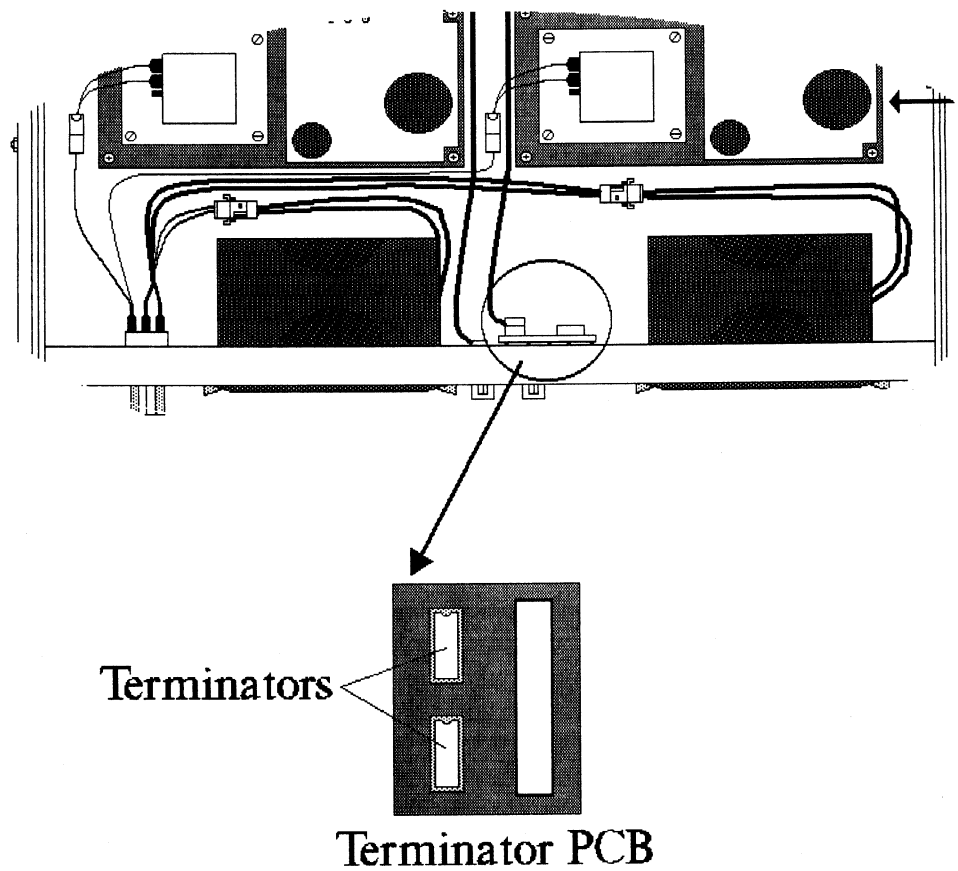
Step 8 Re-configure the controller to reflect the added disk drive.

NOTE: UPGRADED DISK DRIVE UNIT ADDRESS HAS BEEN PRE-SET AT THE FACTORY ACCORDING TO CONFIGURATION INFORMATION OBTAINED AT TIME OF ORDERING. IF ADDRESS MUST BE CHANGED, REFER TO APPENDIX D FOR UNIT ADDRESSING INFORMATION.

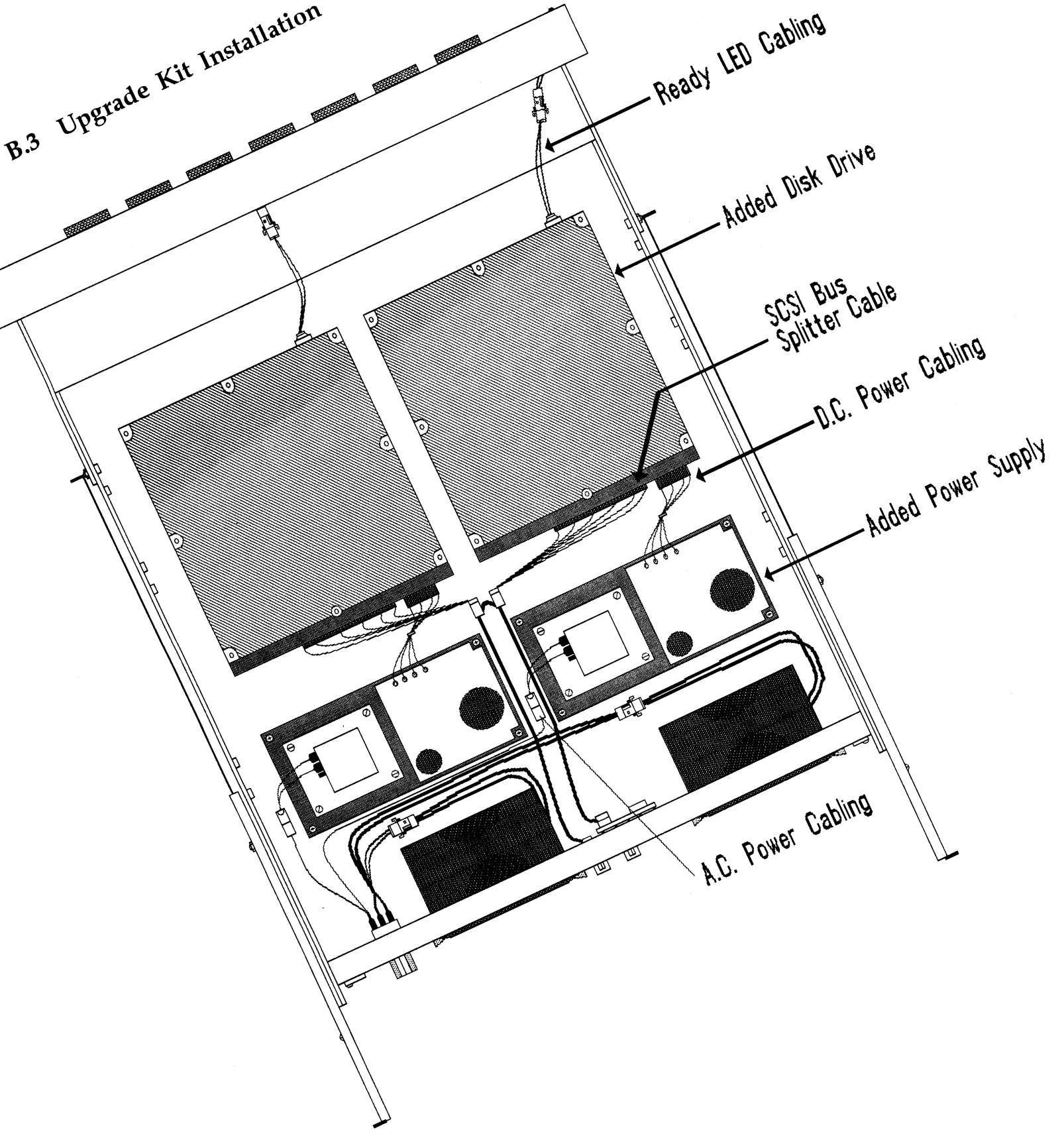
**FIGURE B.1 Multiple Drive Enclosure (Rear View)**



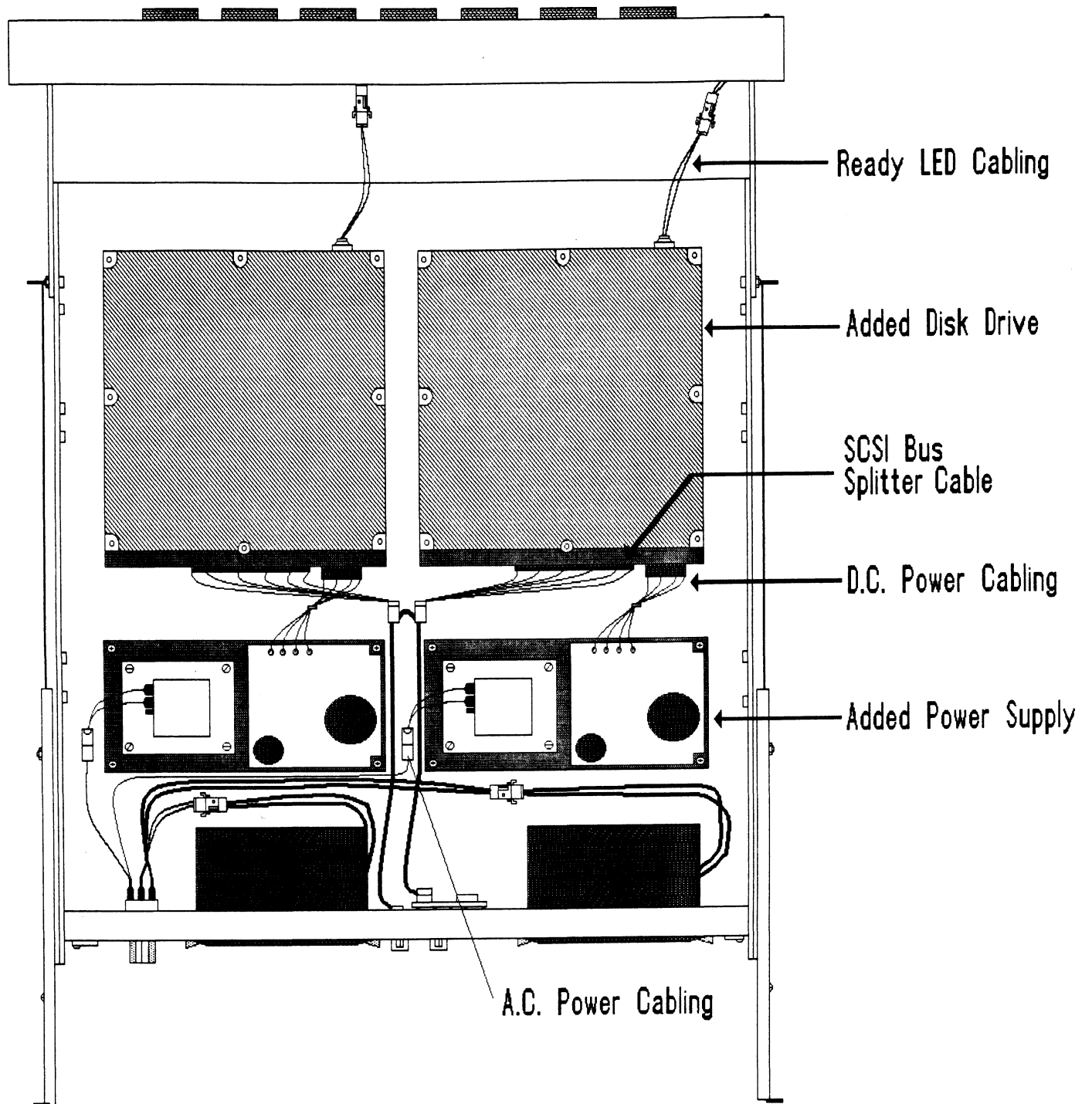
**FIGURE B.2 SCSI Interface Terminators**



# B.3 Upgrade Kit Installation



**FIGURE B.3 Upgrade Kit Installation**







## APPENDIX C

### C.0 PREVENTIVE MAINTENANCE

#### C.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.**

---



## APPENDIX D

### D.0 SCSI UNIT ADDRESSING

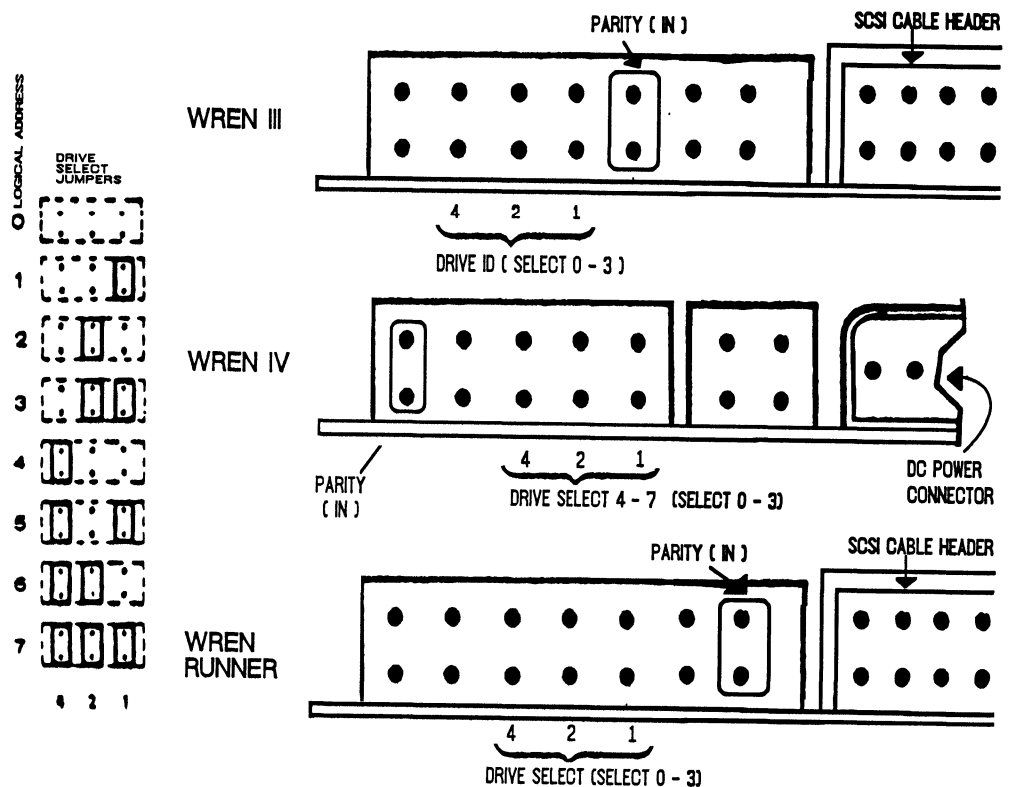
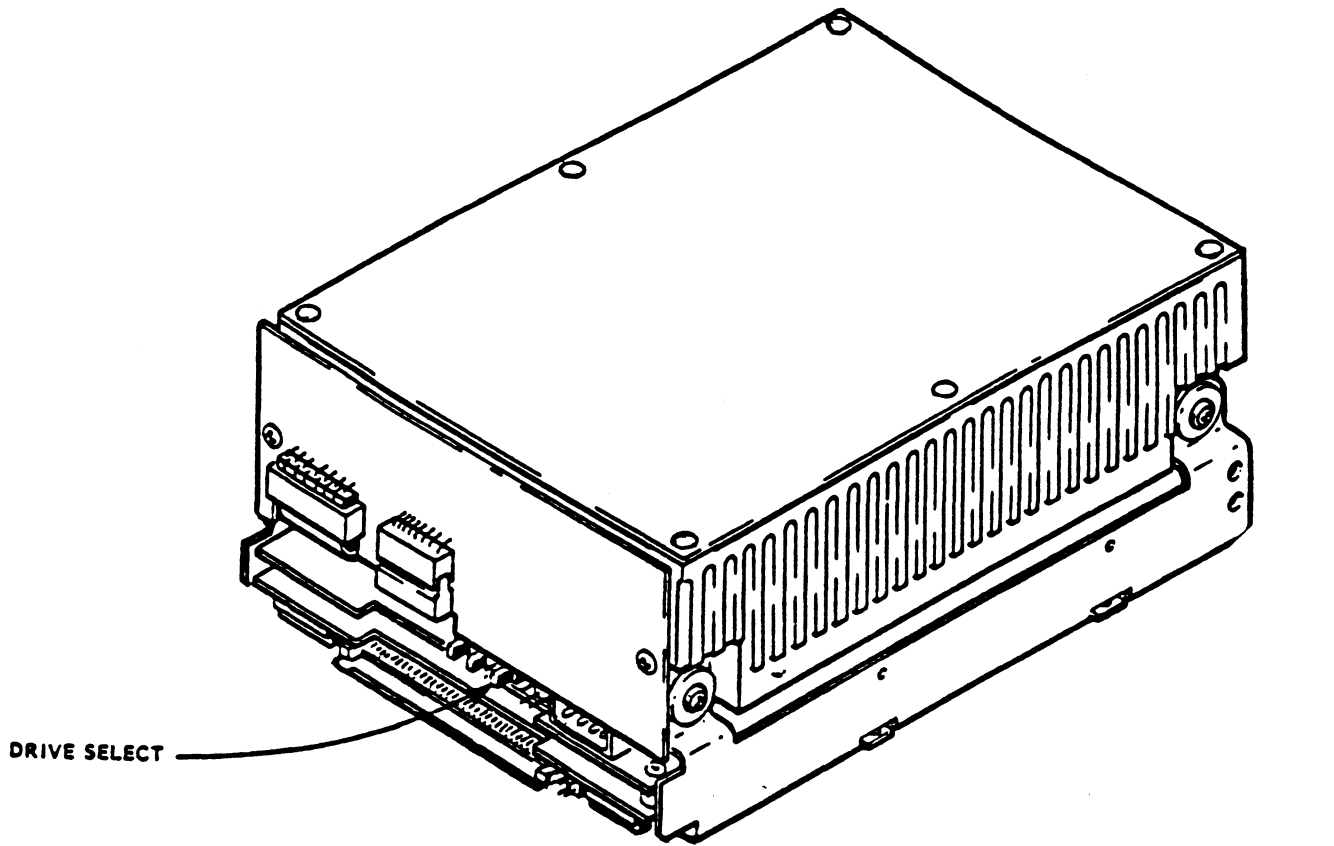
The factory default SCSI Unit Addressing has been set as follows unless otherwise specified:

LOGICAL UNIT	SCSI ADDRESS
0	0
1	1
2	2
3	3

See Figure D.1 for information on how to physically change and/or set the Unit Address.

FIGURE D.1 SCSI Unit Addressing

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.



## APPENDIX E

### E.0 LED ERROR CODES

A complete discussion of the LEDs and their role in basic subsystem trouble-shooting is presented in Sections 3.1.2 and 3.2 of this manual. The tables below identify the specific test or error associated with each error code.

TABLE E.1 Self-Test Error Codes

CODE	TEST
1	EEPROM CHECKSUM
2	SCRATCH PAD MEMORY
3	BUFFER RAM

## APPENDIX C PREVENTIVE MAINTENANCE

### 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.

---

## APPENDIX D SCSI UNIT ADDRESSING

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

LOGICAL UNIT	SCSI ADDRESS
0	0
1	1
2	2
3	3

See Figure D.1 for information on how to physically change and/or set the Unit Address; or if your subsystem is a SKZ-600, refer to the Sony MO manual.



\*\*\*\*\*

DESCRIPTION: SCZ-2 DISK CONTROLLER FORMATTER PROGRAM

Product of ZETACO, 1987

\*\*\*\*\*

.TITL SCZ2F

.DUSR X=1

.NOMAC X

;1.0 PROGRAM NAME: SCZ2F.SR

;2.0 REVISION HISTORY:

REV.	DATE	
01	09/29/87	;

;3.0 MACHINE REQUIREMENTS:

NOVA/ECLIPSE FAMILY CENTRAL PROCESSOR  
16K READ/WRITE MEMORY  
SCZ-2 DISK CONTROLLER  
0-3 DISK DRIVES  
TELETYPE or CRT and CONTROL

;4.0 TEST REQUIREMENTS: N/A

;5.0 SUMMARY:

The ZETACO DISK CONTROLLER FORMATTER PROGRAM  
Is designed to FORMAT and then run a short Seek  
exerciser (seek read one sector). The PROGRAM is  
INOT! A MAINTENANCE PROGRAM and ASSUMES the HARDWARE  
to be in WORKING ORDER. The Device Code may be 20-76  
OCTAL with the Default being 27.

;6.0 RESTRICTIONS:

NONE

```

;
; A. FORMATTER PROGRAM (STARTING ADDRESS <SA> 500)
; The disk is first formatted after which a "FORMAT DONE"
; message is printed. Then a random seek test is performed,
; and "PASS" is printed. Since the FORMAT is a FORMAT DRIVE
; command, the log is NOT available while the drives are
; being formatted.
;
; B. FORMATTER PROGRAM (SA 501)
; Same as SA 500.
;
; C. LOG RECOVERY (SA 502)
; Use to recover log of program after it has stopped to get a
; LOG PRINTOUT.
;
; D. COMMAND STRING INTERPRETER (SA 503)
; As a trouble shooting aid the service engineer may type in
; their own TEST LOOP. After starting at 503, three ARGUMENTS
; must be entered in response to three program questions;
; "UNIT", "DATA", and "COMMAND STRING". All numbers must be
; entered in OCTAL.
;
; I.      UNIT:   Type unit # or carriage return
;              to use the previous entry
;
; II.     DATA:  RAN=RANDOM
;                 ALO=ALL ONES
;                 ALZ=ALL ZEROS
;                 PAT=110110 PATTERN
;                 FLO=FLOATING ONE PATTERN
;                 FLZ=FLOATING ZERO PATTERN
;                 ADR=ALTERNATING CYLINDER and
;                 HEAD, SECTOR WORDS
;                 VAR=Existing words entered previously as
;                 described below
;
;                 Alternatively enter a string of up to 7
;                 OCTAL 16 bit words to be used as DATA.
;                 The words entered are used repeatedly
;                 to make up a sector block. Type carriage
;                 return to use the previous entry.
;
; III.    COMMAND STRING:
;
; OPTIONS 1.      READ HEAD, SECTOR, #SECTORS
;           2.      WRITE SAME
;           3.      SEEK CYLINDER
;           4.      RECALIBRATE
;           5.      LOOP (go to beginning or LR)
;           6.      DELAY N (N=DELAY in MS)
;           7.      TRESPASS
;           8.      RELEASE
;           9.      OFF (OFFSET FORWARD)
;           10.     OFR (OFFSET REVERSE)
;           11.     LR (begin LOOP here)
;           12.     VERIFY (WRITE)
;           13.     Type Carriage Return to use the
;                   previous COMMAND STRING.
;
;
; Note that either SPACES or a COMMA
; may be used as an argument delimiter.
; Each response is terminated by
; typing carriage return. If more

```

```
; feed to space to the next line. The  
; word "SAME" used with READ, or WRITE,  
; will cause the previous disk address  
; parameters to be used.
```

```
; An R typed while a string is being executed will  
; cause the program to return to command string start.  
; The ESCAPE KEY will bypass UNIT and DATA prompts to  
; the command string prompt.
```

```
; The following example would cause UNIT  
; 1 to SEEK CYLINDER 50, then repeatedly  
; WRITE SECTORS 2 and 3 of HEAD 5, then  
; READ it back and CHECK. Data is specified  
; as ALTERNATE WORDS of ZEROS then ONES.
```

```
; UNIT: 1  
; DATA: 0,177777  
; COMMAND STRING: SEEK 50 LR WRITE 5,2,2 READ SAME LOOP
```

;8.0 OPERATING MODES/SWITCH SETTINGS:

;8.1 SWITCH SETTINGS

; Location "SWREG" is used to select the program options.  
; This Location will be set according to the answers  
; supplied by the Operator. The Options can be changed  
; or verified by using one of the commands given in Sec.  
; 8.3

;8.2 SWITCH OPTIONS

; Different bits and their interpretation at location  
; "SWREG" is as follows:

BIT	OCTAL VALUE	BINARY VALUE	INTERPRETATION
1	40000 000000	0 1	LOOP on ERROR SKIP LOOPING on ERROR
2	20000 000000	0 1	PRINT to CONSOLE ABORT PRINT OUT to CONSOLE
5	02000 000000	0 1	DO NOT PRINT on the LINE PRINTER PRINT on the BYTE I/O LINE PRINTER(DC17)
16(G)	00000 100000	0 1	DO NOT PRINT on DMA LINE PRINTER PRINT on DMA LINE PRINTER(DC17)

;8.3 SWITCH COMMANDS

; Once the Program starts executing the state of any of  
; the Bits can be changed by Hitting KEYS 1-9, A-Z. The  
; Program will Continue Running after Updating the Options.  
; Each Key will Complement the state of the Bit affiliat-  
; ed with it, thus Bit 4 can be Altered by Hitting Key 4.  
; Setting of any Bit of Location "SWREG" will Set Bit 0.  
; (Default Mode is defined as all Bits of SWREG Set to 0)

;8.4 OTHER COMMANDS (° = CONTROL KEY)

; "CR" A "RETURN" can be typed to Continue the Program  
; after its locked in a Switch Modification Mode  
; °D This Command given at any time will reset "SWREG"  
; to Default Mode and Restart the Program.  
; °R This Command given at any time will Restart the  
; Program. Switches are left with the values they  
; had before the Command was issued.  
; °O This Command given at any time will cause the  
; Program Control to go to ODT.  
; M This Command given at any time will print the  
; Current Operating Modes.  
; 0 This Command given at any time will lock the  
; Program into Switch Modification Mode where  
; more than 1 Bit can be changed.

```

;9.0 OPERATING PROCEEDURE/OPERATOR INPUT:
;
; A. Verify drive (s) are ready on-line
; B. Load Program
; C. To RUN other than TEST 500, Enter CONTROL "0"
; at 9.2, Enter STARTING ADDRESS followed by an "R"
;
; STARTING ADDRESS (SA)
; 200 Read Unit Characteristics and then Run FORMATTER (500)
; 500 FORMATTER PROGRAM
; 501 FORMATTER PROGRAM
; 502 ERROR LOG RECOVERY
; 503 COMMAND STRING INTERPRETER
;
;9.1 Operator is requested to enter DEVICE CODE of CONTROLLER
; (DEFAULT 27)
;9.2 Operator is requested to SET SWPAK followed by a Carriage
; Return (SEE 8.3)
;9.3 MONTH, DAY, YEAR (I.E. 77...), HOUR, & MIN (if [CR] is
; given this routine is bypassed)
;9.4 Unit Numbers, Types, and their Characteristics are then
; Displayed, (The Operator should Verify these values) Operator
; is then requested to enter UNIT NUMBERS to be tested(0-3)
;9.5 Operator is then requested to enter TYPE of disk ( to create a
; User Defined enter 10)
;
; A. If TYPE entered is 10, enter 0, 1, 2, or 3 to
; RE-DEFINE a disk TYPE
;
; B. # of HEADS for NEW TYPE (in DECIMAL)
;
; C. # of CYLINDERS for NEW TYPE (in DECIMAL)
;
; D. # of SECTORS for NEW TYPE (in DECIMAL, CANNOT be
; DOWNSIZED)
;
; E. Return to 9.5
;
; OPERATOR INPUT CONTROLLED PRINTOUTS ARE AS FOLLOWS:
;
; L = First 200. DATA, or ADDRESS ERRORS.

```

;10.0 DEBUG HELP:  
;  
;OCTAL DEBUGGER (ODT)  
;

; This Formatter is equipped with a built in ODT which can be  
; accessed by hitting CONTROL O at any time during the execution  
; of the Program (after Setting the Parameters). On entering ODT  
; the Address of the Location having the next instruction to be  
; executed will be typed-out.  
;

; The following Conventions are used by the ODT:

- ; ? Pressing any illegal key causes the ODT to respond  
; with a "?".
- ; @ ODT is ready and at your service.

; An ODT Command has the following Format:

[ARGUMENT][COMMAND]

; An Argument may be one of the following:

- ; "EXP" An OCTAL Expression consisting of OCTAL Numbers  
; separated by Plus (+) or Minus (-) signs. Leading  
; Zeros need not be typed.
- ; "ADR" An Address is the same as an Expression except  
; that Bit 0 is neglected.

; A Command is a single teletype character

; The Locations that can be EXAMINED and MODIFIED by the user  
; are called CELLS. These CELLS are of two Types: Internal CPU  
; Cells and Memory Locations. The Command to OPEN one of the  
; Internal Registers is of the form "nA" where n is any OCTAL  
; Expression between 0 and 7.  
;

- ; 0-3 For ACCUMULATORS 0-3
- ; 4 For PC of the next instruction to be Executed in the  
; event of a "P" Command.
- ; 5 CPU and TTO Status  
; BIT INTERPRETATION  
; 15 Status of TTO DONE FLAG  
; 14 Status of INTERRUPTS (ION FLAG)  
; 13 Status of CARRY BIT
- ; 6 Address of the Location having the BREAK POINT (If any)
- ; 7 Instruction at the BREAK POINT Location

; Other Commands to OPEN Cells are:

- ; "ADR"/ Open the Cell and Print its contents
- ; ./ Open the Cell currently pointed to by the Pointer and  
; Print its contents.
- ; +"ADR"/ Add "ADR" to the Pointer, Open the Cell and Print its  
; contents.
- ; -"ADR"/ Subtract "ADR" from the Pointer, Open the Cell and  
; Print its contents.
- ; "CR" The Return Key is used to Close the Open Cell with or  
; without Modification.
- ; "LF" Line Feed is used to Close the Open Cell with or without  
; Modification and to Open the succeeding Cell.
- ; CTRL Close the Open Cell with or without Modification and  
; Open the preceding Cell.
- ; / Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents.
- ; +"ADR"/ Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents + "ADDR".
- ; -"ADR"/ Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents - "ADR".

; Modification of a Cell:

; Once a Cell has been opened its contents can be Modified by  
; typing the New Value the Cell is to contain in the form of  
; an OCTAL Expression followed by "CR" or "LF". If a + or - is  
; typed as the first character of the Expression then the Value  
; of the Expression is Added to or Subtracted from the Old  
; contents of the Cell. The Address itself or an Expression  
; relative to the Address can be Deposited by typing a "." or  
; ",+/-OCTAL Expression". A Rubout Command given right after  
; opening a Cell allows the Modification of its contents as if  
; they were typed in just before the Command was issued.

; Other ODT Commands:

; RUBOUT This Key is used to Delete ERRONEOUSLY typed digits.  
; Each time the Key is pressed the right most digit is  
; Deleted and Echoed on the Terminal. If the Rubout  
; Key is pressed right after opening a Cell then it  
; Deletes the right most digit of the Cells contents.  
; This allows the Modification of the Cell as if its  
; contents were typed in just before the Key was pressed.

; "ADR"B Insert a BREAK POINT at Location "ADR".  
; Only one Break Point can be inserted and any entry to  
; ODT after Executing a Break Point will cause it to be  
; Deleted.

; D Delete the Break Point if any.

; P Restart the Execution of the program at CURRENT Location

; "ADR"R Start Executing the program at "ADR" after an IORST.

; K Kill the String typed so far. The ODT responds with a  
; "?" and the Open Cell is closed without Modification.

; = Print the OCTAL Value of the INPUT only.

; This will Close any Open Cells without Modification and  
; will not Open a Cell

; NOTE: In Programs which RELOCATE THEMSELVES the  
; user should place Break Points ONLY in the  
; ORIGINAL PROGRAM AREA. If a Break Point is  
; placed outside this area the results will  
; be unpredictable.

;11.0 SPECIAL NOTES/SPECIAL FEATURES:

; The Program is INOT! a Maintenance Program and assumes  
; the HARDWARE to be in working order.

;12.0 PROGRAM RUNTIME:

; Runtimes are dependant on Drive Size and Drive Type.

.EOT





APPENDIX G

G.0 DIAGNOSTIC PROGRAM DETAILS



\*\*\*\*\*

DESCRIPTION: SCZ-2 DISK CONTROLLER DIAGNOSTIC

Product of ZETACO, 1987

\*\*\*\*\*

.TITL SCZ2D  
.DUSR X=1  
.NOMAC X

1.0 PROGRAM NAME: SCZ2D.SR

2.0 REVISION HISTORY:

REV. DATE

01 09/29/87 ; INITIAL RELEASE (4)

3.0 MACHINE REQUIREMENTS:

NOVA/ECLIPSE FAMILY CENTRAL PROCESSOR  
MINIMUM of 16K READ/WRITE MEMORY  
SCZ-2 DISK CONTROLLER  
0-3 DISK DRIVES  
TELETYPE or CRT and CONTROL

4.0 TEST REQUIREMENTS: N/A

5.0 SUMMARY:

The SCZ-2 DISK CONTROLLER DIAGNOSTIC PROGRAM is a  
HARDWARE DIAGNOSTIC for the SCZ-2 DISK CONTROLLER  
and DRIVES. The Device Code may be 20-76 OCTAL  
with the Default being 27.

6.0 RESTRICTIONS:

NONE

7.0 PROGRAM DESCRIPTION/THEORY OF OPERATION:

7.1 "A" TESTS CHECK:

- BUSY, DONE, I/O BUS SELECT LOGIC  
- DISK SELECT LOGIC

```

; 7.2 "B" TESTS CHECK:
;
; - START, BUSY, CLEAR LOGIC
; - RECALIBRATE, ATTN, INTERRUPT LOGIC
; - INTERRUPT DISABLE, INTA LOGIC
; - That SEEKS to CYL'S 0,1/2 CYL MAX, and CYL MAX
;   can at least be EXECUTED and SET DRIVE BUSY.
; - READY/SELECT LOGIC
;
; 7.3 "C" TESTS CHECK:
;
; - That the CA REGISTER INCREMENTS properly
;   VIA DCH
; - That a WRITE can be EXECUTED
; - SELD, CLEAR LOGIC
; - That SEEK/WRITE Operations can be EXECUTED
; - WRITES to Different HDS, SECTORS
; - MULTI-SECTOR WRITES
; - The INCREMENT HEAD LOGIC
; - ILLEGAL SECTOR, SURFACE, CYLINDER Conditions
;
; 7.4 "E" TESTS CHECK:
;
; - That a READ may be EXECUTED
; - 8 SECTOR WRITE/READ OPERATIONS (9 Different
;   Data Patterns) at CYL'S 0,1/2 CYL MAX and CYL MAX
;   with Full Core Compare
; - Data VERIFY Function (Normal and with Forced Errors)
; - OFFSET MODES
; - ILLEGAL COMMAND TRAPS
; - WRITE CYL# to HEAD 0, SECTOR 0 of All Cylinders
; - WRITE HEAD # to SECTOR 0 of All Heads on CYL 0
; - WRITE SECTOR # to All Sectors of Head 0, CYL 0
; - Each of the above Operations is followed by
;   a Corresponding READ/CHECK Operation to Verify
;   Disk Addressing Logic.
;
; 7.5 "S" TESTS ARE SEEK EXERCISERS
;
; - Performs RANDOM SEEKING. Each SEEK is Followed
;   by a Read to Head 0, Sector 0
;
; - Performs RANDOM OVERLAPPED SEEKING to TWO DRIVES.
;   Each SEEK is Followed by a Read to Head 0, Sector 0.
;   U1 is the the Primary Unit under Test and U2
;   is the next Drive found in a 1,2,3,0 ETC. Search.
;   If only 1 Drive, Test is Bypassed. Test is only run
;   after a Pass is Achieved on All Drives.

```

; 8.0 OPERATING MODES/SWITCH SETTINGS:

;8.1 SWITCH SETTINGS

; Location "SWREG" is used to select the program options. This  
; Location will be set according to the answers supplied by  
; the Operator. The Options can be changed or verified by  
; using one of the commands given in Sec. 8.3.

;8.2 SWITCH OPTIONS

; Different bits and their interpretation at location  
; "SWREG" is as follows:

BIT	OCTAL VALUE	BINARY VALUE	INTERPRETATION
1	40000 000000	0 1	LOOP on ERROR SKIP LOOPING on ERROR
2	20000 000000	0 1	PRINT to CONSOLE ABORT PRINT OUT to CONSOLE
3	10000 000000	0 1	DO NOT PRINT % FAILURE PRINT % FAILURE
5	02000 000000	0 1	DO NOT PRINT on the LINE PRINTER PRINT on the BYTE I/O LINE PRINTER(DC17)
6	01000 000000	0 1	DO NOT HALT on ERROR HALT on ERROR
8	00200 000000	0 1	N/A RECALIBRATE during SCOPE LOOP
9	00100 000000	0 1	N/A 1 SECOND DELAY during SCOPE LOOP
10(A)	00040 000000	0 1	N/A PRINT TEST #'S on all passes
11(B)	00020 000000	0 1	N/A PROGRAM will EXIT to ODT, SWT is Set to 0 upon EXIT
16(G)	00000 100000	0 1	DO NOT PRINT on the DMA LINE PRINTER PRINT on the DMA LINE PRINTER(DC 17)

;8.3 SWITCH COMMANDS

; Once the Program starts executing the state of any of  
; the Bits can be changed by Hitting KEYS 1-9, A-Z. The  
; Program will Continue Running after Updating the Options.  
; Each Key will Complement the state of the Bit affilia-  
; ted with it, thus Bit 4 can be Altered by Hitting Key 4.  
; Setting of any Bit of Location "SWREG" will Set Bit 0.  
; (Default Mode is defined as all Bits of SWREG Set to 0)

```

;
; 8.4 OTHER COMMANDS (° = CONTROL KEY)
;
; "CR" A "RETURN" can be typed to Continue the Program
; after its locked In a Switch Modification Mode
;
; °D This Command given at any time will reset "SWREG"
; to Default Mode and Restart the Program.
;
; °R This Command given at any time will Restart the
; Program. Switches are left with the values they
; had before the Command was issued.
;
; °O This Command given at any time will cause the
; Program Control to go to ODT.
;
; M This Command given at any time will print the
; Current Operating Modes.
;
; 0 This Command given at any time will lock the
; Program into Switch Modification Mode where
; more than 1 Bit can be changed.
;
; 9.0 OPERATING PROCEEDURE/OPERATOR INPUT:
;
; 9.1 Load the Program
;
; 9.2 STARTING ADDRESSES
; 200-To IDENTIFY DISK TYPE (INITIALIZE)
; PROGRAM then PROCEEDS to 500.
; 201-ODT DIRECT ENTRY ONLY
; 202-RANDOM SEEK EXERCISERS. (1 PASS of DIAG FIRST)
; SEEK EXER 1 is a SINGLE DRIVE EXERCISER
; SEEK EXER 2 is TWO DRIVE EXERCISER with SEEK OVERLAP
; 500-DIAGNOSTIC (RESTART)
; 501-TIMEOUT FF TEST
;
; 9.3 The Program Prints "PASS" following each
; Complete Pass through the Tests. Random
; Seek Exerciser performs 1000 Seeks
; per "PASS" Message.
;
; 9.4 Device Code of Controller is Requested (27 is Default)
;
; 9.5 Unit Numbers to be Tested are Requested to which the
; Operator Enters the Unit Numbers to be Tested, Separating
; the Individual #'s by a <, > or <Space>.
;
; 9.6 Operator is Requested to Enter 1, if Unit Characteristics
; Displayed are INCORRECT, and Wants to LOOP on Reading them.

```

; 10. PROGRAM OUTPUT/ERROR DESCRIPTION:  
; When an ERROR is Detected the Program Prints the ERROR  
; PC, AC'S 0,1,and 2 at the point of ERROR, the Program then  
; goes into a Scope Loop between the Entries to .SETUP and  
; .LOOP allowing the Operator to Set SWPAK. In General the  
; ERROR PC will point to a Call ERROR.

; The Printout will be of one of the following Formats:

; A. STANDALONE CONTROLLER TEST FAILURES-

; B. STATUS ERRORS

; MODE UNIT # DATA  
; CYL # HEAD # SECTOR #  
; AC1(STATUS) SHOULD =AC0  
; DESCRIPTIONS of FAILING STATUS BITS

; C. MEMORY/DISK ADDRESS ERROR

; MODE UNIT # DATA  
; CYL # HEAD # SECTOR #  
; ENDING MEMORY/DISK ADDRESS ERROR  
; AC1(MA/DA) SHOULD =AC0

; C. INTERRUPT TIMEOUT

; MODE UNIT # DATA  
; CYL # HEAD # SECTOR #  
; INTERRUPT TIMEOUT

; Additional Test Significance can be found in the Program  
; Listing, although it is hoped that a need for the Listing  
; will be Minimal. SWPACK(SWREG) will provide all Control  
; over Test Loop Options and Printouts.

; Data Errors will result in the 1st 3 Good/Bad pairs and  
; their Addresses being Printed along with the Total Count.  
; If an ECC Error is Detected, the Call EHECC will  
; Acknowledge the Fact and Return to the Main Test for  
; the Data Compare. Printouts result on the 1st Error Pass  
; only. As the Check Routine Checks the entire Read Buffer,  
; any Error accompanied by an ECC Error, terminating the  
; Read, may cause all Data in succeeding Sectors to appear Bad.

; Tests that perform a Recalibrate have a 2 SEC. Delay built  
; into the Scope Loop. Set SWPAK 9 = 1 to introduce an  
; additional 1 Second Delay during the Scope Loop.

; In General each successive Test Assumes all Previous Tests  
; work. Bypassing Errors can result in confusing situations  
; in the setup of more Complex Tests.

; 11. DEBUG HELP:

; OCTAL DEBUGGER (ODT)

; This Diagnostic is equipped with a built in ODT which can be  
; accessed by hitting CONTROL 0 at any time during the execution  
; of the Program (after Setting the Parameters). On entering ODT  
; the Address of the Location having the next instruction to be  
; executed will be typed-out.

; The following Conventions are used by the ODT:

; ? Pressing any illegal key causes the ODT to respond  
; with a "?".

; @ ODT is ready and at your service.

; An ODT Command has the following Format:

[ARGUMENT][COMMAND]

; An Argument may be one of the following:

; "EXP" An OCTAL Expression consisting of OCTAL Numbers  
; separated by Plus (+) or Minus (-) signs. Leading  
; Zeros need not be typed.

; "ADR" An Address is the same as an Expression except  
; that Bit 0 is neglected.

; A Command is a single teletype character

; The Locations that can be EXAMINED and MODIFIED by the user  
; are called CELLS. These CELLS are of two Types: Internal CPU  
; Cells and Memory Locations. The Command to OPEN one of the  
; Internal Registers is of the form "nA" where n is any OCTAL  
; Expression between 0 and 7.

; 0-3 For ACCUMULATORS 0-3

; 4 For PC of the next instruction to be Executed in the  
; event of a "P" Command.

; 5 CPU and TTO Status

BIT INTERPRETATION

15 Status of TTO DONE FLAG

14 Status of INTERRUPTS (ION FLAG)

13 Status of CARRY BIT

; 6 Address of the Location having the BREAK POINT (If any)

; 7 Instruction at the BREAK POINT Location



; Other Commands to OPEN Cells are:

; "ADR"/ Open the Cell and Print its contents  
; ./ Open the Cell currently pointed to by the Pointer and  
; Print its contents.  
; .+"ADR"/ Add "ADR" to the Pointer, Open the Cell and Print its  
; contents.  
; .-"ADR"/ Subtract "ADR" from the Pointer, Open the Cell and  
; Print its contents.  
; "CR" The Return Key is used to Close the Open Cell with or  
; without Modification.  
; "LF" Line Feed is used to Close the Open Cell with or without  
; Modification and to Open the succeeding Cell.  
; CTRL Close the Open Cell with or without Modification and  
; Open the preceding Cell.  
; / Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents.  
; +"ADR"/ Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents + "ADDR".  
; -"ADR"/ Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents - "ADR".

; Modification of a Cell:

; Once a Cell has been opened its contents can be Modified by  
; typing the New Value the Cell is to contain in the form of  
; an OCTAL Expression followed by "CR" or "LF". If a + or - is  
; typed as the first character of the Expression then the Value  
; of the Expression is Added to or Subtracted from the Old  
; contents of the Cell. The Address itself or an Expression  
; relative to the Address can be Deposited by typing a "." or  
; :,+/-OCTAL Expression". A Rubout Command given right after  
; opening a Cell allows the Modification of its contents as if  
; they were typed in just before the Command was issued.

; Other ODT Commands:

; RUBOUT This Key is used to Delete ERRONEOUSLY typed digits.  
; Each time the Key is pressed the right most digit is  
; Deleted and Echoed on the Terminal. If the Rubout  
; Key is pressed right after opening a Cell then it  
; Deletes the right most digit of the Cells contents.  
; This allows the Modification of the Cell as if its  
; contents were typed in just before the Key was pressed.  
; "ADR"B Insert a BREAK POINT at Location "ADR".  
; Only one Break Point can be inserted and any entry to  
; ODT after Executing a Break Point will cause it to be  
; Deleted.  
; D Delete the Break Point if any.  
; P Restart the Execution of the program at CURRENT Location  
; "ADR"R Start Executing the program at "ADR" after an IORST.  
; K Kill the String typed so far. The ODT responds with a  
; "?" and the Open Cell is closed without Modification.  
; = Print the OCTAL Value of the INPUT only.  
; This will Close any Open Cells without Modification and  
; will not Open a Cell

;  
;  
; 12. SPECIAL NOTES/SPECIAL FEATURES:

; 12.1 If the Disk Pack has media flaws on Cylinder  
; 0, or on the First 8 Sectors of Head 0 of any Cylinder,  
; Error Printouts may result if errors are Encountered.

; 12.2 Some Scope Loops will require a Recalibrate to  
; Initialize the Disk Drive following a failure. Set  
; SWPAK 8 = 1 to Introduce the Recalibrate to the Unit  
; under Test.

; 12.3 DISK DRIVES  
; Only use Disk DRIVES Formatted by the SCZ-2 Formatter  
; Program. The Diagnostic Program will Write over most of  
; the Disk Surface.

; 13. RUN TIME:

; The Run Time for a PASS is approximately: 12 MIN.

APPENDIX H

H.0 RELIABILITY PROGRAM DETAILS



as ALTERNATE WORDS of ZEROS then ONES.

UNIT: 1

DATA: 0,177777

COMMAND STRING: SEEK 50 LR WRITE 5,2,2 READ SAME LOOP

#### E. ERROR COUNT/LOG RECOVERY (SA 504)

In the event a Program was stopped during a run, the Error Logs may be recovered at this Starting Address.

\*\*\*MUST be done before any Program RESTART as Program Initialization Zeroes all Logs.

#### F. RUNALL (SA 505)

Program alternates between the Programs described in 7.B (4 Data Patterns -PAT,RAN,FLZ,FLO) and 7.C(6 Data Patterns -PAT,RAN,ADR,ALT1,ZEROES,ONES) and 7.H, and in that order.

#### G. SEEK EXERCISER (SA 506)

Program provides a SEEK scan sequence converging from the extreme Outermost Tracks into the adjacent track in the center, then diverging again to the extremes.

#### H. RANDOM SEEK EXERCISER (SA 507)

Program provides a Random SEEK sequence

###G,H all SEEKS in G/H are followed by a 1 Sector Read but with no Data Check. All SEEKS are timed with MAX,MIN, and AVE. times being Logged in MS. SEEK Paths for MAX,MIN Values are also Logged.

### 8.0 OPERATING MODES/SWITCH SETTINGS:

#### 8.1 SWITCH SETTINGS

Location "SWREG" is used to select the program options. This Location will be set according to the answers supplied by the Operator. The Options can be changed or verified by using one of the commands given in Sec. 8.3

#### 8.2 SWITCH OPTIONS

Different bits and their interpretation at location "SWREG" is as follows:

BIT	OCTAL VALUE	BINARY VALUE	INTERPRETATION
1	40000	0	LOOP on ERROR
	000000	1	SKIP LOOPING on ERROR
2	20000	0	PRINT to CONSOLE
	000000	1	ABORT PRINT OUT to CONSOLE
4	04000	0	PRINT PASS
	000000	1	DO NOT PRINT PASS
5	02000	0	DO NOT PRINT on the LINE PRINTER
	000000	1	PRINT on the BYTE I/O LINE PRINTER(DC17)
6	01000	0	DO NOT EXIT to ODT on ERROR
	000000	1	EXIT to ODT on ERROR
7	00400	0	**** N/A



```

; 501 RELIABILITY TEST, (OPTIONS)
; 502 INCREMENTAL DISK ADDRESS TEST
; 503 COMMAND STRING INTERPRETER
; 504 ERROR COUNT/LOG RECOVERY
; 505 RUN ALL
; 506 SEEK EXERCISER (CONVERGING, DIVERGING PATTERN)
; 507 SEEK EXERCISER (RANDOM PATTERN)
; 510 MULTIPLE DEVICE CODE ENTRY

;9.1 Operator is requested to enter DEVICE CODE of CONTROLLER
; (DEFAULT 27).
;9.2 STARTING ADDRESS is Displayed and Operator is requested to
; SET SWPAK followed by a Carriage Return (SEE 8.3).
;9.3 Operator is requested to enter YES/NO to Exercise Maps, if
; present and supported.
;9.4 MONTH, DAY, YEAR (I.E. 77...), HOUR, & MINUTE (if [CR] is
; given this routine is bypassed).
;9.5 Unit Numbers, Types, and their Characteristics are then
; Displayed, (The Operator should Verify these values) Operator
; is then requested to enter UNIT NUMBERS to be tested (0-3).
;9.6 Operator is then requested to enter TYPE of disk ( to create a
; User Defined enter 10)
; A. If TYPE entered is 10, enter 0, 1, 2, or 3 to
; RE-DEFINE a disk TYPE
; B. # of HEADS for NEW TYPE (in DECIMAL)
; C. # of CYLINDERS for NEW TYPE (in DECIMAL)
; D. # of SECTORS for NEW TYPE (in DECIMAL, CANNOT be
; DOWNSIZED)
; E. RETURN to 9.6

; ## A [CR] only response to Unit Numbers, will leave Unit
; information in previous state.

; ## A [CR] only response to YES/NO will DEFAULT to NO.
;

; OPERATOR INPUT CONTROLLED PRINTOUTS ARE AS FOLLOWS:

; L = FIRST 100. DATA, or ADDRESS ERRORS
; S = SEEK TIMING STATISTICS (506,507 ONLY)
; W = SECTORS W/R, ERROR COUNTS
;
; **NOTE** Any Character typed will end Printouts at the next
; change of Data Type.

;10.0 PROGRAM OUTPUT/ERROR DESCRIPTION:

; All Errors are Identified, Counted, and the Program is
; routed via base to a call to CKSW. on the basis of Switch
; Settings (SEE 8.2) The Program will go into a scope loop,
; or proceed, depending on the SWPAK Settings.

; Upon loss of Ready and a Single Drive, the Program will
; print the appropriate Error Message and will not proceed
; until Ready is returned. If Multiple Drives exist, The
; Program will continue with the remaining Drives. If the
; down Drive is placed back On-line, the Program will resume
; Testing of that Drive. The above also applies to the loss
; of Write enable if the Program is in a Write Mode.

; RECALIBRATE - Any unusual Status is reported immediately
; and an Error Return executed.

```

```

;10.1 SEEK - Positioner Fault Status Increments Seek Error
; Counter. Any Error Status results in Status Printout and
; Error Return. A Recalibrate will be performed by the Error
; Handler. Program will Log the first 20. Cylinders TO/FROM
; on finding Seek Errors.

;10.2 WRITE - Following "DONE" on a Write, Errors are checked in
; the sequence shown below. Error recovery procedure is
; outlined for each case. If the Error is not present the
; next Check is made.

; Drive Status (DIB) is Checked 1st for both Read and Write
; before any DIA Checks are made.
;
; 1. READ/WRITE TIMEOUTS, DATA LATE, ILLEGAL SECTOR, PARITY,
; DATA VERIFY, or any DRIVE FAULTS- Increment the appropriate
; Error Count, Print the Illegal Status and do an Error Return.
; Any Drive Fault will cause a Recalibrate to be performed by
; the Error Handler.

; 2. ADDRESS ERROR- Repeat the Write, if Test Passes the
; second time, increment the Soft Address Error Count and do
; a Normal Return; otherwise increment the Hard Address Error
; count and do an Error Return.

; If a Hard Cylinder Address Error occurs, a Read on an
; adjacent Head will be attempted to determine whether the
; Fault should be classed as a Seek Error or an Address Error.
; The First 20. Address Errors will have their Addresses Logged.
;
; 3. BAD SECTOR- Log the Disk Address (1st 100.) and do a Normal
; Return. No Printout will result, although the I/O Operation
; was prematurely terminated. A "SOFT" Error will be Recorded
; if the Sector under Test Passes at Least 1 of 4 Retrys. The
; Log denotes SOFT Errors by a count greater than 0,
; representing the Error Count tallied. ***SEE 10.3A.

; 4. ENDING MEMORY ADDRESS - Increment the Memory Address Error
; Count, Print the Error Message, Check for a Disk Address Error
; and do an Error Return.

; 5. ENDING DISK ADDRESS - Increment the Disk Address Error
; Count, Print the Error Message, and do an Error Return.

;10.3 READ - All Read Errors with the exception of Data related
; Errors are handled the same as described for the Write
; Operations.

; DATA ERRORS - Data is REREAD 3 X (4X if ECC UNDETECTED) if
; Program is in Write/Read Mode and Data is Bad all 4 tries,
; A Hard Error Count is incremented and an Error Return is
; taken. If Data is Good on any of Four tries, a Soft Error
; Count is incremented and a Normal Return is taken.

; If the Program is in a Read ONLY Mode (IE. Read Mode for any
; 502 Program or when 505 is running a 502 Program), the Data
; will be REREAD an additional 4 times in both Offset Forward
; and Offset Reverse Modes before the Problem is classed as a
; Hard Error.

; Thus Total retries for a Hard ECC Detected Error in a Read
; ONLY Mode is 12 (13 for ECC UNDETECTED), and 4 if in a
; Write/Read Mode (5 if ECC UNDETECTED). ***SEE 10.3A

```



; Printed and Logged. The Disk Addresses of all Data problems  
; will be Printed and the First 100. will be Logged. The First  
; Three Good/Bad word pairs and respective Addresses will be  
; Printed.

; If SWPAK9=1 (Bypass Data Check) Hard or Soft Data Errors  
; will be determined by ECC Status.

### ;10.3A ECC (ERROR CORRECTION CODE) ANALYSIS

; All Read Passes including retries will have the ECC results  
; Logged as per the following 4 Categories:

; 1. ECC CORRECTED -The ECC detected and successfully  
; corrected the DATA ERROR.

; 2. NON-CORRECTABLE ECC -The ECC detected and CORRECTLY  
; diagnosed the Error Pattern as UNCORRECTABLE.

; 3. ECC UNDETECTED -The ECC Failed to detect a Data Error.  
; This may be a Malfunction of the ECC Logic, but it is  
; more likely one of the following problems:

; A Failure of the Drive to Write a Sector.

; A Failure in the Controller Data paths.

; 4. ECC FAILED -Two Conditions may fall into this Category.

; 4A. An ECC Error was detected but with no Accompanying  
; Data Error. A Check is made to see whether the ECC Words  
; point to an Error within the two Appended Write ECC Words.  
; If such an Error is determined to be the case, the Error  
; will be Logged as Correctable and no ECC Failed message  
; will result. This type of Error should represent only a  
; very small Percentage of the Data Errors (<1%- Large  
; Sample). If a Significantly Higher Percentage of this  
; Error results, Then an ECC Problem would be Indicated.

; If the ECC does not point to the two Appended Write ECC  
; Words, then an ECC Failed message (1st Pass only) will  
; result and the Actual ECC Words Read from the Controller  
; will be printed.

; 4B. An ECC Error was detected, but the ECC either Failed  
; to Correct a Correctable Error, or tried to Correct an  
; Uncorrectable Error. These Conditions (Possibly caused  
; by Problems other than ECC) will result in a printout  
; (1st Pass only) of the Simulated Write and Simulated  
; Read ECC Words plus the Actual Read ECC Words as Read  
; from the Controller.

; The Simulated Write ECC Words are the result of a  
; Program Simulation of the ECC Logic on what the Program  
; believes to be the Write Data (A Write Error will cause  
; this Assumption to be False), and represents what the  
; Program believes should have been written as the Actual  
; two Write ECC Words on the Disk.

; The Simulated Read ECC Words are the result of another  
; Program Simulation of the ECC Logic on the Read Data  
; in Memory, and represent what the Program believes  
; should be Read from the Controller as the two ECC  
; Words. The Actual Read ECC Words are those two Words

```
; as Read from the Disk Controller.
;10.4 ERRORS- Error Status is printed whenever encountered
; as follows:
; 'MODE' UNIT: 'N'
; CYL- 'N' HEAD 'N' SECT 'N' #SECT 'N'
; DIA/DIB STATUS= 'N' 'DESCRIPTIVE MESSAGE'
```

```
; Where CYL, HEAD, SECT refer to the final Disk Address at
; the point of Error, and #SECT refers to the Number of
; Sectors already done in the Multiple Sector Transfer.
```

```
; When Data Errors are found, only THREE are printed per
; encounter plus the Total Number of Errors.(See PARA 5)
; If the Data Error is ECC UNDETECTED and the System is
; Mapped, the Map, Physical 1K Address, and the DCH
; Logical Addresses are also printed.
```

```
; When Looping is Involved (Retried or for Scoping)
; Status is printed on the 1st Pass only.
```

;10.5 STATISTICS -

```
; Type a W during random testing to get a Report of the
; Number of Sectors Written(and/or)Read, plus Error Counts
; in Decimal.
```

```
; Type L for First 100. Disk Addresses of Bad Sectors and
; Data Errors, and First 20. of Address Errors and Seek
; Errors (Seek Path). If Error Addresses are encountered
; more than once (1st Pass), a Count of up to 32. will be
; recorded in the Log. Also a Count of up to 15. Hard Errors
; will be recorded. This Count will be A subset of the the
; first Count.
```

```
; The Address Information will be in OCTAL while the Counts
; will be DECIMAL.
```

```
; Type S for Seek Timing Statistics if running either Seek
; Exerciser.
```

,11.0 DEBUG HELP:

;OCTAL DEBUGGER (ODT)

; This Reliability is equipped with a built in ODT which can be  
; accessed by hitting CONTROL 0 at any time during the execution  
; of the Program (after Setting the Parameters). On entering ODT  
; the Address of the Location having the next instruction to be  
; executed will be typed-out.

; The following Conventions are used by the ODT:

; ? Pressing any illegal key causes the ODT to respond  
; with a "?".

; @ ODT is ready and at your service.

; An ODT Command has the following Format:

; [ARGUMENT][COMMAND]

; An Argument may be one of the following:

; "EXP" An OCTAL Expression consisting of OCTAL Numbers  
; separated by Plus (+) or Minus (-) signs. Leading  
; Zeros need not be typed.

; "ADR" An Address is the same as an Expression except  
; that Bit 0 is neglected.

; A Command is a single teletype character

; The Locations that can be EXAMINED and MODIFIED by the user  
; are called CELLS. These CELLS are of two Types: Internal CPU  
; Cells and Memory Locations. The Command to OPEN one of the  
; Internal Registers is of the form "nA" where n is any OCTAL  
; Expression between 0 and 7.

; 0-3 For ACCUMULATORS 0-3

; 4 For PC of the next instruction to be Executed in the  
; event of a "P" Command.

; 5 CPU and TIO Status

; BIT INTERPRETATION

; 15 Status of TIO DONE FLAG

; 14 Status of INTERRUPTS (ION FLAG)

; 13 Status of CARRY BIT

; 6 Address of the Location having the BREAK POINT (If any)

; 7 Instruction at the BREAK POINT Location

; Other Commands to OPEN Cells are:

; "ADR"/ Open the Cell and Print its contents

; ./ Open the Cell currently pointed to by the Pointer and  
; Print its contents.

; .+"ADR"/ Add "ADR" to the Pointer, Open the Cell and Print its  
; contents.

; .-"ADR"/ Subtract "ADR" from the Pointer, Open the Cell and  
; Print its contents.

; "CR" The Return Key is used to Close the Open Cell with or  
; without Modification.

; "LF" Line Feed is used to Close the Open Cell with or without  
; Modification and to Open the succeeding Cell.

; CTRL Close the Open Cell with or without Modification and  
; Open the preceding Cell.

; / Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents.

; +"ADR"/ Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents + "ADDR".

; -"ADR"/ Close the Open Cell without Modification, and Open the  
; Cell pointed to by its contents - "ADR".



; MAPPED ODT COMMANDS

; In addition to the previously listed ODT Commands, there  
; is available a Command Set that allow Map Translations for  
; Debugging purposes.

; Map Command Format

; The Letter "M" is used to specify a Map Command and is  
; used in conjunction with the Set of Characters that form  
; the Map Command Group. A Map Command is thus formed by  
; using the Letter "M" and following it with the desired  
; Command Letter (Such as "MT", "MA", ETC.)

; Map Command Errors

; If a Map Command is entered and the Error Message "No Map"  
; appears, then either:  
; A) A Map was not found  
; B) The Program does not support Mapped ODT.

; Map Commands

; Note: All Map Commands must be preceded by an "M" to  
; indicate that they are Map Commands.

; "A" Enable User "A" Map Translations  
; "B" Enable User "B" Map Translations  
; "M" Enable Map Translations with the last "User"  
; "U" Disable Mapping  
; "L" Map Supervisor Last Block  
; "E" Print Single Map Entry  
; "T" Print Map Entry Table

; 12.0 SPECIAL NOTES/SPECIAL FEATURES:

; 1. A CR only response to Unit Numbers, ETC will leave  
; Information In Previous State.

; 2. The Program will Account for up to a MAX. of  $2^{31}$  Sectors  
; Written or Read. Special Test runs exceeding this facility  
; will require an OPERATOR'S TEST LOG to augment software  
; accounting.  $2^{31}$  Sectors = Approx.  $2 \times 10^9$  Words.

; 4. SWPAK7=1, Program halts after write with Read Verification  
; allowing operator to change packs. SWPAK8=1, Puts Program Into  
; Read only mode ## SA'S 501,502 Only. If SA 501-Data must !NOT!  
; be Variable. Start at the above selected Address.

; 5. All Numbers entered in 7.0 must be in Octal. Any Non-Octal  
; Input is treated as a Letter. Any Letter Input for CYL, HEAD,  
; SECTOR, or # of SECTORS gets Random function in the Reliability  
; Test with Options.

; 6. At times the ECC may attempt to Correct a Non-Correctable  
; Data Error and the Simulated ECC and Actual ECC will Match  
; even though an ECC Failure will have been Printed. This is  
; Due to a Failure of the ECC Polynomial itself to Distinguish  
; between two different Error Patterns. One Correctable and one  
; Uncorrectable. This is !NOT! a Hardware Failure.

; 13.0 PROGRAM RUNTIME:

; Program Runtimes are substantially reduced with Memories of  
; 16K or Larger. Program can use up to 24K using 2 Buffers  
; and up to 32K using 4 Buffers in the Random Reliability  
; Tests.

; Runtime is defined as Time from Start to a "PASS" Message.  
; Typical runtime for a Read only or Write only Pass of SA  
; 502 (Incremental Disk Address Test) is Approx. 3 and 1/2  
; Minutes with a Nova 800 (or Faster CPU) with at least 24K  
; of Memory, and 96 Megabyte.

\*\*\*\*\*

DESCRIPTION: SCZ-2 DISK CONTROLLER RELIABILITY PROGRAM

Product of ZETACO, 1987

\*\*\*\*\*

.TITL SCZ2R  
.DUSR X=1  
.NOMAC X

1.0 PROGRAM NAME: SCZ2R.SR

2.0 REVISION HISTORY:

REV. DATE

01 09/29/87

; INITIAL RELEASE (5)

3.0 MACHINE REQUIREMENTS:

NOVA/ECLIPSE FAMILY CENTRAL PROCESSOR  
16K READ/WRITE MEMORY  
SCZ-2 DISK CONTROLLER  
0-3 DISK DRIVES  
TELETYPE or CRT and CONTROL

4.0 TEST REQUIREMENTS: N/A

5.0 SUMMARY:

The SCZ-2 DISK CONTROLLER RELIABILITY PROGRAM is a MAINTENANCE PROGRAM designed to EXERCISE and TEST the SCZ-2 DISK SUB-SYSTEMS and 1-4 DISK DRIVES.

The Device Code may be 20-76 OCTAL with the Default being 27.

```

;6.0  RESTRICTIONS:
;
;      NONE
;7.0  PROGRAM DESCRIPTION/THEORY OF OPERATION:
;
;      A. RELIABILITY TEST (SA 500)
;
;      A Random Number Generator is used to select a Disk Drive,
;      Cylinder, Head, Beginning Sector, and Number of consecutive
;      Sectors. Random Data is then Generated, Written, and Read.
;      The Sequence is repeated Indefinitely. If running Multiple
;      Units, Over Lapped SEEKS are employed, If the next Random
;      Unit is different from the current Unit under I/O Execution.
;
;      B. RELIABILITY TEST (SA 501) with OPTIONS
;
;      Same as A, Except that Operator is given Options on Data
;      Patterns and may choose a Constant Cylinder, Head, Sector
;      or # or Sectors. Any Letter response to CYL, HEAD ETC.
;      gets Random function for that Variable. A Carriage Return
;      only gets the Random function for all Variables.
;
;      The Operator is also asked to respond to JITTER OPTION
;      (YES/NO). If YES, a Random Delay(0-40,50MS) is inserted
;      into the Background Loop to create a more asynchronous
;      Disk I/O Loop.
;
;      C. INCREMENTAL DISK ADDRESS TEST (SA 502)
;
;      Operator is given Option on Data; Requested Data is first
;      Written (SEE SWPAK10) over the entire Pack. Then the Data
;      is Read from all Sectors . This insures that all Disk
;      Blocks are useable and are Formatted properly. The Test
;      is then repeated for all Ready Disks, and PASS is Printed.
;      The sequence is repeated Indefinitely.
;
;      #NOTE
;      SWPAK7=1, Program waits after Write with Read Verification
;      allowing Operator to change Packs. SWPAK8=1, puts Program
;      into Read ONLY Mode ## SA'S 501,502 ONLY. If SA 501-Data
;      must INOT! be Random.
;
;      All Numbers entered above must be in Octal. Any Non-Octal
;      input is treated as a letter. Any letter input for CYL, Head,
;      Sector, or # of Sectors gets Random function in the Reliability
;      Test with Options.

```



D. COMMAND STRING INTERPRETER (SA 503)

As a trouble shooting aid the service engineer may type in their own TEST LOOP. After starting at 503, three ARGUMENTS must be entered in response to three program questions; "UNIT", "DATA", and "COMMAND STRING". All numbers must be entered in OCTAL.

I. UNIT: Type unit # or carriage return to use the previous entry

II. DATA: RAN=RANDOM  
ALO=ALL ONES  
ALZ=ALL ZEROS  
PAT=155555 PATTERN  
ROT=155555 PATTERN Rotated on Successive Passes.  
FLO=FLOATING ONE PATTERN  
FLZ=FLOATING ZERO PATTERN  
ADR=ALTERNATING CYLINDER and HEAD, SECTOR WORDS  
VAR=Existing words entered previously as described below

Alternatively enter a string of up to 7 OCTAL 16 bit words to be used as DATA. The words entered are used repeatedly to make up a sector block. Type carriage return to use the previous entry.

III. COMMAND STRING:

OPTIONS 1. READ HEAD, SECTOR, #SECTORS  
2. WRITE SAME  
3. SEEK CYLINDER  
4. RECALIBRATE  
5. LOOP (go to beginning or LR)  
6. DELAY N (N=DELAY in MS)  
7. TRESPASS  
8. RELEASE  
9. OFF (OFFSET FORWARD)  
10. OFR (OFFSET REVERSE)  
11. LR (begin LOOP here)  
12. VERIFY (WRITE)  
13. Type Carriage Return to use the previous COMMAND STRING.

Note that either SPACES or a COMMA may be used as an argument delimiter. Each response is terminated by typing carriage return. If more room is needed on a line, type line feed to space to the next line. The word "SAME" used with READ, or WRITE, will cause the previous disk address parameters to be used.

An R typed while a string is being executed will cause the program to return to command string start. The ESCAPE KEY will bypass UNIT and DATA prompts to the command string prompt.

The following example would cause UNIT 1 to SEEK CYLINDER 50, then repeatedly WRITE SECTORS 2 and 3 of HEAD 5, then