Model SCZ-2DP

SCSI Disk Controller

Technical Manual

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1-800-537-5292.

Preface

This manual contains information regarding installation, testing, and operation of the ZETACO SCZ-2DP SCSI Disk Controller. The technical contents have 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 the following chapters:

Chapter 1 - Product Overview

Describes the SCZ-2DP Disk controller features, capabilities, specifications, power and interface requirements.

Chapter 2 - Installation Procedures

Describes and illustrates the procedures required to install the SCZ-2DP.

Chapter 3 - Trouble-shooting

Contains information useful in analyzing subsystem problems and how to get help.

Chapter 4 - Programming Notes

A detailed description of the assembly level programming characteristics of the SCZ-2DP.

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Product Overview

1.0 Introduction

ZETACO's SCZ-2DP Disk Controller combines Zebra-emulating capability with the Small Computer Systems Interface (SCSI), to result in an advanced technology disk subsystem for the Data General Nova 3 and 4 and 16-bit Eclipse processors running the RDOS Operating System.

The SCZ-2DP has been implemented on a single 15" x 15" 6-layer printed circuit board, with a paddleboard to route signals to and from the disk drives. The SCZ-2DP is compatible with FCC hardened chassis requirements, and interfaces with DG's data channel.

1.1 Specifications

Functional

Drives per Controller:	Max of 4 SCSI drives.
Recording Format:	Media format is drive vendor unique.
Data Transfer Rate:	Up to 1.5 MB per second (Async.)
Maximum Capacity:	The theoretical maximum capacity supported by a single SCZ-2DP is 2 gigabytes. The maximum for a single drive is 536.8 MB.
Device Code:	Switch selectable
Interrupt Priority Mask Bit:	Bit 7

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

Data Channel Interface: Selectable throttle rate from 1 word to
                              128 words per burst

Sector Data Field: 256 16-bit words per sector

Data Buffering: Two 256-word buffers in a ping-pong
                              configuration

Memory Address: 16 bits

Indicator Lights: RED   Self-Test
                              GREEN   Controller Busy
                              YELLOW   SCSI interface not busy

The SCZ-2DP is designed to operate with the Data channel in any
MEM I/O or I/O slot of a Nova or Eclipse computer.

Disk Drive   Functional: SCSI Interface single-ended Asynchronous
Interface
                    Cabling: *Chassis with Bulkhead*

                                  Internal: Optional 50-conductor flat ribbon cable
                                                 with D connector on one end that
                                                 mounts in the computer EMI/RFI
                                                 backpanel. The other end plugs into the
                                                 A paddleboard.

                                  External or
                                  non-bulkhead
                                  Chassis: Contact ZETACO with your cabling
                                                 requirements.

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

SCSI
Implementation

The SCZ-2DP Controller acts as a host adapter and interfaces to the drive(s) via the industry standard interface known as the Small Computer System Interface (SCSI). The controller adheres to the specifications imposed by ANSI for single ended applications (differential SCSI is not supported).
The SCZ-2DP Controller acts as a host adapter. The handshaking is accomplished by discrete logic as opposed to using a SCSI protocol VLSI IC. The signals are connected to the Host Adapter through the backplane pins and a paddleboard.

A disk subsystem using the SCZ-2DP may be configured with either a single controller or two controllers on the SCSI bus. The SCZ-2DP is jumper selected for SCSI ID 6 or 7. In dual initiator configurations, one controller must be set for ID 6 and the other for ID 7. A maximum of four drives may be run on the bus.

Although the SCZ-2DP was designed to function as a pair of these controllers on the SCSI bus, The SCZ-2DP does meet the required SCSI specifications for arbitration and may work with other SCSI bus controllers providing they adhere to some rules. For any other initiator to work with the SCZ-2DP on the same bus, the initiator must:

1. Not allow drive disconnects/reconnects.
2. Support the SCSI commands Reserve and Release.
3. Be configurable to a SCSI id of 6 or 7.
4. Be properly terminated.

In order for proper system operation the SCSI bus must be terminated at each end of the bus with 220/300 ohm resistor packs. See Section 2.3 for details.

The pin-outs for both the backplane paddleboard and the cable to the drive (as defined by SCSI spec.) are defined by Table 1.1.

TABLE 1.1   *Paddleboard Pin-Out Assignment*

(I) = signal originates from Host Adapter (Initiator)
(T) = signal originates from target drive
(I/T) = signal is bi-directional

SIGNAL NAME	BACKPLANE PIN #		SCSI CABLE PIN #	
-DB0 (I/T)	I	A49	I	2
-DB1 (I/T)	I	A59	I	4
-DB2 (I/T)	I	A61	I	6
-DB3 (I/T)	I	A63	I	8
-DB4 (I/T)	I	A65	I	10
-DB5 (I/T)	I	A67	I	12
-DB6 (I/T)	I	A69	I	14
-DB7 (I/T)	I	A71	I	16
-DBP (I/T)	I	A73	I	18
GND	I	A75	I	20
GND	I	A76	I	22
GND	I	A77	I	24
TERM PWR (I)	I	A78	I	26
GND	I	A79	I	28
GND	I	A81	I	30
-ATN (I)	I	A83	I	32 N.U.
GND	I	A84	I	34
-BSY (T)	I	A85	I	36
-ACK (I)	I	A86	I	38
-RST (I)	I	A87	I	40
-MSG (T)	I	A88	I	42 N.U.

-SEL (I)	I	A89	I	44
-C/D (T)	I	A90	I	46
-REQ (T)	I	A91	I	48
-I/O (T)	I	A92	I	50

Backplane pin-out A47, A57, A75, A76, A77, A79, A81, and A84 will be grounded by the SCZ-2DP.

All odd pins, except pin 25 (pin 25 must be open), will be grounded by the paddleboard.

Mechanical

Dimensions: 15" x 15" x 1/2" (38.1 x 38.1 x 1.27 cm)

Ship Weight: 10 pounds (4.5 kg) - includes controller, paddleboards, cables (if ordered), software tape and documentation.

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

Power Requirements

+5 ($\pm$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/Nova temperature and humidity specifications.

Installation

2.0 Unpacking and Inspection

The following items are shipped standard with each SCZ-2DP:

	ITEM	P/N
A)	SCZ-2DP Controller with Cover	500-490-00
B)	"A" Paddleboard	500-464-00
C)	Software Support Package (9-track magnetic tape)	400-452-00
D)	Technical Manual	600-490-00

In addition, the following optional disk cables may be ordered with the Controller:

1.	Internal Backplane-to-Bulkhead Cable Assembly	300-148-00

Contact ZETACO with your external bulkhead-to-drive requirements.

Upon receipt of the Model SCZ-2DP from the carrier, inspect the shipping carton immediately for any evidence of damage or mishandling in transit.

If the shipping carton is 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 carton is opened.

ZETACO's warranty does not cover shipping damage. For repair or replacement of any ZETACO product damaged in shipment, call ZETACO, Inc. to obtain return authorization instructions.

2.1 Before You Begin

This section contains the procedures necessary for proper installation and configuration of the SCZ-2DP Disk Controller. We recommend that you read through it once in its entirety before you start the actual installation process.

The following subsections, beginning with 2.3, are in order of execution. Subsections 2.3 through 2.7 involve preparation and installation of the hardware components. Subsections 2.8 through 2.10 describe the programs used to complete the installation. These programs are on the Software Support Tape, the 1/2" magnetic tape reel shipped with the SCZ-2DP.

System Hardware Requirements

a) Eclipse or Nova CPU.
b) Magnetic Tape Subsystem
c) SCZ-2DP Controller Board(s)
d) SCSI Disk Drive
e) Console at Device 10/11

You should have complete hardware documentation for your computer and disk drive available for reference during the installation.

The Software Support Tape

Each of the programs on the Software Support Tape has been written by ZETACO specifically for the SCZ-2DP Controller. Use this tape for Media Formatting, Disk Diagnostic and Reliability. **DG's corresponding programs may not work on this controller.**

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

Files 0 and 1 contain the software that enables you to boot from the tape and select the particular program you want loaded into the system. The boot procedure is detailed in Section 2.8.

2.2 Preparing the Computer Chassis

Before installing the SCZ-2DP, the computer chassis must be prepared. To do so, choose an available I/O or MEM I/O slot and establish the correct priority.

FIGURE 2.1 SCZ-2DP Board Layout
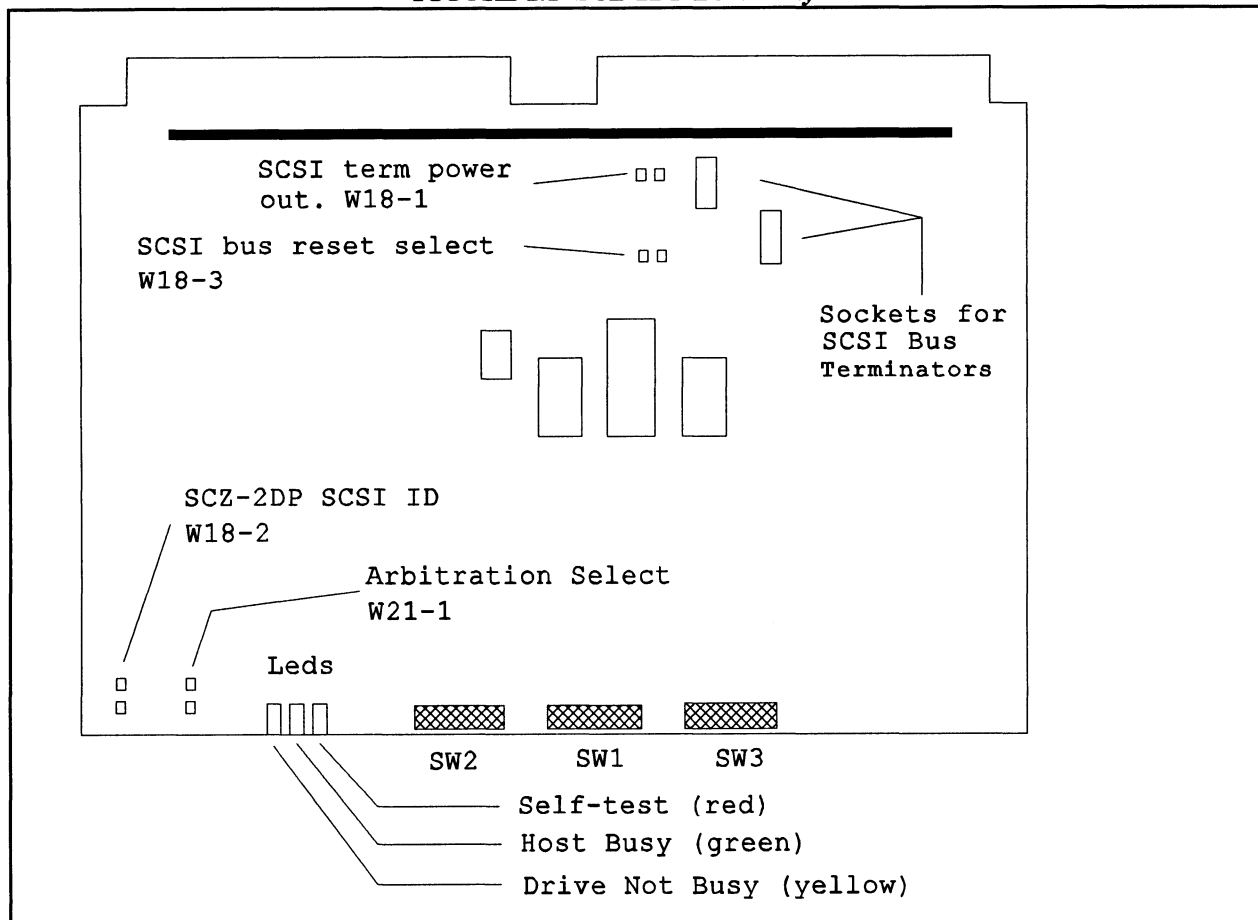
Notes:

1. With W18-1 installed, the SCZ-2DP will drive +5V onto SCSI bus line 26 when using the 500-411-00 paddleboard. The 500-464-00 paddleboard drives +5V onto line 26 on its own and W18-1 does not need to be installed when using this paddleboard. Only install W18-1 when the other end of the SCSI bus is to be terminated with an external terminator.

2. W18-3 must be installed in order for the Tresspass command to issue a SCSI bus reset.

3. W21-1 should only be installed for factory test use.

4. W18-2 In = SCSI ID 6; Out = SCSI ID 7.

5. SCSI bus terminator dips must be removed if using 500-464-00 terminated paddleboard. Terminators must be installed if using the 500-411-00 unterminated paddleboard.

Slot Selection

The SCZ-2DP may be installed in any "I/O" or "MEM I/O" slot. Consult the hardware manual for your particular computer to identify the appropriate available 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 SCZ-2DP and the processor, or between the SCZ-2DP and another controller already installed in the chassis, jumper wires must be installed to obtain priority continuity. To "jumper across" unused slots, connect DCH Priority Out (Pin A93) to DCH Priority In (Pin A94) and Interrupt Priority Out (Pin A95) to Interrupt Priority In (Pin A96). See Figure 2.2.

2.3 Preparing the Controller

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 when running only one drive. (DOWN position).
3	not used	Switch should be DOWN.
4	not used	Switch should be DOWN.
5	Poll Mode	Switch must be UP.
6-8	Throttle	The three throttle setting switches are for

controlling the number of data channel
words per request.

| 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	Select one of a possible 64 drive parameter blocks. A block consists of the number of cylinders, heads, and sectors/track that will be assigned to that drive from a system point of view. The switches are binary weighted, switch 3 is most significant and switch 8 is the least

significant. If a block is selected that has not yet been defined, it will be assigned the maximum parameters (ea. 1024 cylinders, 32 heads, and 32 sectors). **In all cases, all attached units will be seen as the same size.** Please refer to Table 2.1 for additional information about the drive parameters you are choosing.

Disk Drives Supported

The SCZ-2DP is designed to support drives that meet the SCSI Interface Specification and utilize the SCSI Common Command Set. ZETACO has verified several drives with the SCZ-2DP and will continue to test additional drives for verification of compatibility with the SCZ-2DP. If you don't find the drive you want to interface in the Configuration list, call us to discuss your requirements.

Table 2.1 contains the list of drives that have been fully tested at ZETACO with the SCZ-2DP. The columns labeled 3 through 8 are the Disk Parameter select switches on Switch Pack 2. The next three columns indicate the number of cylinders, heads, and sectors per track assigned to the drive for best efficiency for the number of user blocks available. The read capacity is a SCSI command which when executed will return the amount of user blocks available with this model drive (a user block is 512 bytes). The BYTES column is the actual number of bytes available to the system.

Switch combinations for Switch pack 2 positions 3-8 specify the head/sector/cylinder parameters the SCZ-2DP will emulate from the Host computer. Note that in addition to RDOS, AOS may also be built with the SCZ-2DP provided the user selects one of the three 606x emulations and has attached to the SCZ-2DP a drive of capacity at least as great as the emulation selected. The maximum parameters for the SCZ-2DP are 1024 cylinders, 32 heads, and 32 sectors. This amounts to 1,048,576 blocks and 536,870,912 bytes given 512 bytes/block. Therefore, drives larger than 537 MB will most likely function with the SCZ-2DP, but only the first 537 MB of these drives will be utilized.

Both the Seagate ST1480 and the Fujitsu M2684S support auto-relocation of faulty sectors found during reads and writes. This feature is automatically enabled by firmware after powerup or reset if either of these drives is selected.

Table 2.1 Supported Drive List

3	4	5	6	7	8	BLK#	Cyl	Hd	Sc	Read Cap	Bytes Used	Model
d	d	d	d	d	d	00	793	12	32	304,604	155,910,144	Seagate Wren-3 94161-156
d	d	d	d	d	u	01	621	9	32	178,850	91,570,176	Seagate Wren-3 94211-86
d	d	d	d	u	d	02	411	19	24	---	95,956,992	D.G. 6060 parameters
d	d	d	d	u	u	03	815	19	24	---	190,279,680	D.G. 6061 parameters
d	d	d	u	d	d	04	815	5	24	---	50,073,600	D.G. 6067 parameters
d	d	d	u	d	u	05	764	24	32	586,763	300,417,024	Seagate Wren-4 (300)
d	d	d	u	u	d	06	685	13	32	285,039	145,899,520	Micropolis 1375
d	d	d	u	u	u	07	661	8	32	169,224	86,638,592	Seagate Wren-3 94161-86
d	d	u	d	d	d	08	1008	20	32	645,299	330,301,440	Seagate 94181-385H (330)
d	d	u	d	d	u	09	813	32	32		426,246,144	Seagate ST1480 (426 MB)
d	d	u	d	u	d	0A	1024	32	32	1,163,145	536,870,912	H.P. C1716T Optical (536
d	d	u	d	u	u	0B	1014	32	32	1,039,028	531,628,032	Fujitsu M2684S (532 MB)

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 if the switch is UP. This switch should normally be set in the DOWN position, it is only used during the 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 SCZ-2 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 SCZ-2DP, 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.

Jumper Settings

Refer to Figure 2.1 for jumper locations.

Jumper	Function	Description
W18-2	Set the SCSI ID for the SCZ-2DP.	**W18-2 IN**: set controller's SCSI ID to 6. **W18-2 OUT**: set controller's SCSI ID to 7.
W18-3	SCSI Bus	**W18-3 IN**: allow this controller to Reset Selectissue a SCSI Bus Reset. **W18-3 OUT**: do not allow a SCSI Bus Reset from this controller to occur. If the Trespass command is to be supported, this jumper must be installed.
W21-1	Arbitration Select	**W21-1 IN**: Disable this controller from doing SCSI bus arbitration. **W21-1 OUT**: This controller will do SCSI bus arbitration. This jumper must be out if two SCZ-2DPs are attached to the same SCSI bus.

For dual initiator installations, W21-1 **must** be removed; W18-2 must be removed from one SCZ-2DP and W18-2 must be installed in the other SCZ-2DP (two initiators cannot have the same SCSI ID number).

In those dual port applications where drive sharing is done to have redundant systems, W18-3 must be installed to allow a system to issue a SCSI bus reset to the drive. A drive reset is the only method supported by the SCZ-2DP to clear a drive reserve condition caused by the other initiator. If a secondary system expects to carry on processing following a primary system crash, the secondary system **must** issue a Trespass command to the SCZ-2DP which in turn will send a SCSI bus reset. If the drive was reserved by the primary system, the reset will cancel the reserve and open the drive for use by the secondary system.

SCSI Bus Termination

For proper system operation, the SCSI bus needs to be terminated at each end of the bus. In the dual initiator configuration this means both SCZ-2DP controllers must be terminated and the drives attached to the middle of the bus must be unterminated.

If using the terminated paddleboards (500-464-00), then both SCSI bus terminators should be removed from the SCZ-2DP boards (see Figure 2-1).

If the chassis does not permit the wider paddleboard (500-464-00) to be installed (Ex: Nova 3), then the unterminated 500-411-00 paddleboard must be used. If this is the case, the terminator dips must be installed in the SCZ-2DPs.

If only one SCZ-2DP is to be used, then the other end of the bus must be terminated by using either an external terminator, a 500-464-00 paddleboard, or the termination installed in a drive. The only instance where W18-1 should be installed is when the 500-411-00 paddleboard is used and the other end of the bus is terminated by an external terminator.

Dual initiator configurations using the terminated paddleboards insure proper SCSI bus termination when one of the CPUs is powered down and even allow the SCZ-2DP in the down system to be removed from the chassis without affecting the other system.

Proper termination will be maintained as long as that end of the SCSI bus is attached to the 500-464-00 terminated paddleboard regardless of whether or not the paddleboard is attached to the chassis backplane. The 500-464-00 paddleboard sources +5V onto line 26 of the SCSI bus (Termpower line) and prevents +5V contention by isolating line 26 from the chassis +5V supply with a diode.

2.4 Installing the Controller and Paddleboard

First, pull the lock tabs on the two front corners of the board out as far as they will go. Next, carefully guide the Controller board into the I/O slot you selected in Section 2.3. 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.

The computer backplane, viewed from the rear, has the "A" side pins on the left. On computers with vertically mounted controller boards, think of the component side of the boards as up, then the "A" side pins are on the left.

Locate the two rows of pins on the "A" side of the backplane for the slot containing the SCZ-2DP Controller. Ensure that no pins are bent. Position the "A" paddleboard block connector over the "A" backplane pins (#29-#100), with the header connectors facing up. Press the connector securely over the pins, making sure all pins insert and do not bend, until the guide block is flush with the backplane.

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

FIGURE 2.2 Backplane Priority Jumpers

A Side   B Side

Empty Slots   SCZ-2DP Slot
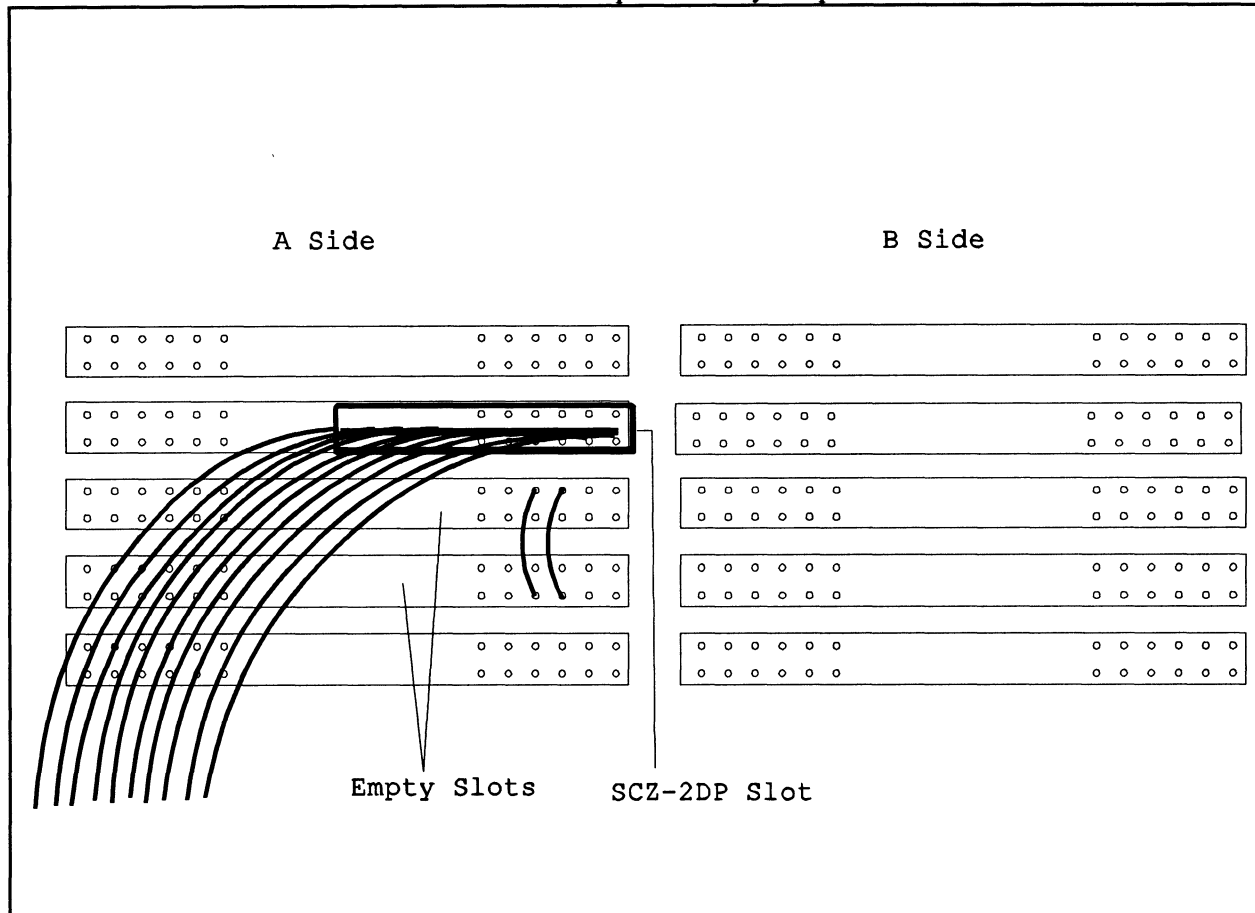
2.5 Cabling

Internal Cabling

The internal cable (P/N 300-148-00) is a flat 50-conductor cable terminated on one end with a socket connector and on the other with a "D" connector. The socket connector end plugs into the "A" paddleboard. The other end of this cable (D connector) mounts on the computer backpanel.

To mount the "D" connectors to the backpanel, first remove the covers from the desired mounting holes, and the hex bolts, washers, and nuts from the connectors. Then, insert the connector into the hole in the backpanel from the inside, insert the hex bolts from the outside, and secure the connector to the backpanel.

External Cabling

Contact ZETACO with your external bulkhead-to-disk drive cabling requirements.

Non-Bulkhead Cabling

Contact ZETACO with your non-bulkhead paddleboard-to-disk drive requirements.

Subsystem Grounding

Because the AC power system safety ground does not necessarily satisfy all system grounding requirements, additional connections are required to earth ground, referred to as system ground. The Controller and its attached drive(s) must be connected to a single point ground system. Ground connections are made via ground braids (5/8" minimum flat braid) that pass from enclosure to enclosure, enclosure to computer chassis and computer chassis to earth ground. Refer to Figure 2.5. If shielded cables are used, this grounding procedure is not required.

WARNING: To ensure proper ground return to earth, each component in the system must be connected using a daisy-chain ground system. The AC and DC grounds within each drive may need to be joined (consult your drive manual). The drives must then be joined by a daisy-chain grounding braid and connected to the grounding post at the rear of the computer cabinet.

==

2.6 Powering up the System

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

RED   SELFTEST - When on, the SCZ-2DP is executing Self-test Diagnostics. Flashing indicates a selftest failure.

GREEN   HOST BUSY - This LED indicates the controller is executing one of the READ/WRITE commands.

YELLOW   SCSI BUSY - When on, this LED indicates that no drives are connected or that none are busy. When dim or flashing, the SCSI bus is active. If extinguished, the SCSI bus may be locked up which would indicate a controller or drive failure or improper SCSI bus termination. (An exception is during format when this LED should be off.)

Self-test takes approximately two seconds to complete. At that point the red LED should turn OFF and remain off. If it does not, or if it blinks, this indicates a Self-test failure. See Section 3.0 for assistance.

The green LED should be OFF, since no READ/WRITE activity will have been initiated immediately after power-up.

The yellow LED will be on during the idle state indicating no disk activity.

2.7 Booting the Software Tape

The bootstrap procedure for the software support tape is as follows:

1. Mount the software support 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. 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:

   Note - The programs for the SCZ-2DP are the same as those for the standard SCZ-2.

   ```
   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 of the installation procedure, you enter the file number, but first refer to section 3.2 for program execution details.

2.8 Formatting the Disk

Format the drive first if the drive (or drives) has never been formatted before. To format the disk, boot the software support tape and load file #3. Refer to section 3.2 for details.

2.9 Verifying the Installation

We recommend that the Disk Reliability program be run for at least one pass to ensure a reliable subsystem before storing the system data on it. If any problems are encountered, the disk Diagnostic (File #2 on tape) can be used to identify the source of the problem. At this point, run Reliability for several minutes, just to verify that the subsystem is operating after the initial format. To do so, boot the software support tape and load file #4. Refer to Section 3.2 for details.

2.10 Initializing 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 section 3.2 will guide you through this procedure.

3

Trouble-Shooting

3.0 Introduction

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

- Microprocessor based Self-test of over 70% of the board upon each powerup.
- Reliability and Diagnostic program on 9-track tape for use during installation and trouble-shooting.
- Customer support hotline, manned from 8:00 a.m. to 5:00 p.m. (CST) to answer your questions. (800-537-5292)
- Up to a two year warranty on workmanship and materials.

3.1 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 Memory	Data read from RAM did not compare with data written.
3	Ram Test	Test patterns have determined that the buffer ram cannot support error free data handling.

3.2 Software Support Tape

In addition to the diagnostic functions provided by the SCZ-2DP 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-2DP 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 2.8.

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:

   Note - The utility programs for the dual port version of the SCZ-2 are the same as those for the standard board.

   ```
   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 Tape

The Software Support 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
```

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 APPENDIX A, 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 to thirty minutes. **

```
FORMATTING DONE ON ALL UNITS, NOW DOING SEEK
EXERCISER.
```

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 identify 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 found 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 PER APPENDIX A, OR ENTER RETURN (CR)
TO CONT.
```

```
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 to otherwise do
to a problem with reading the selected characteristics
from the controller. **

.

.

.

** Listing tests again. **

```
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.

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.

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 APPENDIX A 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
```

** Enter a "W" while the test is running to display the results of the test. **

Reliability Error Description

Reliability errors are displayed when they are detected. The controller status will be displayed with the particular problem spelled out below the status. Each status bit is explained in the programming section but since the error is also spelled out, referencing the programming section may not help. Most errors that can occur are default or ready errors.

Zsdkinit - RDOS Disk Initializer

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

Before you load any RDOS system onto a Model SCZ-2DP, 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-2DP 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-2DP.

The following is a sample procedure/dialogue for running ZSDKINIT:

Load ZSDKINIT from the Software Support Package tape or from a disk that previously had the program loaded on it.

PROGRAM DISPLAYS:

`FILENAME?`

you respond with:

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

PROGRAM DISPLAYS:

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

`DISK DRIVE MODEL NUMBER?`

you respond with:

`SCSI`

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

If the disk type is not valid then the program responds:

`ILLEGAL DISK TYPE`

and the request for the model number will be repeated until your response is acceptable.

The Program next requests the disk unit:

```
DISK UNIT?
```

you respond with:

```
DZx, where x indicates drive number:  0, 1, 2, or
If the disk unit is not valid then the program
responds:

ILLEGAL DISK UNIT DECLARATION
```

and will repeat the question until a valid answer is given.

If the disk unit is valid then the program responds:

```
#HEADS     #SEC/TRK              #CYLINDERSMGB/BLK

 (1)          (2)        (3)        Megabytes if disk is
                                    >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.

(3) = The number of cylinders specified by the
      selected drive configuration switches.

EXAMPLE:   WREN-3 FH 94161-156

#HEADS     #SEC/TRK     #CYLINDERS   MGB/BLK

 12           32           793          156
```

From this point on the commands which can be selected are identical to those of DKINIT and ZSDKINIT will perform exactly as DKINIT.

3.3 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.

Non-destructive
Test Programs

This Section explains tests 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.

These tests 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. There are two different tests that can be run: a random seek test, or a sequential seek test.

To run the random seek test, enter a 501R after the prompt (@). If the sequential test is desired, enter a 502R 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 8.0, OR HIT (CR) TO CONT." is asked, enter an "8" one time and enter "9" one time. Bit 8 set puts the program in read only mode, bit 9 set prevents the data from being checked. Enter an "M" to verify that switch 8 is now on; if it is not, writes will be done, crashing the disk. The 501 and 502 Reliability 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 or just a carriage return will cause the program to select the random function for that variable. **Your response to the DATA question must not result in RANDOM data, instead enter ADR or ALO to select some pattern. If random becomes the data parameter, writes to the disk will occur even if switch 8 has been set to request read only.**

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.

B. Sequential Disk Address Test (SA 502)

The operator is given option on data (from the command string data). Requested data is first written over the entire pack. The data is then read from all sectors. This ensures that all disk pack

blocks are usable and are formatted properly. The test is then repeated for all ready disks, and "Pass" is printed. The sequence is repeated indefinitely. Setting Switch 8 will cause the program to run in read only mode.

3.4 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.

3.5 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.

3.6 Product Return Authorization

When a controller malfunction has been confirmed using the tests outlined in Sections 3.1 to 3.4 above, the controller 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.

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GENERAL INSTALLATION CHECKLIST

CPU _____Operating System and Rev.   _____

Is board 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 when (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?_____

Did Zetaco-supplied software support diskette or 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-2F 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	Self-test	_____
Controller	Diagnostics	_____
Subsystem	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? Include revision number.

3. Describe the system configuration (i.e., peripherals, I/O controllers, model of computer).

To be filled out by CUSTOMER:

    Model #: _____

    Serial #: _____

    RMA #: _____ (Call Zetaco to obtain an RMA number.)

Returned by:

Your name: _____

Firm: _____

Address: _____

Phone: _____

Programming Notes

4.0 Introduction

This section discusses, in detail, the assembly level programming characteristics of the D.G. system in relation to this disk controller. This is of most use to technicians involved in component level diagnostic testing and to programmers involved with utility writing.

4.1 Program I/O Foreword

The program I/O accumulator format is the vehicle used to communicate the control of the disk subsystem between the SCZ-2DP controller and the CPU. This is the requirement of the SCZ-2DP to be considered a true ZEBRA emulator. The program I/O established by ZEBRA was specific to the following drive sizes:

Subsys #	Cylinders	Heads	Sectors	Capacity (bytes)
6060	411	19	24	95,956,992
6061	815	19	24	190,279,680
6067	815	5	24	50,073,600

4.2 Instruction Format

Symbolic form for the I/O instructions:

DXXF AC, DSKP

DXX - DOA, DOB, DOC, DIA, DIB, DIC

F = Function:
C (clear) - Resets Busy and Done flags to zero, aborts all data transfer commands, and clears the data transfer status (DIA) fault bits 6,7,8,9, 10,11,12,13,14 & 15. Also clears RD/WRT and the drive attention flags and interrupt req.

S (start) - Sets the busy flag, clears done and initiates one of the following commands selected by a DOA: Read, Write, Format, Read Buffers or Verify. Also clears interrupt request and data transfer status (DIA) fault bits 6,7,8, 9,10,11,12,13,14 & 15.

P (pulse) - Sets control full flag and initiates one of the following commands selected by a DOA: Recal, Seek, Stop, Offset, Write Disable, Release, Trespass and Exam Controller RAM.

AC = Accumulator: 0, 1, 2 or 3.

DSKP = Device Code: Primary - 27 Octal
Secondary - 67 Octal
(Others available)

BINARY REPRESENTATION OF AN I/O INSTRUCTION

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	1	AC		OP CODE			FUN		DEVICE CODE					

INTERRUPT MASK   BIT 7

MSKO AC

Execution of the Mask Instruction with BIT 7 equal to a one in the selected accumulator will set the interrupt mask within the controller. This will inhibit any further interrupt requests by the controller until the interrupt mask is cleared, either by an IORST instruction or execution of the Mask Instruction with accumulator BIT 7 equal to a zero.

IORESET INSTRUCTION (IORST)

Execution of an IORST instruction serves as a master reset to the controller. Upon completion of an IORST the controller will attempt to select unit zero and default the command register to a read operation.

IOSKIP INSTRUCTION

Used to poll the state of the controller (command is done or busy). If the skip condition is met, the next instruction is skipped; otherwise the next instruction is executed.

SKPBZ DSKP - SKIP IF BUSY FLIP-FLOP IS CLEAR.
SKPBN DSKP - SKIP IF BUSY FLIP-FLOP IS SET.
SKPDZ DSKP - SKIP IF DONE FLIP-FLOP IS CLEAR.
SKPDN DSKP - SKIP IF DONE FLIP-FLOP IS SET.

4.3 Accumulator Formats

DOA - Specify Command and Drive

DOAF AC, DSKP

0 1 2	3 4	5 6 7	8 9	10 11 12 13 14 15
0 1 1	AC	0 1 0	F	DEVICE CODE

Accumulator

0	1 2 3 4	5 6 7 8	9 10	11 12 13 14 15
R/W DN	Clr Seek Done	Command	Drive	EMA MSB's

Bit Position

0 - Clear Read/Write done if it is a one.

1 - Clear Seek Done Attention Flag for Drive Unit 0 if it is a ONE.

2 - Clear Seek Done Attention Flag for Drive Unit 1 if it is a ONE.

3 - Clear Seek Done Attention Flag for Drive Unit 2 if it is a ONE.

4 - Clear Seek Done Attention Flag for Drive Unit 3 if it is a ONE.

5 - 8   Specify Command:

		Function required to Initiate
0000	Read	Start
0001	Recalibrate	Pulse
0010	Seek	Pulse
0011	Stop Disc	Pulse (1)
0100	Offset Forward	Pulse
0101	Offset Reverse	Pulse
0110	Write Disable	Pulse (1)
0111	Release Drive	Pulse (1)
1000	Trespass	Pulse
1001	Set Alt Mode 1	None
1010	Set Alt Mode 2	None
1011	Examine Ram	Pulse
1100	Data Verify	Start
1101	Read Buffers	Start
1110	Write	Start
1111	Format	Start

(1) These commands are not supported by the controller. Any attempt to execute these will be ignored and if a pulse is received, the command full will be cleared.

9-10   Drive Selection:
  00 - Drive unit 0
  01 - Drive unit 1
  10 - Drive unit 2
  11 - Drive unit 3

11-15 Extended Memory Address:
  Not supported, intended for controllers with BMC.

DOB - Load Starting Memory Address

DOBF AC, DSKP

0 1 2	3 4	5 6 7	8 9	10 11 12 13 14 15
0 1 1	AC	1 0 0	F	DEVICE CODE

Accumulator

0	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
Ex Mem Add	Memory Address Bits

Execution of this instruction will load the controllers address counter with the contents of the specified accumulator and will be used as the starting memory address for a command that requires a DCH transfer operation.

DOC - Load Drive Address

DOC - Specify Cylinder

DOCF AC, DSKP

0 1 2	3 4	5 6 7	8 9	10 11 12 13 14 15
0 1 1	AC	1 1 0	F	DEVICE CODE

Accumulator (if previous DOA specified a Seek)

0 1 2 3 4 5	6 7 8 9 10 11 12 13 14 15
Not Used	Cylinder Address

DOC - Read/Write Operations

If the command implies a READ or WRITE type of operation, then the DOC is the starting surface and sector address, and the number of sectors to transfer in two's complement form.

0	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15
Enable BMC maps n.u.	Surface Addr	Sector Addr	Count

Read Status - Non Alternate Mode

DIA - Read Data Transfer Status

DIAF, AC, DSKP

0 1 2	3 4	5 6 7	8 9	10 11 12 13 14 15
0 1 1	AC	0 0 1	F	DEVICE CODE

Accumulator

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

0 - Control Full
1 - R/W Done
2 - Unit 0 Atten Done
3 - Unit 1 Atten Done
4 - Unit 2 Atten Done
5 - Unit 3 Atten Done
6 - SCSI Bus Parity Error
7 - Illegal Sector Adr
8 - ECC Error
9 - Bad Sector Flag
10 - Cyl Addr Error
11 - Surf/Sect Addr Error
12 - Verify Error
13 - R/W Timeout
14 - Data Late
15 - Read/Write Fault

0	CONTROL FULL	Will be a one when the controller receives a pulse function. Will be a zero once the controller completes the function to the drive that was specified by the command (Recal, Seek, Offset, Trespass and Exam Ram).
1	R/W DONE	A one indicates that the done flag was set following a data transfer command.
2-5	UNIT ATTENTION (UNITS 0-3)	A one indicates that the respective drive completed a successful seek or recalibrate operation. If the drive was unsuccessful in its attempt to seek, a positioner fault status will be indicated. A recalibrate operation will clear the fault.
6	BUS PARITY	Indicates a Parity error was detected

during a SCSI transfer either by the host or initiator.

7 ILLEGAL SECTOR ADDRESS

Indicates the starting sector address (DOC) exceeded the capacity of the drive if set to a one. Done sets immediately.

8 ECC ERROR

A sector of data read from the disk did not correlate with the appended polynomial. This means that the data read does not agree with the data that was originally written.

9 BAD SECTOR FLAG

Indicates the controller detected the bad sector flag set to a one.

10 CYLINDER ADDR ERROR

The Cylinder Address contained within the sector's header did not match the requested cylinder given by the previous seek command. Bit 11 will set, instead, if there is no match due to a media flaw. The Read/Write operation will be terminated immediately.

11 SURFACE/SECTOR ADDRESS ERROR

A media flaw occured in the header field as reported by the SCSI target drive.

12 VERIFY ERROR

Data in memory did not agree with the data on the disk. (See Verify Command).

13 READ/WRITE TIMEOUT

A Read or Write type of operation did not complete within five seconds.

14 DATA LATE

Not implemented.

15 READ/WRITE FAULT FLAG

A one indicates that at least one bit is set in bit positions 6 through 14 or a drive fault occurred during a Read/Write transfer operation.

Refer to Table 4.1 for detailed description.

TABLE 4.1   *Read/Write Faults (DIA)*

STATUS BIT POSITION		CONTROLLER ACTION	ERROR RECOVERY
BUS ERROR	6	Sets done immediately.	New command. Re-try Read/Write Transfer.
ILLEGAL SECTOR ADDRESS	7	Sets done immediately.	New command if error re-occurs. Make sure the controller is configured to match the drive type.
ECC ERROR	8	Sets done at the end of sector transfer.	New command. Re-tries with ECC may correct the data.
BAD SECTOR FLAG	9	Sets done immediately.	New command. This sector should be ignored.
CYLINDER ADDRESS ERROR	10	Sets done immediately	New command. The system should diagnose this as a positioner fault.
SURF/SECT ERROR	11	Sets done immediately.	New command.
VERIFY ERROR	12	Sets done at the end of the sector transfer.	New command. Check ECC error also to determine if the error occurred due to a flaw in the media.
READ/ WRITE TIMEOUT	13	Sets done immediately.	New command.

DIB - Read Drive Status

DIB AC, DSKP

0 1 2	3 4	5 6 7	8 9	10 11 12 13 14 15
0 1 1	AC	0 1 1	F	DEVICE CODE

Accumulator

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

*0 - Invalid Status
*1 - Drive Reserved
*2 - Trespassed
3 - Ready
4 - Busy
5 - Positioner Offset
*6 - Write Disabled
*7 - 0
8 - Ill Sur/Cyl Addr
9 - Illegal Command
10 - DC Voltage Fault
11 - Pack Unsafe
12 - Positioner Fault
13 - Servo Clock Fault
14 - Write Fault
15 - Drive Fault

*These bits are not implemented by the SCZ-2F controller.

0   always zero

1   always zero

2   always zero

3   READY   Drive unit specified by a previous DOA command is selected, spindle is up to speed and positioner is on cylinder.

4 BUSY   The positioner within the currently
                           selected drive is not on cylinder.

5 POSITIONER   The selected Read/Write head
   OFFSET   was moved from on cylinder dead
                           center as was specified by an offset
                           forward or reverse command.

6 always zero

7 always zero

8 ILLEGAL   The requested surface or
   SURFACE OR   cylinder address exceeds the
   CYLINDER   capacity of the drive.
   ADDRESS   Read/Write operation will terminate
                           immediately. The translated address
                           for SCSI exceeds the logical block
                           address of the target drive.

9 ILLEGAL   The controller was requested
   COMMAND   to perform a write type of command
                           while servo is offset or drive is write
                           protected. The SCSI target received
                           an illegal command.

10 DC VOLTAGE   Received a SCSI error from
   FAULT   the target drive that is considered
                           catystrophic.

11 PACK UNSAFE   Conditions exist within the drive that
                           may impair the safety of the media.
                           This bit will be a one if a SCSI error
                           status is received that would imply
                           this condition.

12 POSITIONER   This indicates that the drive
   FAULT   was unable to complete a seek
                           command properly. The system
                           should send a recal command to
                           recover from this error.

13 SERVO CLOCK   An unrecoverable media
   FAULT   error reported by the SCSI target
                           that is not related to the data field.

14 WRITE FAULT   A write fault error was reported by

the target drive during a data transfer phase.

15   DRIVE FAULT   One or more bits are set in positions 8 through 14.

DIC - READ SURFACE, SECTOR AND COUNT

DICF AC, DSKP

0 1 2	3 4	5 6 7	8 9	10 11 12 13 14 15
0 1 1	AC	1 0 1	F	DEVICE CODE

Accumulator

0	1 2 3 4 5	6 7 8 9 10	11 12 13 14 15
n.u.	Current Surface Addr	Current Sector Addr	2's Comp of # of Sectors remaining in Xfer

Read Status - Alternate Mode One

See detailed description of Alternate Mode One Command.

DIA - Read Current Memory Address

DIAF AC, DSKP

Accumulator

0	1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
EMA	Currnet Memory Address

After the execution of this instruction the value of the accumulator will contain the memory address to where the next data word transfer will take place. The memory address counter is incremented by one after each DCH transfer.

Read Status -
Alternate Mode
Two

DIA - READ ECC REMAINDER UPPER

DIAF AC, DSKP
Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

Bits 0 thru 7 will always be zero's. Bits 8 thru 15 depends on if an ECC error was reported or not. An uncorrectable syndrome of all one bits will be forced if an ECC error was reported in the read/write done DIA status word. If not an error it is the mechanism used to transfer drive configuration facts (examine RAM).

DIB - READ ECC REMAINDER LOWER

DIBF AC, DSKP

Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

will always be reported as all zero's.

DIC - Not Currently implemented.

4.4 Command
Descriptions

The command set (16 in all) provided by the controller is basically broken up into three groups:

1. Data Transfer Command
2. Drive Commands
3. Alternate Mode Commands

The command is stored in the controller via a DOA instruction.

Before any command is initiated, the selected unit must have valid status and be ready.

Data Transfer
Commands

Start (Set Busy) will initiate any one of the following commands: Read, Write, Format, Verify or Read Buffers. Up to 64 contiguous sectors may be transferred.

Read/Write Initialization Steps:

1. Control Full and Drive Status must be tested for proper state before commencing with a Read/Write Command.

2. Send the Starting Surface and Sector Address along with the Two's Complement of the number of sectors transferred. (See DOC)

3. Send the Starting Memory Address of where the data should be stored or retrieved. (See DOB)

4. Send the Command type and the desired Drive Unit Number. (See DOA)

5. Issue a Start Pulse.

Read/Write Termination Possibilities (Done Set):

1. All the sectors implied by the Two's Complement sector count were transferred.

2. A Drive or Read/Write Error was encountered. DIC command should be issued to determine which sector the error occurred at.

3. Busy was cleared by an IORESET instruction or a clear pulse was issued to the controller during the Read/Write transfer. Done will not set in this case.

The following commands are considered read/write type:

READ
WRITE
VERIFY
READ BUFFERS
FORMAT (drive)

Drive Commands

IOPULSE (sets control full) initiates any one of the following commands: Recalibrate, Seek, Offset, Trespass and Examine Ram.

RECALIBRATE

This command moves the heads to cylinder 0, selects Head 0, and issues a fault clear to the drive.

This command moves the heads more slowly than a seek to 0, so it should not be used for data acquisition.

SEEK

Seek moves the heads to the cylinder specified by the DOC. The controller stores the cylinder address for that particular unit, initiates the SEEK operation and clears control full. While that unit is busy seeking the controller can accept another SEEK command for a different unit (overlapped seeks), or commence with a Read/Write Command for the unit busy seeking.

See the disk drive specification for the Seek Timing.

OFFSET FORWARD

"OFFSET FORWARD" offsets the heads forward off the track center-line. This operation is cleared by the next command. (The drive does not allow write operations when the positioner is Offset). The controller does not actually send an offset type of command to the target drive, it was designed to onlym ake it appear so. Cannot support offsets with SCSI.

OFFSET REVERSE

"OFFSET REVERSE" offsets the heads reverse off the track center-line. This operation is cleared by the next command. (The drive does not allow write operations when the positioner is Offset.) The controller does not actually send an offset type of command to the target drive, it was designed to only make it appear so. Cannot support offsets with SCSI.

EXAMINE RAM COMMAND

This command provides a method of transferring drive parameters to the CPU for each unit based on what is stored in the controllers scatch pad ram's characteristics block. The RAM is initialized with

the characteristics selected by switches 3-8 in switchpack 2. This initialization occurs during power up and following an IORST.

This feature is used for obtaining drive characteristics for Formatter, Reliability, and ZSDKINIT programs.

PROGRAMMING REQUIREMENTS:

NOTE: make sure control full is not set prior to issuing DOA.

```
DOA       AC,DSKP       ; specify unit # and NOP cmd DOC
P         AC,DSKP       ; specify desired parameter
```

WAIT FOR CONTROL FULL TO DROP

```
DOA       AC,DSKP       ; select ALT MODE 2 command
DIA C     AC,DSKP       ; get characteristic byte
```

DOC (specify para)   DIA (unit para received)
------------------   ------------------------
   0000   upper byte of max cyl adr
   0001   lower byte of max cyl adr
   0002   max head adr
   0003   max sector adr

TRESPASS

The trespass command is issued with the pulse function and will cause the SCZ-2DP to drive the SCSI bus reset line active. This requires that W18-3 be installed. (see Fig 2.1)
A SCSI bus reset releases all SCSI device reservations and clears all uncompleted SCSI commands. Trespass may be used in a crash recovery routine to enable the secondary system to gain access to any system or data disks that may have halted activity at a time when they were still reserved by the primary system.

Alternate Modes

A command that will change the context of the data received from a DIA, DIB or DIC. A command other than Alternate Mode or an IORESET will clear Alternate Mode.

ALTERNATE MODE ONE

Changes the context of DIA to read the current memory address. The ending address after a Read/Write transfer will point to the last address plus one.

ALTERNATE MODE TWO

Changes the context of the DIA and DIB command. This is used to extract the syndrome (ECC remainder not equal to zero after a read command) from the controller.

Appendix

A.0 Soft Switch Settings for Zetaco Utilities

Following are the program soft switches common to all three of the Zetaco Utilities (Format, Diagnostic, and Reliability):

Note - Enter "M" to view the state of the switches.

Bit	Binary value	Interpretation
1	0	Loop on error.
	1	Skip looping on error.
2	0	Print to console.
	1	Skip printing to console.
5	0	Do not print to the printer.
	1	Print to the printer.

Additional switches used by the Reliability program:

Note - Enter "W" to examine test results.

Bit	Binary value	Interpretation
8	0	Writes to disk will occur.
	1	Set read only mode (only applies to tests starting at 501 or 502).
9	0	Perform data check
	1	Bypass data check
11	0	Disable bad sector printouts.
	1	Enable bad sector printouts.

Additional switches used by the Diagnostic program:

Bit	Binary value	Interpretation
1	0	Loop on error.
	1	Continue running test past error.
3	0	Do not print % of failure.
	1	Print % of failure.