Model SCZ-5

Multifunction SCSI Controller

Technical Manual

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Preface

This manual contains information regarding installation, testing, and operation of the ZETACO Model SCZ-5 Multifunction SCSI 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

SCZ-5 Multifunction SCSI Controller features, capabilities, specifications, power and interface requirements.

Chapter 2 - Installation Procedures

Procedures required to install and test the SCZ-5 Multifunction SCSI Controller.

Chapter 3 - Trouble-shooting

How to analyze problems; how to get help.

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Product Overview

1.0 Introduction

Zetaco's SCZ-5 Multifunction SCSI Controller is designed to interface a variety of SCSI peripherals to Data General MV series minicomputers.

At the system level, the SCZ-5 utilizes the capabilities of Data General's MTJ and DPJ (Argus) software drivers. System performance benefits of the Argus driver are supported: memory resident control blocks, mapping responsibility, execution of linked control blocks. The SCZ-5 executes all tape commands supported by the MTJ driver and disk commands supported by the DPJ driver.

The controller supports AOS/VS and AOS/VS-II operating systems unmodified. Since the differences between those two do not affect the functioning of the SCZ-5 or the peripherals connected to it, references to AOS/VS are intended to apply to both operating systems.

Features

- Adherence to Common Command Set SCSI Protocol insures drive compatibility
- Supports magnetic disk, optical disk, and magnetic tape
- Command queueing for lower system overhead
- Large on-board memory for efficient data buffering
- Dual microprocessors with full parallel processing
- Automatic self-test and error/status LED display

1.1 Controller Functional Overview

Refer to Figure 1.1 to see the major functional sections of the SCZ-5 Controller. The following paragraphs briefly describe the functions of the various sections.

BMC Data and Control

This section handles transfer of data between the computer and the controller over the Burst Multiplexor Channel (BMC). The BMC handles transfer of disk and tape data as well as Control Block (CB) information. Data is stored temporarily on the controller in the Data Buffer. This section interfaces to the computer via two ribbon cables on the front edge of the controller.

Programmed I/O Data & Control

This section handles Programmed I/O (PIO) functions for the disk, tape and MPORT device codes. These functions include the six command and status registers, busy/done logic, interrupt control and other functions required to handle up to four device codes. This section interfaces to the computer via the A and B backplane connectors. Each Busy Flag register drives one of the four right-most green LEDs on the controller.

Data Buffer

A high-speed buffer, this is used to temporarily hold data transfers between the controller and computer memory over the BMC. Data is alternatley buffered here in two 256-word buffers. Data is filled into the first buffer at the same time that data is emptied out of the second. This ping-pong buffer method is used in conjunction with the variable BMC burst and break values to optimize overall system performance.

SCSI Controller IC and Paddleboard

This device is used to manage SCSI bus control and data flow functions. It handles all SCSI physical level timing requirements and off-loads many other SCSI control functions from direct microprocessor control. The SCSI controller interfaces to the paddleboard via the A backplane. The internal cable connects between the paddleboard and chassis bulkhead, to which the external SCSI cabling connects.

Memory Controller

The Memory Controller is made up of a single chip memory controller (XC2064), a memory transfer counter and memory address generator. Its function is to control the high-speed flow of data between the Data Buffer, the 53C90A SCSI Controller and the 128KB Static RAM located on the SCSI control side of the controller.

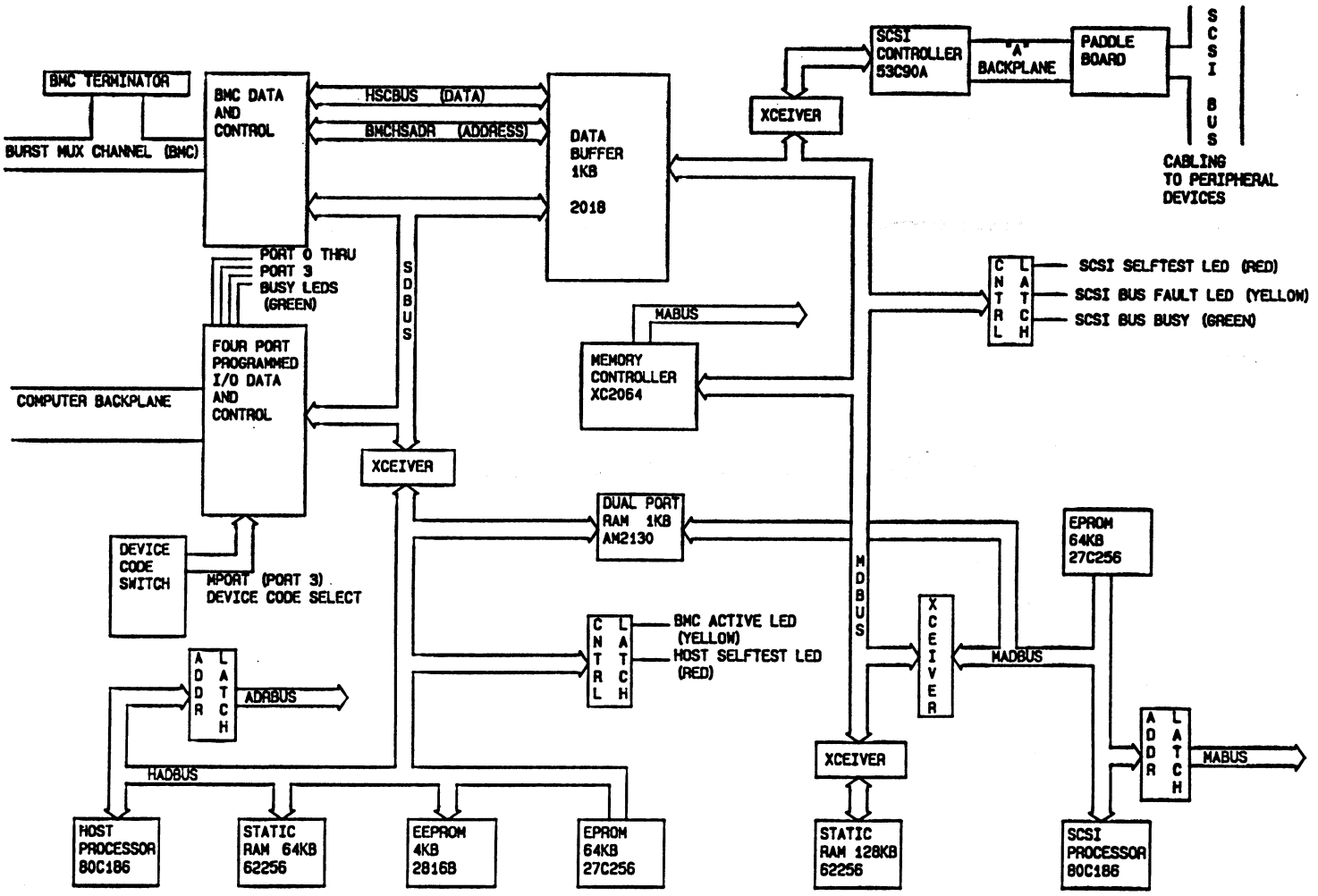


Figure 1.3
SCZ-5 Block Diagram

Dual Port RAM

This is a 1KB RAM which is used for communication between the Host and SCSI processors.

Host & SCSI 80C186 Processors & Associated Logic

These 16-bit microprocessors manage the various functions on their respective sides of the controller. The Host Processors responsibilities include Control Block management, PIO functions and BMC mapping options. The Host Processor translates Control Blocks from the computer into a command structure that the SCSI Processor can interpret. The SCSI Processor translates these commands to the SCSI command protocol and sends them onto the disk and tape drives. The SCSI Processor is responsible for the management of the various commands for up to seven SCSI devices.

Each micrprocessor has its own local memory devices. Each has 64KB of EPROM for firmware storage. The E^2PROM that holds configuration facts is accessible to the Host Processor. The SCSI Processor has 128KB of static RAM, which is used for large on-board data buffering tasks such as disk mirror sync. Processors communicate with each other via the Dual Port RAM.

1.2 Device Code Port Assignments

The SCZ-5 contains PIO control facilities, or ports, to handle up to four device codes. Two of these device codes are used for disk and tape control, while a third is reserved for future use for auxiliary device control. The fourth handles Maintenance Port (MPORT) control functions required by the controller utility programs.

The controller maintains a fixed interrupt priority structure between the four ports: Port 0 has highest interrupt priority, Port 1 the next highest, Port 2 the next, and MPORT the least priority. To achieve a variable interrupt priority structure within the controller, the devices (disk, tape, aux) are assigned ports at configuration time based on the interrupt priority specified.

The disk and tape control sections can be configured for higher/lower interrupt priority. The device configured to the higher interrupt priority will be assigned to Port 0, while the lower priority device will be assigned to Port 1.

The device with the higher priority will receive interrupt servicing by the computer first if two or more devices are requesting service at the same time.

1.3 LED Indicators

There are 9 LEDs located along the front edge of the controller, visible when the computer front cover is removed. This section describes the meaning of the LEDs as viewed from left to right (component side of controller up).

The left-most three LEDs indicate SCSI Processor status:

RED — SCSI Self-test

This LED turns ON to indicate SCSI Processor self-test is in progress. Upon successful completion of self-test at power-up, the LED should go OFF. If it does not go off within 30 seconds, or begins to flash along with the other 2 adjacent LEDs, self-test has failed. Refer to Chapter 3 of this manual for more information.

YELLOW — SCSI Bus Fault

Indicates an abnormal SCSI bus condition such as cable fault. Also used to flash self-test error codes.

GREEN — SCSI Bus Busy

When ON, this LED indicates that the SCSI bus is BUSY, i.e., a device has control of the bus. This LED will be OFF during BUS FREE or DISCONNECT SCSI conditions. This means that although the SCSI Busy LED may be OFF, the disk and tape drives may still be performing operations such as format or head positioning, but are temporarily "disconnected" from the controller.

The six right-most LEDs indicate Host Processor status:

RED — Host Self-test

This LED turns ON to indicate Host Processor self-test is in progress. Upon successful completion of self-test at power-up, the LED should go OFF. If it does not go off within 30 seconds, or begins to flash, self-test has failed. Refer to Chapter 3 of this manual for more information.

This will also be ON when the Host Processor is in DEBUG mode. Debug mode is only used while running the controller utilities such as the Configurator program.

YELLOW BMC Active

Indicates that the BMC bus is actively transferring data between the controller and computer memory.

GREEN Port 0 Busy (highest interrupt priority)_

GREEN Port 1 Busy

GREEN Port 2 Busy

GREEN Maintenance Port (MPORT) Busy (lowest interrupt priority)

These four green LEDs show the status of the Busy flags for the four controller ports. An ON LED indicates the Busy flag is set.

Observing the Busy flag provides a means of monitoring controller/computer activity. When ON, an LED indicates that the port is busy executing a PIO command. When an LED goes OFF, the ports Busy flag has been cleared and the port is ready to accept another command.

Note that this refers only to the processing of PIO commands, not Control Blocks. In other words, a port whose Busy flag is not set may still be in process of executing a command. Refer to your programmer's reference for more information.

The disk and tape control sections of the controller will be assigned to either Port 0 or Port 1, depending on the configured setting of "Disk/Tape Interrupt Priority." Refer to Section 1.2 for more information.

1.4 SCZ-5 Controller Specifications

Drives per Controller: Up to 7 SCSI targets

Data Transfer Rate: Up to 5 *MB/sec* (Synchronous)
Up to 3 *MB/sec* (Asynchronous)

Device Codes: Programmable

Interrupt Priority Mask Bit: Bit 10 for tape, Bit 7 for disk

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

Data Channel Interface: Not Supported

Burst Multiplexor Channel Interface:

. . . . Less than 1 STTL load
. . . . 64*ma* drive at 0.7*v*
. . . . Supports selectablity of any of the 8 priority requests
. . . . Selectable burst rates of 1 to 256, 16 bit words/access
. . . . Selectable break count from 1 to 256 sync clock periods
. . . . Support BMC transfer rates equal to the fastest available BMC computers

Data Buffering: Two 256-word BMC buffers in a ping-pong configuration. Also, buffering provided on the drives.

Memory Address: 21 bits

The SCZ-5 is designed to operate only with the BMC and must be installed in an **I/O ONLY** slot of an MV computer. Its operating system must support the MTJ and DPJ drivers. Table 2.11 lists the Data General computers in which the SCZ-5 will function, along with corresponding I/O ONLY slot numbers.

BMC Bus Cables

To operate the SCZ-5 over the BMC channel, a physical connection between the SCZ-5 and the Data General BMC channel is required. This connection is made via two 40-conductor flat ribbon cables. Each has a single socket on one end (for the BMC controller) and multiple sockets (for multiple boards accessing the BMC) on the other.

Device Interface

The SCZ-5 communicates with the devices via the SCSI interface. It can operate in synchronous or asynchronous mode. The SCZ-5 is fully operational with either differential or single-ended drives. (Different paddleboards and cables are required for each type. They can never be mixed.)

Mechanical

Dimensions: 15" x 15" (37*cm* x 37*cm*)

Shipping Weight: 10 pounds (4.536 *kg*) (includes controller, paddleboard, internal cable, software tape and documentation)

Paddleboard: Active component design with one 50-pin cable connector (A-side of backplane)

Power Requirements

+5 *v*DC (±5%) at 9 *amps* typical

Environmental

Operating Environment:

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

Non-Operating Environment:

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

Exceeds all MV temperature and humidity specifications.

1.5 Cabling

If you have not purchased your cables from Zetaco, you will need to provide cabling from your computer bulkhead to the SCSI peripherals you are using and to any additional drives you want to use.

Your drive(s) may be single-ended or differential. Cables with a characteristic impedance of 120 *ohms* or greater should be used with single-ended drives. A characteristic impedance of 100 *ohms* or greater is necessary for differential drives. SCSI's maximum allowable cable length is 82 feet for differential, and 19 feet for single-ended.

Internal Cabling

Internal cables connect from paddleboard to bulkhead. An internal cable is shipped standard with each SCZ-5. Located inside the bulkhead:

Paddleboard: Active backplane paddleboard with one 50-pin connector

Cable: 28" standard 50-conductor flat ribbon cable

External Cabling

You will need an external cable to connect bulkhead-to-drive enclosure; and additional daisy-chain cables if you have multiple enclosures. External cables are not shipped with each SCZ-5 but can be optionally ordered. Contact Zetaco for information.

Standard cable information:

Bulkhead-to-Drive: Nine-foot, 50-conductor, shielded round cable connecting bulkhead to disk/tape drive enclosure

Drive-to-Drive: Two-foot, 50-conductor, shielded round cable (optional) for connecting more enclosures

Non-bulkhead installation kit available.

NOTE ***The SCSI maximum cumulative cable length allowable for a fully populated subsystem is 82 feet for differential drives and 19 feet for single-ended SCSI drives.***

2

Installation

2.0 Before You Begin Installation

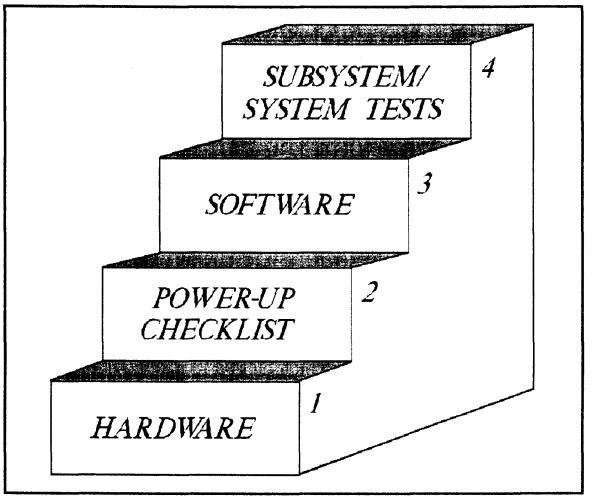
The installation process can be divided into two parts: hardware and software. Hardware installation is covered first in the following sections. Every attempt has been made to cover the process sequentially. It would be a good idea to read through all the information before doing anything and to have on hand the tools and references suggested.

Overview of the Installation Process

The installation process described in the following sections is designed to proceed step by step and provide methods for you to verify results. After you have all hardware in place, the checklist and power-up sequence provides a partial confirmation of success.

In the software section, using the Support Package Tape programs and other optional system tests, you can further determine your success.

Diagram of Installation Process



2.1 Hardware Installation as a Procedure

The hardware covered in this section includes the computer chassis, the SCZ-5 Multifunction SCSI Controller, disk or tape drive, and the cables. Any changes you may need to make to the hardware are described in the appropriate section.

Each of the following sections details one of these steps for installation of the SCZ-5:

1. Selecting a slot for the SCZ-5 in the computer chassis and making it functional.

2. What to do with the jumpers and switches on the SCZ-5 controller.

3. Installing the SCZ-5 and paddleboard into the chassis.

4. Setting up the peripheral.

5. Connecting all cables; SCSI and BMC.

Since so much of the installation depends on complying with Data General architecture, have reference material about the system hardware on hand. For example, in order to access the backplane to install the SCZ-5 paddleboard, it will be necessary to remove the backpanel bulkhead (if FCC compliant). It may not be clear how to do this by just looking at it.

There are a variety of ways Data General sets up its computers.

- Some have vertically mounted boards, some are horizontal.
- Some have one IOC, others have more.
- Bus repeaters may be installed on an expansion chassis.

The scope of these installation instructions is broad. You must have enough information about the system itself to fill in the details. **Tools you may need for installation:**

1. A Phillips screwdriver
2. A set of nut drivers
3. A small straight-blade screwdriver
4. A large straight-blade screwdriver
5. A set of needlenose pliers
6. A flashlight

The SCZ-5 is a sensitive piece of electronic equipment. Observe precautions to prevent damage by static; wear a wrist band and strap while handling the controller.

What to do if there is damage...

Immediately after receiving it and before you unpack your Zetaco shipment, inspect the shipping carton(s) for any evidence of damage or mishandling in transit.

Zetaco's warranty does not cover shipping damages. Therefore, if the shipping cartons are water stained or otherwise damaged, contact the carrier or shipping agent, before opening, with information on the damage. Request that a representative be present during receiving inspection.

For repair or replacement of any Zetaco product damaged in shipment, call Zetaco for return instructions and authorization.

2.11 Selecting a Slot & Making it Functional

The first thing to do is determine which slot of the computer can be used for the SCZ-5. Then, be sure the priority signals are available for that slot.

Slot Selected Must be I/O ONLY

The SCZ-5 must be installed in an **I/O ONLY** slot. Each type of Data General computer reserves different slots as **I/O ONLY**. Refer to Table 2.11 for this specific information. Examine the computer to determine which of the proper slots are available. It may be necessary to rearrange boards to accommodate the SCZ-5 in an **I/O ONLY** slot.

CAUTION ***Component damage will result and Zetaco's warranty is VOID if anything other than an I/O ONLY slot is used.***

Table 2.11

Identification of I/O ONLY Slots

CPU Model	I/O ONLY Slot Numbers
MV/4000	12 - 20
MV/6000	2 - 16 (I/O Expansion Chassis)
MV/7800*	Chassis dependent
MV/8000	29, 42, 48 - 56
MV/8000II	9 - 21
MV/8000C	13 - 20
MV/9500*	Chassis dependent
MV/10000	13 - 24, 26 - 36
MV/15000	6 - 12
MV/20000	19 - 38
MV/40000**	Any Eclipse I/O Slot

* Since the MV/7800 and the MV/9500 are upgrade vehicles for Data General machines, they can be installed in a variety of chassis types. Choose a slot defined as **I/O ONLY** for the type of chassis being used.

** Only differential SCSI drives may be connected to the MV/40000.

Availability to BMC

Since the BMC is the high-speed data path on the MV class machines, an increasing number of devices need access to it. The SCZ-5 can only operate on the BMC. When planning slot location for the SCZ-5 controller, availability of a BMC connector to that slot is as important as finding one that is I/O ONLY.

Priority Must be Maintained

There are two signals on the Data General backplane that aid the system in managing controller activity. These are: Data Channel (DCH) Priority, and Interrupt Priority. Even though the SCZ-5 does not operate on the DCH bus, the signal must be available to pass to the next controller. If any empty slots exist between the CPU board and the controller furthest from it, it will be necessary to add jumper wires from Priority Out of the controller before the gap to Priority In of the one after. Figure 2.11 demonstrates this.

Pin-to-Pin Connections

Pin # A93 *(DCH OUT)* goes to Pin # A94 *(DCH IN)*

Pin # A95 *(INTERRUPT OUT)* goes to Pin # A96 *(INTERRUPT IN)*

The result of improper jumpering will be a non-functional subsystem.

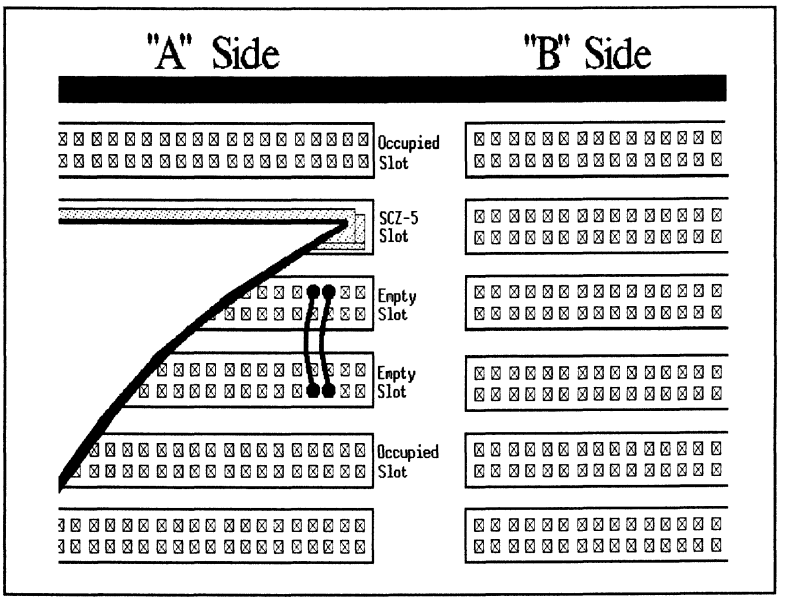


Figure 2.11
Backplane Priority Jumpers

2.12 Setting Switches

Most option setup for the SCZ-5 is handled by programming the E²PROM on the controller. The controller options handled in hardware are configured via the switchpack on the front of the board. There are three: system device code, E²PROM write disable, and configuration over-ride. Also, the paddleboard has one jumper that determines the source of SCSI terminator power.

Choosing the Device Code Address

You must set the maintenance port (MPORT) device code switches to the proper address at controller installation time. It is this address through which the Configurator Program will later communicate with the SCZ-5, allowing you to set the controller's disk and tape device codes. Any device code not already selected may be used, but the standard ones are:

MPORT . . . primary 40_8
. . . . . secondary 41_8

The switchpack used to set the maintenance port device code is located on the front of the board. This fact makes changing the controller device code easy, even after installation into the computer chassis. Switches 3 - 8 of the switchpack are used to set the device code. Switch 1 either initiates a self-test loop or overrides the set configuration facts stored in E²PROM. Switch 2 is for enable/disable of the E²PROM write protect. See Figure 2.12 for complete instructions.

When to Use the E²PROM Write Disable

The E²PROM on the controller stores information necessary for proper subsystem functioning. To completely protect this data, the option to disable writes to the E²PROM is available. In future installation steps some of this information may need to be modified to tailor a subsystem to the system into which it's being installed. At this time, leave switch 2 in the DOWN position to disable *writes*, until you run the Configuration Program.

Using Configuration Over-ride

Think of this feature as 'insurance' — it disables all devices but the tape drive so that you can configure the controller without accidentally affecting the other peripherals. If you're booting the SCZ-5 software support tape from the SCZ-5, you must boot from Logical Unit 0. This over-ride switch can be used to make sure the controller will recognize Logical Unit 0, enabling you to boot the Configurator Program.

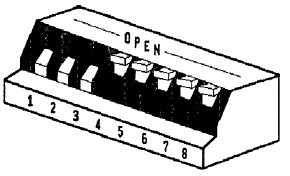
The leftmost switch on the switchpack (S1) can be used to set the controller options to certain known values.

- Tape device code is forced to the value set by the device code switchpack.
- Tape Logical Unit 0 is mapped to SCSI ID 5. (Your tape boot device must be set to SCSI ID 5 to use this feature.)
- The disk controller portion of the SCZ-5 becomes disabled until S1 is set back to the MPORT device code.

To use the Configuration Over-ride switch:

1. Set the SCZ-5 device code switches to the tape controller device code (instead of the MPORT).
2. Power-up the system.
3. Wait 30 seconds for the SCZ-5 self-test to complete, as indicated when the LEDs are no longer lit.
4. Flip S1 UP.
5. After running the Configurator Program, flip S1 DOWN and S3-S8 back to the MPORT device code.

If you have this switch UP before power-up or during self-test, the controller will loop on self-test.



Note:

Switch Down = Binary 1
Switch Up = Binary 0
Switch 3 = Most Significant Bit
Device Code = 40_8 is Shown
Switch 2 = E^2PROM Write Disable (DOWN)

Device Code	S1 Over-ride	S2 E^2PROM WRITE DISABLE	S3 DS0	S4 DS1	S5 DS2	S6 DS3	S7 DS4	S8 DS5
0X			UP	UP	UP			
1X			UP	UP	DOWN			
2X			UP	DOWN	UP			
3X			UP	DOWN	DOWN			
4X			DOWN	UP	UP			
5X			DOWN	UP	DOWN			
6X			DOWN	DOWN	UP			
7X			DOWN	DOWN	DOWN			
X0						UP	UP	UP
X1						UP	UP	DOWN
X2						UP	DOWN	UP
X3						UP	DOWN	DOWN
X4						DOWN	UP	UP
X5						DOWN	UP	DOWN
X6						DOWN	DOWN	UP
X7						DOWN	DOWN	DOWN

Figure 2.12
Maintenance Port Device Code Switches Located on Controller

2.13 Jumpers

Jumper W1-1 on the paddleboard is used to connect the controller's terminator power source to the SCSI bus. With jumper W1-1 installed, the controller will supply terminator power and maintain proper bus termination even if other terminator power sources, such as the second initiator in a dual-initiator configuration, are shut off. Zetaco recommends that you leave Jumper W1-1 installed. The paddleboard has an integral isolation diode that eliminates regulation with multiple power sources.

2.14 Installing Controller and Paddleboard

The physical placement of the controller and paddleboard into the computer requires care and patience. You may find a flashlight to be helpful.

How to Properly Install the Controller into its Slot

1. Pull out the levers at the front corners of the controller until they stick out straight in front.
2. Carefully guide the controller into the chosen **I/O ONLY** slot until the levers snap around the front of the chassis frame.
3. Gently apply pressure to the levers. The pressure you apply is forcing the goldfingers of the controller into the backplane socket. DO NOT apply undue pressure. If you don't feel the controller "give" a little as you are pushing it in, you may have the board misaligned. Remove and try again.
4. The board is properly installed if the levers end up flat against the board.

If you are inserting the SCZ-5 into the middle of a group of boards, you may need to extend the adjacent boards to be even with the SCZ-5 and insert them as a group.

How to Properly Install the SCZ-5 Paddleboard

1. Determine the "A" side of the backplane. Viewed from the rear, the "A" side is on the left for a chassis with horizontal boards or on the top for a vertical board chassis.
2. Locate the two rows of pins on the "A" side that correspond to the slot in which the SCZ-5 is installed.
3. Check for and carefully straighten any bent pins. Use a different slot if any of the pins are broken off.
4. Position the paddleboard connector block to cover all 100 pins of the "A" backplane. **Be sure that the component side of the paddleboard is facing the same way as the components on the controller.**
5. Press the connector squarely over the pins, making sure all pins insert and do not bend, until the connector block is flush with the backplane. Although an amount of pressure is necessary, DO NOT FORCE.

CAUTION **Component damage may occur at power-up if paddleboard is misaligned.**

1. ***Check BOTH ends for non-inserted pins.***
2. ***Doublecheck that the block is positioned over the correct two rows of pins, and NOT between slots.***
3. ***It may be necessary to count pairs of rows to determine correct positioning.***

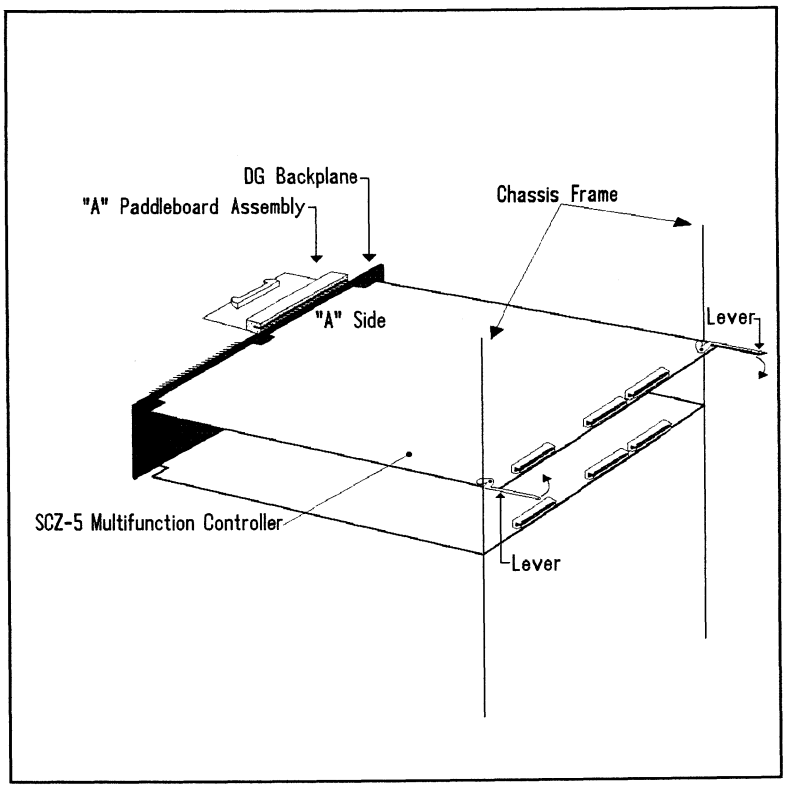


Figure 2.14
Installing the Paddleboard and Controller

2.15 Find out About Your Peripheral

Each peripheral manufacturer has a different way of setting the unit of a drive, indicating that power is on or that a self-test failure has occurred. These things, and others such as how to load/unload and write protect a tape or optical disk are all important points to know about.

You should have a copy of the manufacturer's manual for the disk or tape drive you are to use. It would be a good idea to research the following:

. . . . . Where are unit select switches?
. . . . . Is there a self-test?
. . . . . Are there LED status indicators?
. . . . . If so, what do they mean?
. . . . . How is a tape or removable media write-protected?
. . . . . How is removable media loaded/unloaded?
. . . . . Where can removable media be purchased?
. . . . . Do the tape heads need periodic cleaning?
. . . . . How should removable media be stored?
. . . . . What environment constraints are there for the peripheral devices?

More to Find Out About

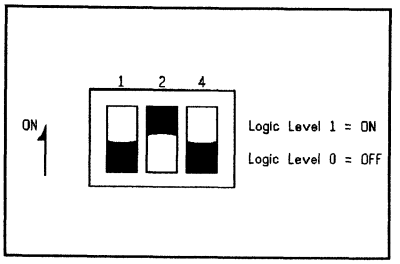
Make sure the drive you want to use is in the SCZ-5 Configurator Program. To find out, run the 9-track software support tape that is supplied with the SCZ-5, choosing "Configurator" off the menu. If an unsupported drive is used with the SCZ-5, chances are it will not operate properly.

Another concern is what type of enclosure the drive will fit into. If it is a rack-mount unit, find out the installation instructions.

You may always contact your Zetaco Sales Representative for the most current information on qualified drives.

Table 2.15

Example of SCSI ID Switch Settings for Exabyte Tape Drive



SW 1 SCSI ID Setting

SW1-1	SW1-2	SW1-3	ID
OFF	OFF	OFF	0
ON	OFF	OFF	1
OFF	ON	OFF	2
ON	ON	OFF	3
OFF	OFF	ON	4
ON	OFF	ON	5
OFF	ON	ON	6
ON	ON	ON	7

Example of SCSI ID Settings for Seagate's Wren Disk Drive

Drive ID is binary coded jumper position (most significant bit on left). For example, the jumper in position 1 would be Drive ID 1. No jumpers means ID 0.

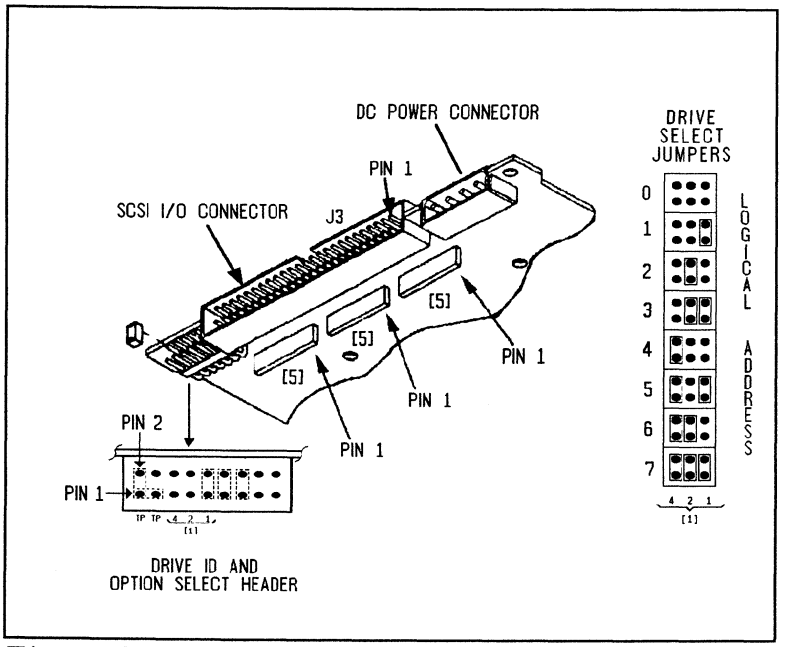


Figure 2.15
Example of Wren VII SCSI ID Switch Settings

2.16 Using More Than One Drive

You will probably want to control at least one tape and one disk with the SCZ-5. You can have up to seven devices on its SCSI bus. There is a limit to the cumulative length of the SCSI cables, and only the last drive can be terminated.

How Many Drives can be Added?

The SCZ-5 Multifunction SCSI Controller is designed to support up to seven devices on its SCSI bus. You can use any combination of disk, optical disk and tape, within these constraints:

- At this time the MTJ (tape) driver under AOS/VS can only recognize four logical units per device code.
- The DPJ (disk) driver under AOS/VS supports up to 8 logical disk units.
- Each drive, and the controller, must have a different SCSI ID.
- The cumulative total cable lengths of all drives attached to one SCZ-5 must not exceed 25 meters (82 feet) for differential drives and 6 meters (19.6 feet) for single-ended. If there is cabling inside a peripheral enclosure, the length must be included in the total.

Cabling Issues

To comply with FCC regulations, all external cables must be shielded. It is necessary to use shielded cables with a characteristic impedance of 120 *ohms* (or greater) for single-ended, and 100 *ohms* (or greater) for differential drives. It is best to use cables of the same characteristic impedance on the same bus to minimize discontinuities and signal reflections. Call a Zetaco representative for more information on available cables and lengths. Do not exceed the maximum cumulative lengths.

Figure 2.16 depicts a series of drives. Add the cable lengths using the following formula to determine whether you are over the limit. (To convert to feet, 39.37 inches are in one meter.)

n = number of devices on bus
L = length of cables between devices
d = length of drive internal cable

(.7 + L1 + L2 + ...Lx) + d must be ≤ 25 meters (differential)
must be ≤ 6 meters (single-ended)

1. Add together all the lengths of shielded cables for all drives including the cable from the computer chassis. Also include the seven tenths of a meter used inside the HOST chassis.

2. Multiply the number of drives (*n*) by *d*. This represents the cable length found inside each drive enclosure.

3. Add the two numbers. The total must be equal to or less than the 25 meter limit for differential or 6 meter limit for single-ended.

Terminate the Bus

The SCSI interface requires termination at both ends of the bus. The paddleboard is terminated on the controller end and the last drive must also receive termination. Install the terminator per manufacturer instruction for the last drive on the bus. See Figure 2.16.

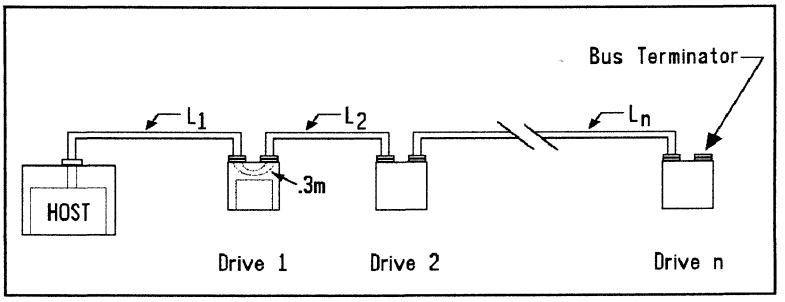


Figure 2.16
Daisy-Chained Drives

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 SCZ-5 and its attached drive/s must be connected to a singlepoint 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.

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.***

2.17 The Cable Connections

The cable going out to the drive comes in two parts: internal and external. The separation occurs at the chassis bulkhead to comply with FCC regulations. Extra external cables are needed to cable to more than one device. BMC cables provide the only bus the SCZ-5 can use for data transfer.

The Paddleboard-to-Drive Connection

You will need to provide a cable that goes from your computer bulkhead to your peripheral.

The paddleboard pin-out follows the pin-out for the SCSI interface, single-ended or differential.

Contact your Zetaco representative if you wish to purchase cables.

Providing Access to the BMC Bus for the SCZ-5 Controller

Since the BMC is the high-speed data path on the MV generation of computers, an increasing number of devices require access to it. Chances are that BMC cables are already in place on the system. If so, insert the free connector of each cable into the SCZ-5.

If the SCZ-5 is the first BMC device to be installed in the system, you must use the provided cables. See Figure 2.17.

1. The end of the cables with a single connector goes to the system BMC controller. Pay attention to Pin 1 orientation as you insert.

2. The other end of each BMC bus cable will have a group of connectors designed to be inserted into different BMC accessing devices. Insert one connector from each cable into the sockets provided on the SCZ-5.

The standard Zetaco BMC bus cables have 4 connectors to access BMC devices; cables with 6 and 8 connectors are also available.

Providing Termination for the BMC Bus

Each SCZ-5 Controller is shipped with a BMC terminator installed. Figure 2.17 shows the location. Only the last device on the BMC should be terminated. Remove the terminator plug from the SCZ-5 if it is not the last device on the BMC.

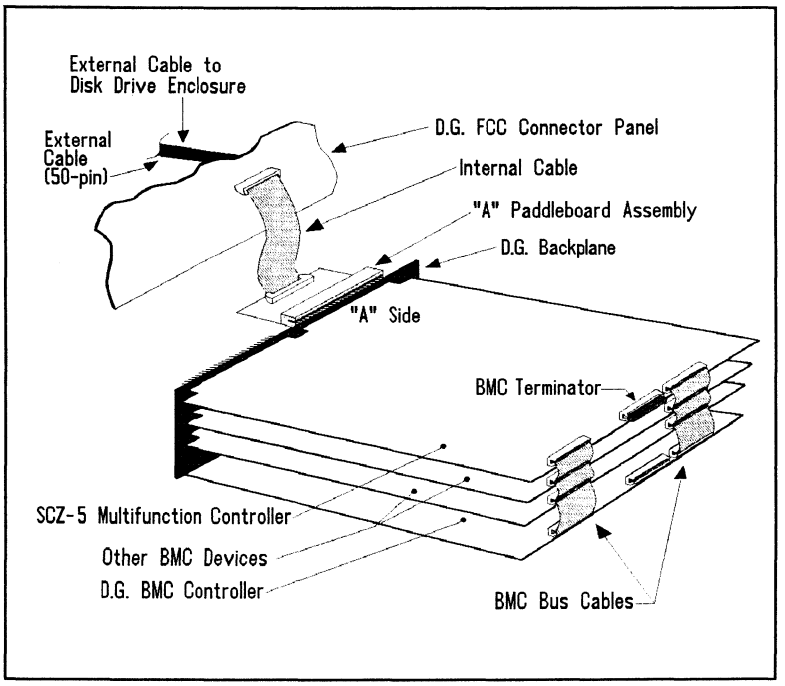


Figure 2.17
SCZ-5 Cabling Diagram

2.2 How to Check for Normal Power-Up

Before going on to the software part of the installation, you must make sure the hardware is working properly. The best way to test for initial problems is to turn on the power.

The SCZ-5 goes through a power-up self-test, and so may your drive(s). Other system devices, including the CPU, do this too.

When an SCZ-5 is functional, you should see:

- All SCZ-5 LEDs will be out after 30 seconds.

If your drive(s) are functional you should see:

- All power indicators lit and the status LEDs (if any) should indicate self-test passed on each drive.

When an MV system is ready, you should:

- Have a system prompt on your CRT screen.
- Be able to enter commands onto the screen and get system response.
- Be able to load system microcode to make the system functional.

As an installation aid, refer to the Checklist in Table 2.2. If your subsystem did not power-up correctly, look through the checklist for omissions, then go to the "Trouble-shooting" chapter of this manual. Be sure the SCZ-5 switches are set properly (refer to 2.12), especially the configuration over-ride and device code switches. If the system is acting strangely, refer to the proper Data General documentation.

Table 2.2 Hardware Installation Checklist

Check here:	If:
	Slot is I/O ONLY
	Slot has DCH and Interrupt Priority to it
	Device Code switches are set
	Controller inserted tightly (levers flush)
	Paddleboard is installed on "A" Side
	Paddleboard covers all 100 pins
	Paddleboard aligned to correct slot
	Paddleboard is cabled to drive
	BMC cables installed to correct devices
	BMC terminator installed on last BMC device
	BMC terminator removed from SCZ-5 if not last
	Power indicators for all drives are ON
	Media is loaded into drive(s)

2.3 The Software Installation Procedure

The software focused on here is the software necessary to complete the integration of the SCZ-5 into your system. You will need to configure the Controller, initialize the disk(s), run tests, and enable the drivers under the operating system.

The majority of the information in this chapter is about the programs written by Zetaco specifically for our product. The Data General system program, VSGEN must also be run. The Data General programs, CONTEST, MV/SYSTEMX, MLTT RELI and UDKV RELI are also tools for your use. Details on how to use these programs are not available here, only information on when their use is appropriate.

The following sections may be followed step-by-step in the order presented.

1. Using the Support Package Tape.

2. Using the Configurator program to set options.

3. Using the Initializer program for disk set-up.

4. Using the Reliability programs for test.

5. Preparation under the Operating System.

Have Enough Reference Material Ready

It is always appropriate to have Data General documentation on hand when installing something new. It would be especially valuable to have the Data General guide:

"How to Generate and Run AOS/VS."

The chapter on using VSGEN will be especially useful when performing the fourth step listed above.

If you have access to documentation on the Data General test programs available with the system, have that on hand also.

System Requirements for Installation

- An MV family CPU running AOS/VS with minimum 32K words of memory with MTJ and DPJ drivers available.
- Console at Device 10/11.
- Printer at Device 17 (if error log and configuration fact copies are desired).

2.31 Using the Support Package Tape

There are several important tools supplied on the Support Package Tape. With the Configurator program you may alter information stored in the E²PROM on the controller according to your needs. The Initializer program is used to format disks. The Reliability programs automatically perform a series of tests on the peripheral devices.

What the Files on the Tape are For

The Support Package Tape is structured so that the programs on files two to five can be loaded and executed directly from the tape. These programs are used in the installation and maintenance of the controller and peripherals. Each is a stand-alone program; none can be run under the operating system.

File Six on the tape contains the following:

1) Copies of the Configurator, Disk Initializer, Tape Reliability and Disk Reliability programs, in .SV file format. These programs can be booted from the system disk instead of the tape. However, it does not mean that they can run under AOS/VS, only that they are bootable from disk. Booting the programs from disk eliminates the need to mount the tape each time you need to run one of these programs. Once the programs have been loaded onto your disk, they may be executed using the "Run A Specified Program" function in your technical maintenance menu. Complete instructions are provided later in this section.

2) Stand-among Disk Initializer program "SCZ5I.CLI". This macro calls a version of the Disk Initializer program which runs under the AOS/VS operating system. It is useful for performing the disk initialization functions without having to bring down the AOS/VS system. Complete instructions are provided later in this section for using the program.

Files 0 and 1 on the Support Package tape contain special bootstrap programs that perform housekeeping tasks so that other programs can run. They also bring up the tape menu seen in Figure 2.31.

SysAdmin Tools Added to Support Tape

Along with .SV format copies of the other programs and a stand-among Disk Initializer program, **File Six** on the SCZ-5 Software Support Package Tape includes (a) a handy diagnostic tool that displays the current status of all peripherals on the SCSI bus, (b) a program to automatically rewind and unload a specified tape, and (c) a program to format a tape in a dual density tape drive.

To accommodate these three programs, there are nine files, three of which are the programs themselves, while the other six are *help* and *cli* files used to run the programs. The files are:

SCZ5M.PR	SCZ-5 Monitor program
SCZ5M.CLI	Used to run SCZ5M.PR
SCZ5M.HELP	This file contains a copy of the help information from SCZ5M.PR
REWUL.PR	SCZ-5 Rewind Unload program
REWUL.CLI	Used to run REWUL.PR
REWUL.HELP	This file contains a copy of the help information from REWUL.PR
SCZ5TF.PR	SCZ-5 Tape Format program
SCZ5TF.CLI	Used to run SCZ5TF.PR
SCZ5TF.HELP	This file contains a copy of the help information from SCZ5TF.PR

How to Access the Tape

All devices on the SCZ-5 SCSI bus and the computer should be powered on and ready, with no error conditions. The next step is to access the contents of the Support Package Tape.

The Support Package software has been shipped to you on a standard 9-track, ½" reel. If you have installed a ½" reel tape drive for use with your SCZ-5, you may boot the tape from this drive, assuming the SCZ-5 has been pre-configured to known settings (device code, tape drive model). The standard SCZ-5 tape device code is 23_8. Or, you can boot the software tape from any other ½" 1600 BPI tape subsystem you may already have installed on your system. Do the following:

1. Mount the tape on your ½" reel tape drive. Make sure you know what device code for which the ½" tape controller is set.

2. Load the system microcode if you are just powering the system up. (System microcode is not necessary to run the Configurator program, but it is necessary for the Reliability programs and Initializer.)

3. When the SCP prompt appears, type B or BOOT and the device code of the controller being used.

   `SCP> BOOT nn <or> B nn` , where "nn" is the device code of your ½" tape controller.

After a time, the Support tape menu is displayed, as shown in Figure 2.31.

```
File            #Program

 2              SCZ-5 Configurator
 3              SCZ-5 Disk Initializer
 4              SCZ-5 Tape Reliability
 5              SCZ-5 Disk Reliability
 6              Standamong Disk Initializer SCZ5I
                Standamong SCZ-5 monitor SCZ5M
                Standamong SCZ-5 rewind unload REWUL
                Standamong SCZ-5 tape formatter SCZ5TF and
                previous ".SV" files in AOS/VS Dump format.
```

Figure 2.31
Support Tape Menu

4. Enter the file number (2-5) of the program you want to run, followed by a carriage return. The selected program will be loaded into CPU memory and executed.

2.32 Using the Configurator Program to Set Options

The performance of the SCZ-5 and the peripherals it controls depends on more than how fast the drives are.... it also relies on how well the other pieces of the system interact together. The Configurator program provides a dialogue, giving you choices on set-up, to allow you to easily change what is already stored.

The Zetaco Configurator program is designed to interact with you, help you decide what to do (if you need help), and then store your changes into the SCZ-5 E^2PROM.

The Configurator is an easy-to-use program. It provides a choice whether to use it in ***novice*** or ***expert*** mode. In ***novice*** mode, help screens are automatically displayed. The program is menu driven, but the first full screen you see is the Configuration Overview. It is also displayed after you make changes to an option. Figure 2.32a shows what it looks like. From this screen you can get to the Main Command Menu. The main menu choices are shown in Figure 2.32b. Each main menu choice has a menu of its own.

Examine the data in the Configuration Overview. It is important to make sure that the Burst Rate, Break Count, and BMC Priority values are what you want. Also verify that the correct peripheral units are specified. To change any of the information in the Configuration Overview, enter the number of the main menu command or go to the Main Command Menu by pressing NEWLINE.

Selection from the Main Menu depends on what you want to do. To change BMC priority, Burst Rate, or Break Count, select:

```
1.  Display/edit the CONTROLLER-SPECIFIC
    parameters.
```

To make a change to the disk or tape drive choices displayed, select either:

```
2.  Display/edit the TAPE DRIVE assignment
    table.

3.  Display/edit the DISK DRIVE assignment
    table.
```

NOTE ***While you are using the Configurator program, the controller right-hand red LED will be on steadily. This indicates that you are communicating to the SCZ-5 Controller on a hardware level. When you have finished making your changes and exit the program, the red LED will go out.***

After you are done making your changes to the E²PROM configuration, be sure to update the SCZ-5. This is choice 9 from the Main Menu. To update the controller configuration, set the E²PROM write-disable switch (S2) to the UP position. When the update is complete, flip S2 DOWN to protect the E²PROM contents.

```
MPORT dev: 40  Printer dev: 17  Printer: ON  Help lev: EXPERT

             *****  Configuration Overview  *****

Controller-Specific Parameters      Current Setting
******************************      ***************

- Tape port BMC burst rate . . . :          32
- Tape port BMC break count. . . :           4
- Tape port device code. . . . . :          23
- Disk port BMC burst rate . . . :          32
- Disk port BMC break count. . . :           4
- Disk port device code. . . . . :          24
- BMC priority (tape & disk) . . :           0
- Initiator (SCZ-5) SCSI ID. . . :           7
- Interrupt Priority High/Low. . :      Disk/Tape

Physical devices are currently assigned to the following
********************************************************
logical units:
**************

TAPE logical unit(s):  0
DISK logical unit(s):  0

Please enter your desired command or NEWLINE to see
the command menu:
```

Figure 2.32a
Sample Configuration Overview Screen

```
MPORT dev: 40  Printer dev: 17  Printer: ON  Help lev: EXPERT

                      Main Command Menu
                      *****************

  1.  Display/edit the CONTROLLER-SPECIFIC parameters.
  2.  Display/edit the TAPE DRIVE assignment table.
  3.  Display/edit the DISK DRIVE assignment table.
  4.  Reserved.
  5.  Display the CONFIGURATION OVERVIEW.
  6.  CLEAR all current configuration fields.
  7.  Print a CONFIGURATION REPORT.
  8.  Modify the PROGRAM CONTROL features.
  9.  UPDATE the SCZ-5 controller with your selected
       operating parameters.
  10. QUIT.
```

Figure 2.32b
Sample Configurator Main Menu

2.33 More Information on Which Options to Change

Anytime you add to a system, you change the interaction of the parts. The transition can be painless by choosing the set-up options intelligently.

BMC Options

How you select the values for these options will affect how well the new Controller gets along with those already there. Base your decisions for these values on:

1. How much system-wide traffic the Controller will be asked to handle.

2. When the Subsystem will get the most use. After or before hours? During peak worktime?

BMC PRIORITY: Choose a number between zero and seven. (On the MV/4000 you must choose between zero and three.) The higher the number given to a Controller, the more weight the Data General BMC controller gives to its request for bus access. There can be no duplication or the system will get confused.

RECOMMENDATION FOR SCZ-5: Since the SCZ-5 controls your disk device, you will want as high a number as possible.

BMC BURST RATE: This value can be 2, 4, 8, 16, 32, 64, 128, or 256. This is the number of words that can be transferred by the Controller per BMC bus request. After the transfer limit has been reached, the Controller must relinquish the bus and wait to try again. A low value may make data transfers take a long time, decreasing performance. A high value may dominate the bus, causing data late problems with other controllers. You can choose separate and different parameters for disk and tape.

RECOMMENDATION FOR SCZ-5: Of course it depends on your system usage, but a good number to begin with is 32 for both disk and tape.

BMC BREAK COUNT: Choose a number between one and 255. This sets the amount of time the controller waits between data transfers, before trying to get access to the BMC bus again. Basically, this number tells the Controller how many BMC Sync Clock periods it must count before making another BMC request. You can choose separate and different parameters for disk and tape.

Try to balance this number with the BMC priority selected. A high priority device with a small Break Count will be on the bus a greater amount of time, possibly excluding others.

RECOMMENDATION FOR SCZ-5: BMC Break Count may be configured separately for disk and tape; a good number to begin with for both is four. They can be set at the same number despite the difference between disk and tape transfer speeds because of the SCSI intelligence on the drives. SCSI drives have the capability to accept a command and then disconnect from the controller from wasting BMC time waiting for more data from a drive.

BMC OPTION:	WHAT TO REMEMBER:	RECOMMENDATION:
Priority	- Want highest numbers assigned to the most intensively used devices. - DO NOT DUPLICATE	Highest Number Possible
Burst Rate	- Low value on high traffic device could cause lowered performance. - High value can cause device to dominate BMC bus causing data late on others.	32
Break Count	- Balance this number with priority of the device. - Too high a value may degrade drive-to-controller performance.	4

DISK BYTE ORDER: Disk byte order is set up from the disk menu. (Byte order on tape is not configurable.) Set this parameter to the least significant byte first, then modify as necessary later. Note that if you're replacing a Zetaco SCZ-3 Disk Controller with the SCZ-5, set the byte order to match the one being replaced.

Selecting SCSI ID for the SCZ-5

A SCSI bus can support up to eight devices. Communication on the SCSI bus is allowed between only two devices at a time; one acts as an initiator and the other acts as a target. The initiator (typically a controller such as the SCZ-5) originates an operation and the target performs the operation. Each device has its own SCSI ID. The SCZ-5 is counted as one of the eight possible devices. It is through the Configurator that you choose which ID to make it. The ID numbers are weighted, with more priority going to the higher number device during certain bus phases. **SCSI ID seven is recommended for the SCZ-5. Be sure that there are no duplicate ID's on the bus.**

Setting Interrupt Priority

Set this parameter from the controller-specific parameters menu on the Configurator. Choose which (either disk or tape) should get highest priority. Usually disk should have the higher priority.

2.34 Using the Disk Initializer Program

The Disk Initializer program is used to prepare disk drives for use with the SCZ-5. If you received the disk drives and controller together as a subsystem, the drives may have already been prepared for you; however, an understanding of this program is recommended for anyone who deals with the installation or maintenance of the controller or disk drives.

WARNING: Use of this program may result in loss of all data on the disk drives. Please read the following sections carefully. If you choose to perform a *format* or *write/read analyze*, all data on the specified disk drive will be destroyed.

The Disk Initializer is used to format and perform a surface analysis on the disk drives and help manage media flaws on the disks, which are also known as "bad blocks." Most disk drive models have some degree of build-in bad block management of their own, which helps offload the effort required of the controller (and system maintenance personnel) in handling bad blocks. For a more detailed description of what *format* and *analyze* will do, refer to the section on Choosing Program Options.

Stand-alone and Stand-among Program Versions

Two versions of the Disk Initializer program are provided on the support tape; a stand-alone version that runs only when the AOS/VS operating system is not running, and a stand-among version that runs under the AOS/VS operating system. The stand-alone version must be used if the disk you wish to format or analyze is your system disk or is another disk that is currently INIT'd under the system. The stand-among version is useful for examining the disk soft error logs while the system is up, or for formatting optical platters without bringing down the system.

Running Stand-alone SCZ5I

To run the stand-alone Disk Initializer, either load the program from tape per the instructions in section 2.31, or from disk, per the instructions in section 2.37.

Running Stand-among SCZ5I

To run the stand-among Disk Initializer, you must first have loaded the program from tape onto disk per the instructions in section 2.37. You can then run it from any user console enabled by EXEC. To run the program, you must have both the SUPERUSER and CHANGE TYPE priviledges assigned to your username by the Profile Editor. Refer to the Generating and Running AOS/VS documentation for more information on user profiles.

When the SCZ5I.CLI macro is invoked, the environment is pushed, then the current directory is changed to :UTIL and SCZ5I.PR is executed. Upon program termination, the previous environment and directory are restored.

With the :UTIL directory in your searchlist, type

) **SUPERUSER ON** <cr>
*) **SCZ5I** <cr>

The program will begin execution. The program will ask you for the controller Maintenance Port device code. This is the device code that the controller front switches are set to. DO NOT enter the controller disk device code. The program will then determine the disk controller device code, and confirm this before proceeding. One difference between the stand-alone and stand-among versions is the stand-among version requires that you enter each unit by its disk unit name, or "DPJxx". Also, stand-among SCZ5I restricts operations performed on disks currently INIT'd under the system. To perform those functions that access the user data area of the disk such as Format, Analyze or Relocate blocks, you must first RELEASE the disk unit.

When to Use This Program

Use the Disk Initializer when you want to:

1. Completely re-initialize a disk drive for use with the system. The disk may be new and possibly unformatted, or you may simply want to perform a total re-initialization of the disk drive to ensure its format is good.

2. Examine and/or relocate the bad blocks in the SCZ-5 soft error log.

3. Perform other scheduled system maintenance, which may include one or more of the following operations. "Destructive" indicates that the operation will result in a loss of data on that disk.

   - Relocate the bad blocks in the controller soft error log
   - Relocate other bad blocks not found in the soft error log
   - Perform a *read-only* analysis of the entire disk
   - Perform a *write/read/verify* analysis of the entire disk (**destructive**)
   - Perform a format of the entire disk (**destructive**)

The Program Sequence to Follow

Basically, when you run the program, you:

1. Choose the disk drive units and the program options for each unit. Use the [E] command from the main menu. In response to "Device Code?", enter the device code of the disk controller.

2. Start the operations. Use the [S] command from the main menu.

3. To monitor program status, use the [L] command.

Choosing Program Options for Each Unit

Analyze Disk

This option performs a disk surface analysis to detect and then relocate the bad blocks to another area of the disk. The purpose of analyze is to detect and remove as many bad blocks as possible before using the disk under the system, reducing the risk of loss of data later if a defect worsens. This selection can also be used as disk initialization do-all since it allows you to perform all the options on the specified unit.

First, the program asks whether you wish to format the disk prior to it performing the surface analysis. Refer to the Format option description (following) for more information on formatting the disk and on the following question of whether or not to retain previously relocated sectors.

Next, the program asks whether or not you wish to run Read-Only Analyze.

- Read-Only Analyze performs a non-destructive, one-pass, sequential *read* over the entire disk to test for bad blocks. When the program finds a bad block, it relocates the block along with the data contained in it to a good "spare" block in a reserved area of the disk. The result of using this option is that it will eliminate as many "soft" errors as possible without losing or affecting any disk data. This option will also offer you the choice of whether or not to relocate the blocks listed in the controller soft error log. We recommend you answer YES to this question **only** if the specified disk drive is not configured with Auto-Relocation enabled. Refer to the Relocate Blocks option for more information on auto-relocation.

If you answer NO to the Read-Only Analyze question, the program will perform a full *write/read/verify* data analysis. This choice is recommended for any new installation before the disk is put into use with the operating system. If you choose this option, we also recommend you answered YES to "Format?" earlier to allow new sector headers to be written onto the disk.

- Write/Read/Verify Analyze performs a multiple-pattern sequential *write/read* data verification over the entire disk to detect and relocate as many bad blocks as possible. **USE OF THIS OPTION WILL RESULT IN THE LOSS OF ALL DISK DATA FOR THE SPECIFIED UNIT.** The program then asks how many data patterns are used to detect data-sensitive and intermittent media defects. Enter a number between 1 and 10. The more data patterns used, the longer the testing will take. We recommend at least 3 patterns be used. If the controller soft error log contains any blocks, the program will ask if you want the blocks relocated. We recommend you answer YES to this question ONLY if the specified disk drive is not configured with Auto-Relocation enabled. Refer to the Relocate Blocks option for more information on auto-relocation.

Relocate Blocks

This option allows you to examine and/or relocate the blocks listed in the controller soft error log and/or any additional bad block addresses you wish to enter yourself. The soft error log contains a list of the blocks on the disk that the disk drive has reported as having "soft" errors, i.e., blocks that are still usable but require some amount of error correction.

By relocating these bad blocks, you move your disk data to good blocks on the disk and reduce the risk of losing data if the original bad blocks become completely unusable. You should ONLY relocate these blocks if the disk drive has not been configured with Auto-Relocation ENABLED using the controller Configurator utility. If Auto-Relocation is enabled, the disk drive has already relocated the bad blocks, and the log contains these blocks for reference only.

For those block addresses you wish to enter manually, you must enter in the disk physical block address format. If you wish to relocate a block listed in your system log that is in cylinder/head/sector format, you must convert it to the physical block address using the formula at the top of page 2-34:

(# of heads/drive * # of sectors/track * cylinder #)
+ (# of sectors/track * head #)
+ (sector #)
= physical block address

Format Only

The Format Only option is the lowest level operation you can give a disk drive and is the first step in a full disk initialization. Normally, you would not use this option but would instead perform the format by answering YES to the "Format?" question in the Analyze option path, since you should normally follow a re-format with a surface analysis. The format operation erases and re-records block addresses on the disk surfaces, ensuring readable block headers and track alignment. **USE OF THE FORMAT OPTION WILL RESULT IN THE LOSS OF ALL DATA ON THE SPECIFIED DISK DRIVE.**

The program asks if you want to "Retain Previously Relocated Sectors?" This refers to whether or not the disk drive retains its "growth" list of relocated blocks, i.e., those blocks that have been detected as bad over time by either the Disk Initializer program or the drive itself, and have been relocated. This does NOT refer to the drives "primary" defect list written by the drive manufacturer — these relocated blocks are not affected.

We recommend that you answer YES to this question, unless some abnormal condition may have caused the disk drive to relocate an excessive amount of bad sectors that may not have been bad. If you answer NO, we recommend that you run at least a 5-pattern *write/read/verify* surface analysis on the drive.

INIT Soft Error Log

This option clears the controller soft error log without relocating the blocks listed in it. It should normally only be used when the selected drive is configured for Auto-Relocation mode, after the log has been examined and recorded. If Auto-Relocation is enabled, the log represents blocks that have already been relocated by the disk drive.

Rewriteable Optical Disk Users

If you are using the disk controller with rewriteable (magneto-optical) disk drives, keep the following in mind:

1. New cartridges can come either unformatted or in the wrong disk format type. Because of this you MUST FORMAT EACH SIDE of new rewriteable optical cartridges.

   Start by inserting the cartridge into the drive with side A up, and format the disk. When the format is complete (each side takes approximately 25 minutes), remove the cartridge, re-insert with side B up, and issue the Start command again. The cartridges are formatted to the ISO standard format type.

2. It is usually not necessary to perform surface analysis on the rewriteable disks because the disk drive has extensive built-in bad block management capabilities. Additionally, cartridges are factory-certified and media defects mapped out by the manufacturer. Because of this, the default option for an optical drive is Format Only. A 3-pattern *write/read/verify* surface analysis takes about 3 hours per side.

If You Are Upgrading From An SCZ-3 Controller

If you are upgrading a subsystem, from an SCZ-3.1 or SCZ-3.2 controller to an SCZ-5 Controller, you do not need to run the Disk Initializer program. The disks need no re-initialization to upgrade to the SCZ-5 Controller. All controller microcode is contained in EPROM on the controller, not on the disk drives. This applies to rewriteable optical disk subsystems as well.

2.35 Using SCZ5M Monitor Program

SCZ5M monitors all disk and tape activity on a SCZ-5 Multifunction Controller, reading this information from the controller's maintance port. It can also be used to find out how much tape is still available for recording on a tape cartridge.

SCZ5M.PR, which is the Monitor Program, can be especially helpful as a diagnostic tool because it displays the status of all devices on the SCSI bus, so you can see what's going on at any given time.

A copy of what the help information for this program looks like is shown below. Note that you can exit the Monitor Program at any time by typing (cntl C) then (cntl B).

SCZ-5 Monitor Help

Description:

This program will display the current file number, record number, and active SCSI command for all configured tape units. It will also display the last block number accessed and active SCSI command for all configured disk units.

Requirements:

The SCZ-5 monitor program requires an SCZ-5 controller board. You also must have the CHANGE TYPE privilege to execute this program.

Switches:

These switches may be used in any combination or not at all.

/MODE= (0 for OCTAL, 1 for DECIMAL, and 2 for HEXADECIMAL) default = 1

This allows the numbers to be displayed in octal, decimal, or hexadecimal. Octal numbers are displayed with no leading zeros and no point afterwards. Decimal numbers are displayed with no leading zeros and followed by a decimal point. Hexadecimal numbers are displayed with leading zeros but no point afterwards.

/MPORT= (maintenance port device code in OCTAL) default = 40

This allows the device code of the SCZ-5 maintance port (the switches on the front of the controller board) to be a nonstandard value.

/UPDATE= (0-65 seconds) default = 3 seconds

This allows the delay time between screen updates to be set. The shorter this time is, the faster changes will show up on the screen and the more CPU and controller time the program will consume.

/TREM @MTJX

This displays the amount of tape remaining on the specified drive. This information is read directly from the tape drive.

/TTY

Use this switch if you have a TTY or hard copy type terminal.

/HELP This displays this help information.

Exiting the program:
Exit the SCZ-5 monitor at any time by typing (cntl C) then (cntl B).

Status definitions:

Idle	There was no SCSI command active when the SCZ-5 was polled
Read	Read disk sectors or read tape records
Write	Write disk sectors or write tape records
Format	Format a disk unit
Recal	Return the disk read/write heads to cylinder zero
SpaceF	Space file marks
SpaceR	Space records
Rewind	Rewind the tape unit to the beginning of the tape (BOT)
Rew UL	Rewind and unload a tape
Load	Load a tape
WFMK	Write a file mark
Erase	Erase tape
T Rdy	Test unit ready
Mo Sel	Mode select
Mo Sen	Mode sense
Rq Sns	Request sense data from the drive

Example: X SCZ5M/MPORT=41/MODE=0/UPDATE=0
The maintance port device code is 41 octal, numbers are printed in octal, and the screen is updated as fast as possible.

2.36 Using the REWUL Rewind/Unload Program

REWUL is used to rewind and unload a tape on the SCZ-5 Multifunction Controller, instead of the standard rewind command in AOS/VS or AOS/VS II.

REWUL is especially useful if you wish to remove the tape from the drive after rewinding, or if the system administrator wishes to prohibit anyone else from using a tape after a backup. One way the latter could be done is to do the backup from a .CLI file and have the last command in the .CLI file be REWUL @MTJX where X is the tape unit number.

Example:
DUMP_II/V @MTJ0:0 :UDD:#
DUMP_II/V @MTJ0:1 :UTIL:#
REWUL @MTJ0

This is a copy of the help information for this program:

SCZ-5 Rewind Unload Help

Description:

This program will rewind and unload the specified tape drive.

Requirements:

The SCZ-5 rewind and unload program requires an SCZ-5 controller board. You must have the CHANGE TYPE privilege to execute this program.

Switches:

/MPORT= (maintenance port device code in OCTAL)
default = 40

This allows the device code of the SCZ-5 maintance port (the switches on the front of the controller) to be a nonstandard value.

/HELP Displays this help information.

Example: REWUL/MPORT=41 @MTJ0

The maintance port device code is 41 octal and @MTJ0 is rewound and unloaded.

2.37 Using the SCZ5TF Tape Formatter Program

SCZ5TF is used for formatting a tape in a dual density tape drive such as the WangDAT 2600.

SCZ5TF is used for initializing new tapes to the desired format, or for changing the format of an old tape. Most of the tape drives that require formatting default to the highest density format when a new blank tape is used.

If an old tape or a formatted tape is used, SCZ5TF determines the current format and uses it.

SCZ-5 Tape Format help

This is a copy of the help information for this program:

Description:

This program formats a tape to the specified tape density.

Requirements:

The SCZ-5 Tape Format program requires a SCZ-5 controller board. (You must have the CHANGE TYPE privilege to execute this program.)

Switches:

/MPORT= (maintenance port device code in OCTAL) default = 40

This allows the device code of the SCZ-5 maintance port (the switches on the front of the controller board) to be a nonstandard value.

/HELP This displays this help information.

/LOW Use this to select the lowest density on multi-density drives:

4mm drives - standard DDS format.
8mm drives - EXB-8200 format.

/HIGH Use this to select the highest density on multi-density drives:

4mm drives - data compression format.
8mm drives - EXB-8500 format.

Example: SCZ5TF/MPORT=41/LOW @MTJ0
The maintance port device code is 41 octal and the tape in @MTJ0 is formatted to the lowest density format.

Note that the tape format must be specified.

2.38 Using the Reliability Programs

The function of the Reliability programs is exactly what the name implies: they test that the drive and controller are operational, and that extended use with the combinations of commands does not make them fail. There are separate test programs for disk and tape, but they operating in the same fashion.

As a stand-alone program, each Reliability utility tests only the part of the subsystem that you are installing; disk or tape. No attempt is made to provide an exhaustive system level test. It does not, for example, tell you if you have duplicated BMC priorities. To test for system level functioning, run Data General's MVSYSTEMX.

```
RELIABILITY PROGRAM
Enable mapping (YES, [NO]):
Execution Mode:
    [R]andom Reliability      [S]equential Reliability
Enter your choice [R]:


              SCZ-5 RELIABILITY UTILITY
                     REV. XX
            COPYRIGHT 19XX, ZETACO, INC.

                    COMMAND LIST

    [E]NTER A DEVICE              [D]ELETE A DEVICE
    [S]TART A DEVICE              [H]ALT A DEVICE
    [C]OMMAND LIST                [L]IST ERROR TOTALS
    [F]LAGS                       [M]ODE OF DISPLAY
    [Q]UIT

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

Figure 2.35
Main Menu of Reliability Test Program

Choosing the Program Global Parameters

Before you get to the Main Menu, you are asked to choose several global operating parameters. These choices are asked only when the program is booted or restarted. The parameters are for: **Mapping** and **Program Execution Modes.**

Mapping

Enabling this feature allows the Reliability program to test some of the mapping features for which the SCZ-5 is responsible. These features are defined in the Data General Programmer's Reference series. It is not necessary to enable mapping in order to test controller-drive functionality. The default answer is no. **DO NOT enable this mode if running in an MV/7800 or MV/4000.**

Program Execution Modes

You may choose to run in sequential or random mode for both disk and tape.

Disk: In sequential mode, the entire disk is written once. The controller re-reads it to verify, then stops. In random mode, the controller writes a random number of sectors at random locations, then reads it all back to verify. Random mode will continue until stopped. The time it takes to run these processes varies, depending on the size and speed of the disk drive.

Tape: In sequential mode, continuous *writes* of a fixed size are performed to EOT, the tape is rewound, and, if the verify feature is enabled, a *read* to EOT ensues. In random modes, a variable number of records containing a various number of bytes is written to a file. It is immediately read and verified (if enabled), and the program continues. Random mode will continue until stopped.

The Program Sequence to Follow

Basically, when you run the program, you:

1. Select the global program parameters. Random Mode with no mapping is a good choice for first installation. Let the test run for 20 minutes.

2. Enter the devices you want to test and the test specifics for each of them. Use the [E] command from the main menu.

3. Run the tests. Use the [S] command.

4. Examine the status of each drive. Use the [L] command.

See Section 3.4 for information on error messages from this program.

2.39 Summary of Reliability Commands

Use this explanation of each Reliability command to better understand how to use the program. Commands are the same in both Reliability programs.

The Main Menu Options

1. **ENTER A DEVICE** – This command does several things:

   a) Initializes the Controller.

   b) Looks for READY units - You may operate on any drive that appears READY to the Controller. The program reports, starting with UNIT 0, that a drive is ready and allows a YES/NO choice for selection.

   c) Sets Disk & Tape Test Parameters - After accepting a READY unit for testing, the program asks for input about the records the test will write.

   DISK: The screen shows how many megabytes the disk has, then accepts YES/NO choices for *write* only, *read* only, to verify data, and one of nine data patterns to *write/read.*

   TAPE: For random mode, the program will ask the maximum number of records it can put in each file, and the maximum number of bytes each record can contain. For sequential mode, it requests only the fixed number of bytes to put in each record. Default value is given for each question. Next, the program accepts YES/NO choices for *write* only, *read* only, verify data, and one of nine data patterns to *write/read.*

   After each READY unit that you wish to run has its test parameters defined, the program returns to the command prompt. To actually begin the tests you have selected, use the START command.

2. **START A DEVICE** – This command gives you the option of starting the test on all entered devices, or on any combination of them. To verify that the program is running, observe the green LED's on the controller or issue a LIST command.

3. **LIST ERROR TOTALS** – This command lists status **and** error information. It can be used any time you wish to find out about the devices running. If you use the command before issuing a START, the disk information about mode will be accurate, but the runtime, blocks written and read, and error totals will not; and tape information about current file, current records, and EOTs reached will not be correct.

4. **COMMAND LIST** – This command displays the Command Menu.

5. **HALT A DEVICE** – Any device can be halted without affecting tests being performed on other devices.

6. **DELETE A DEVICE** – Once you HALT a test being run on a device, you can delete that device from the testing altogether, by using this command.

7. **PRINTER CONTROL** – This command enables or disables the printer. If the program is running unattended, enable the printer so you can capture error messages. Use of this command does not affect tests being run. A program RESTART will put it back to the default of disabled printer.

8. **RESTART THE PROGRAM** – This command completely re-initializes the program. You must reselect mode, devices, and re-enable the printer.

9. **FLAGS** – The flag available in the Reliability program can be set to halt the program when an error is encountered or, the default, simply log the error and continue. If you choose to halt at an error condition, the program will log the error and jump to the Debugger resident in the program. To leave the Debugger, and restart the program, type RT. The flag may be changed while tests are running.

10. **QUIT** – This command gets you out of the program.

11. **MODIFY DISPLAY MODE** – You can choose to use hexadecimal, decimal or octal for program display and input.

2.40 Preparation Under the Operating System

Any controller and drive being added to a Data General system needs to be made recognizable to the system software. This is done using the VSGEN program provided with AOS/VS system software. Also, files from the Support Package Tape may be loaded onto an AOS/VS system disk for ease of future use.

Why Run VSGEN?

All hardware in a system needs to be unified in some way in order to work together. This is the job of the system software, or Operating System. There are several layers of complexity to this software. That software closest to the hardware is often said to DRIVE the hardware. It knows about the bit meanings of status returned and how to tell the hardware what to do. This software is referred to as a DRIVER. All pieces of hardware need a Driver to interpret and translate for it.

The purpose of the program VSGEN is to select the Driver compatible with the hardware you are installing.

What to Know Before You Run VSGEN

You need to know:

1. What device codes to which you have set the disk and tape ports.
2. The drivers to select are MTJ for tape, and DPJ for disk.
3. The name of the configuration file to edit for additions.
4. The unit number for which each device is configured.

For further assistance, consult system management documentation.

Loading Support Tape Files Onto Your AOS/VS System Disk

The last file on the Support Package tape is in DUMP format. This means that it is recognizable to the system LOAD program. When loaded onto disk as described below, the programs will be placed in the :UTIL directory on your system disk.

(Note: the stand-among Disk Initializer program and its macro MUST reside in :UTIL directory to function properly. Running the program in the same directory that LDU's reside may have adverse effects under the AOS/VS II operating system.)

Standard CLI Commands to Load File 6

To load the programs onto an AOS/VS system disk as described, load them with root (:) as you current directory using the following script:

) **SUPERUSER ON**
*) **DIR :**
*) **LOAD/V @MTzx:6**
*) **REW @MTzx**
*) **SUPERUSER OFF**

where:

z = the tape controller type (A, B, C, D, or J)
x = the tape unit number

The programs will be loaded into the :UTIL directory of your system disk.

Running Stand-alone Programs

To load and run a stand-alone program from disk, bring down your system and re-boot the system disk. From your Technical Maintenance Menu, choose the option "Run A Specified Program". Then, enter the full pathname of the file you wish to run, including the .SV extension. For example, if you want to run the Configurator, enter:

:UTIL:CFSCZ5.SV <cr>

The following are the full pathnames you would enter to run the stand-alone SCZ-5 programs from disk:

```
Configurator  . . . . :UTIL:CFSCZ5.SV
Disk Initializer  . . :UTIL:SCZ5I.SV
Tape Reliability  . . :UTIL:SCZ5TR.SV
Disk Reliability  . . :UTIL:SCZ5DR.SV
```

Running Stand-among Programs

To load and run a stand-among program under AOS/VS, first make sure your current searchlist includes the :UTIL directory. You must also have Superuser privilege on.

To run the stand-among Disk Initializer, enter:

```
) SUPERUSER ON <cr>
) SCZ5I <cr>
```

To run the SCZ-5 Monitor, Rewind/Unload, or Tape Formatter, Superuser privilege is not required. You can find out what switches are available by entering one of the following:

```
) SCZ5M/HELP <cr>
      or

) REWUL/HELP <cr>
      or

) SCZ5TF/HELP <cr>
```

3

Trouble-shooting

3.0 Trouble-shooting SCZ-5 Errors

Problems can occur during initial installation or after a period of time. Most installation difficulties are apparent at the first power-up or while performing installation set-up and test procedures using the Support Package Tape. Problems that occur after a time of successful usage are more likely to take the form of system error messages. Trouble-shooting under the operating system is difficult if not impossible. It is best to rely on stand alone test programs such as Zetaco Reliability or Data General MVSYSTEMX for help.

Power-up Problems

You must be aware of equipment failure messages at the crucial time of applying power to the subsystem. In this matter, the hardware is supported by:

- Microprocessor based controller self-tests performed each time power is applied
- Controller LED status indicators for self-test

Test Programs to Use

The SCZ-5 has its own easy-to-use test programs, written specifically for its peripherals. They should be used during installation and may also be used at any time problems are suspected. Data General programs such as MVSYSTEMX, MLTT_RELI, UDKV_RELI and CONTEST may also be used on this Zetaco product and can be useful to diagnose unclear system errors.

Field Support

Zetaco provides support through authorized distributors with:

- Quick turnaround for factory repair/replacement
- Warranties on workmanship and materials

3.1 Interpreting Controller Self-test Errors at Power-Up

Self-test resides in ROM on the controller. It is designed to check the most critical functions of the hardware each time power is applied. Self-test is actually composed of two independent modules, each consisting of a series of tests and each associated with a group of three LEDs on the front of the board.

There are 9 LEDs on the controller, grouped as 3 and as 6. Each group is a series of red, yellow, and green. See Figure 3.1 to identify LED placement on the Controller board.

The entire test takes about 30 seconds to complete. While self-test is being performed, both red LEDs will be lit. If self-test is successful, all LEDs go out.

If the LEDs remain on for a time longer than self-test should take, the Controller may not be seated correctly. If a portion of the hardware is defective, an error sequence will flash on the LEDs.

Table 3.1 explains what can be done in each of these instances.

Table 3.1 ***What the LEDs Mean***

SYMPTOM	WHAT TO TRY
Both RED steadily lit.	Re-seat controller or install in another slot.
A pattern is flashed on the LEDs.	Retry power-up. Record error code. Call for assistance.
All LEDs extinguished.	**Don't do anything!** This is normal.

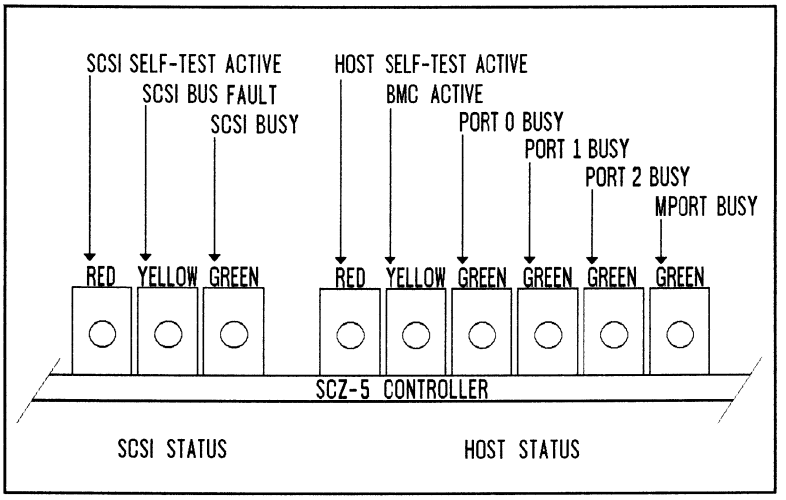


Figure 3.1
LED Status Indicators

3.11 Identifying the Self-test Failure

There are two sets of LEDs that reflect the status of the two parts of the board. The right-most six LEDs report the status of the tests performed on the Host logic, which is responsive to the Data General Argus drivers. The left-most three LEDs correlate to the tests performed on the logic controlling the SCSI device(s). Each side has a different way to report a test that fails.

Host Side Error Decoding

When the Host side logic errors during self-test, the red LED on the right flashes. The number of times it flashes between pauses corresponds to the number of the test that failed. Possible test failures are displayed as follows:

RED LED FLASHES:	TEST THAT FAILED:
1	High Speed Buffer Bank0
2	High Speed Buffer Bank1
3	Dual Port RAM
4	Combined Dual Port RAM
5	RAM Test
12	E^2PROM Checksum *(follow Reconfigure Instructions)*
13 - 22	Decimal Value of SCSI Side Failure

Reconfigure Instructions

All configurable SCZ-5 options are held in an E^2PROM, which stands for *Electrically Erasable Programmable Read Only Memory*. Since the chip can be erased electrically by design, it can be affected by transient pulses or by static. If the contents of the SCZ-5 E^2PROM are corrupt, its checksum will be wrong when checked during self-test and self-test will fail with an "E^2PROM Checksum" error. Do the following to remedy this:

1. Locate switchpak on front of SCZ-5 and flip switch 1 UP to stop the LED from flashing, thus allowing self-test to complete.

2. After the LED has stopped flashing, leave switch 1 UP until after configuration. Flip switch 2 UP to **enable** *writes* to the E^2PROM.

3. Bring up the SCZ-5 Configurator program and re-input configuration facts. Update the E^2PROM.

4. **Be sure to put switches 1 and 2 DOWN again.** It is a good idea to keep a print-out of the correct configuration facts.

SCSI Side Error Decoding

The numbering of the SCSI side tests is in octal. All three of the LEDs on the left are used to indicate the octal number of the test that failed, not just the red LED.

The octal number is displayed in binary format on the LEDs. Since the highest single digit in octal is seven, three LEDs are enough to transmit the code of the failing test, one digit at a time.

Figure 3.11 shows the octal value represented by the LEDs. Follow this procedure to decode them:

1. Watch for all three LEDs to light in sequence, right to left. This marks the beginning of the code sequence.

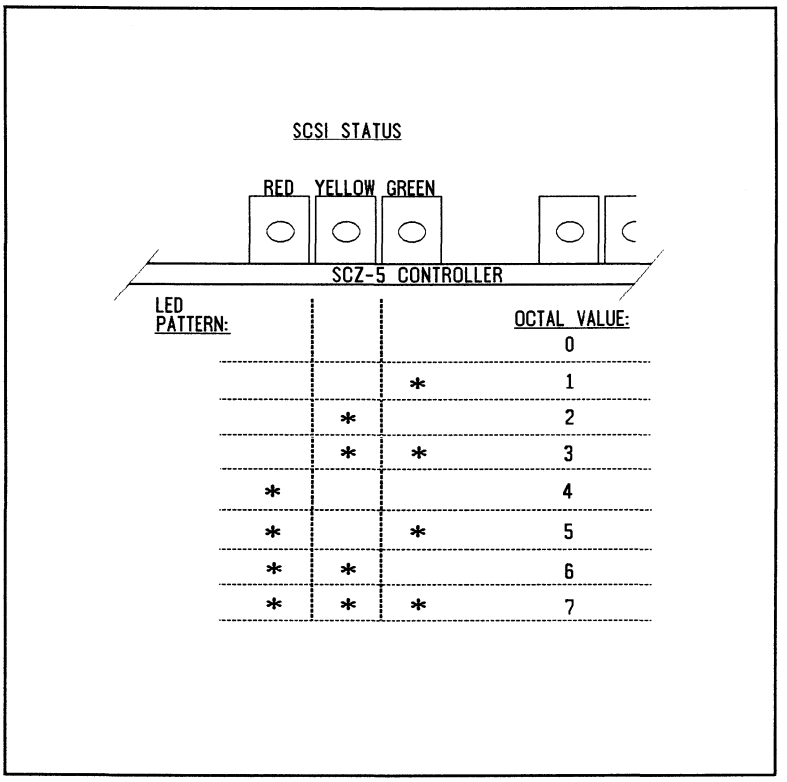
2. Observe which LED lights next and record its value as the Most Significant Digit of the code, determined from Figure 3.11.

3. After a blank pause, one or more LEDs will light, or none, representing the value of the Least Significant Digit. Record this value next to the first.

4. After another blank pause, the beginning sequence will reoccur, and the code will repeat. These are the possible SCSI side test failures that may occur:

DIGITS FLASHED:	TEST THAT FAILED:
04	Dual Port RAM
15	Error programming the Gate Array
16	Error reading back/verifying the Programmable Gate Array
17	Static RAM test failed
20	BMC Buffer test failed
21	BMC Buffer parity error
22	Test of DMA Transfer Counter failed
23	Test of DMA Address Counter failed
24	Test of 80186 timer failed
25	Test of SCSI Control Chip Registers failed

26	SCSI Hang Timer test failed
27	Unexpected interrupt detected by self-test



LED PATTERN:			OCTAL VALUE:
			0
		*	1
	*		2
	*	*	3
*			4
*		*	5
*	*		6
*	*	*	7

Figure 3.11
Getting an Octal Number from LEDs

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3.12 Decoding Non-self-test Errors

In addition to errors that occur during self-test, there are a few errors that can occur during normal system operation.

The SCZ-5 Multifunction Controller is designed to report several kinds of hardware failure that may occur after power-up. This aids you in verifying system reported faults.

SCSI Side LED Errors

Like the SCSI side self-test failure codes, the Operational Error codes are two digit octal values. (Both are under seven.) To distinguish from the other, the Most Significant digit is always seven.

Follow this procedure:

1. Watch for the LEDs to light in sequence, right to left.
2. Watch for all three LEDs to light at once. (This represents a seven, indicating an operational error.)
3. After a pause, the LED display will change to indicate the Least Significant octal digit. Note which LEDs light.
4. After a pause, the LEDs will light in sequence again and the patter will repeat.
5. Find the value of the Least Significant octal digit by looking below. (The Most Significant octal digit will always be 7 for this type of error.) These are the errors that may occur:

OCTAL VALUE	MEANING
72	Illegal 80186 Interrupt
73	SCSI-to-Host Request queue overflow
74	SCSI CB Done queue overflow
75	SCSI CB queue overflow
76	Illegal Command
77	SCSI Side Memory Fault

If any of these error codes are flashed, record the code and call Zetaco's Customer Support Hotline for assistance: 800-537-5292.

Host Side Red LED Errors

If the host side of the SCZ-5 receives an unexpected status from the SCSI controller side, this LED will flash one more than the unit number of the device associated with the command being executed. This type of error does not always indicate a problem with a peripheral. Try doing a reset to clear this condition.

Meaning of a Steadily Lit SCSI-side Yellow LED

The error reported by this LED does not indicate a Controller hardware failure. Instead, it is most likely indicative of a failure that has occurred on the drive.

A steadily lit yellow LED on the left means a drive interface fault has occurred.

In order of most likely to least likely, the cause of this failure may be:

1. Drive Related — If possible, try a different drive.
2. Cabling — Check that all cable connections are solid. Try replacing them with known good ones.
3. Controller — Try replacing the controller.

3.3 Problems Running the Utility Programs

Sometimes difficulty running the utility programs is due to operator or installation error. Sometimes it is defective equipment. There are a few things to check on first that might lead to a simple solution to a problem.

It is valuable to use the Zetaco Utility Programs, Configurator, Initializer, and Reliability programs anytime you suspect trouble with the SCZ-5 Controller or your drives. During initial installation, they are most valuable in assessing any trouble before running under the operating system.

If you are having trouble getting the programs to run properly, there may be defective equipment, or just operator or installation error.

Assumptions About the Installation

The following information is based on the assumption that these things are true:

1. The controller is intalled in a good slot.
2. The backplane and BMC priorities are correct.
3. No problems exist with the computer, your disk or tape drive, or other peripherals.

If you cannot verify these assumptions for the system you are working on, start your investigation there.

Two Common Difficulties When Running the Programs

To eliminate operator or installation error from consideration when these errors occur, try the following suggestions.

1. *Controller does not respond when selected*

   This can happen with any of the programs, but for various reasons. Most often you will see a *hang* condition after you enter the device code of the board when the program prompts for it. It is at this point that the program tries to communicate with the controller. Anything in the path of communication between board and program is suspect. This includes backplane priority and connection, device code settings, and system microcode corruption.

2. *Drives appear not ready*

   You will only see this with the Initializer or Reliability programs because the Configurator only needs to communicate to the board. You don't even need to hook up the drives to run the Configurator.

The Reliability program goes through an Initialization process when the [E]nter Device command is used. Part of this process is to try to access any drive for which it is configured and report back on its READY status. If a drive is not READY, the program cannot use it, and will not allow you to select it. Anything in the path of communication between the controller and drive is suspect. This includes cables, paddleboard, position of paddleboard, drive facts in Configurator, and SCSI drive ID settings. Whether the drive is powered down or improperly terminated could be a factor.

The same concerns and checks would be appropriate if it is the WRONG drive that appears ready.

Table 3.3

Common Problems & Solutions Using Utility Programs

IF THIS:	YOU'LL SEE THIS:	CHECK/TRY THIS:
Controller does not respond	Configurator will hang Reliability will error	1) Device code as used & as configured 2) Load/Reload system microcode 3) Re-seat controller & retry 4) Has controller self-test passed?
Drive(s) appear Not Ready	Reliability will report Not Ready Configurator doesn't care	1) Verify configuration facts 2) Replace cables to drive 3) Paddleboard installed at correct slot 4) Replace paddleboard 5) SCSI Drive ID switches are correct 6) Drive is turned on 7) Correct drive is terminated
Wrong drive appears Ready	Reliability reports wrong drive Ready Configurator doesn't care	1) Verify configuration facts 2) SCSI Drive ID switches are correct 3) Termination is on correct drive 4) ALL drives are turned on

3.4 Types of Error Messages From Reliability

Run a Reliability program anytime you need to verify the integrity of controller-drive communication. Using a test program such as Reliability can give more information about a problem condition existing with a controller or peripheral.

Description of PIO and CB Error Reporting

The Reliability programs use the same command protocol, Control Block (CB) and Programmed Input/Output (PIO), as the system does. An error can occur while the Reliability test program is executing either type of command. When a Control Block has a failure, you will see an error reported on your console. The disk and tape error reports look slightly different:

```
********************** ERROR REPORT **********************

RUN TIME  0. HRS.   0. MINS.  51. SECS.  2 TENTHS.
DEVICE CODE:   23     UNIT #:    0.
FILE #:        0      RECORD #:        0
REQUESTED # OF RECORDS:         1     BYTES/RECORD:      200
ACTUAL    # OF RECORDS:         0     BYTES/RECORD:        0
COMMAND: READ/ONE WORD/VERIFY        ACTIVE DATA TYPE: -ALLZ
PAGE ADDR:     0    XFER ADDR:   5072     ACTUAL ADDR:  5072
ASYNC STATUS   :                   3
    CB EXECUTION ERROR: HARD ERRORS
CB STATUS      :                100001
    ANY CB HARD EXECUTION ERROR
    CB DONE BIT
CB ERROR       :                  20
    VERIFY ERROR
CB UNIT STATUS :                   0
SENSE KEY      :                   0
    NO SENSE BEING REPORTED
ERROR BYTE     :                   0
```

Figure 3.4a
CB Type Error Report - Tape

```
********************** ERROR REPORT **********************

RUN TIME  0. HRS.  20. MINS.  3. SECS.
DEVICE CODE:   24     UNIT #:    0.    MAPPING NOT ENABLED
STATE:  **ACTIVE**
MODES:  - RANDOM, R/W, DATA CHECK - ADDR
LOGICAL BLOCK   124532     SECTOR COUNT     4
MEMORY ADDRESS   64321     COMMAND          WRITE
PAGE TABLE ADDRESS   0     RETURNED XFER COUNT   0
PHYSICAL BLOCK: 125452     =CYLINDER: 123  HEAD: 3  SECTOR: 34
ACTIVE DATA TYPE:  -ALL0
ASYNC STATUS     :      3
    CB EXECUTION ERROR: HARD ERRORS
CB STATUS        :             100001
    ANY CB HARD EXECUTION ERROR
    CB DONE BIT
CB ERROR         :                 20
    HEADER NONCOMPARE
CB UNIT STATUS :               24000
    READY
    PORT RESERVED BIT 1
DISK ERROR       :                5000
```

Figure 3.4b
CB Type Error Report - Disk

A PIO Command can error or never complete, and the message will take this form for tape and disk RELI:

```
********************** ERROR REPORT **********************

RUN TIME  0. HRS.   2. MINS.   2. SECS.  3 TENTHS.
DEVICE CODE:   23     UNIT #:    0.   MAPPING NOT ENABLED
CURRENT FILE:27936. CURRENT RECORD:28277. EOTS REACHED:28021
STATE: HALTED  MODE: SEQUENTIAL, READ/WRITE, DATA CHECK-ADDR
               REG A       REG B        REG C
OPERATION        0         10707          73
STATUS           0         10707       142073
DEVICE STATE      :  FULLY INITIALIZED
CB BUFFER STATE   :  NOT FULL
EXECUTION STATUS  :  ILLEGAL COMMAND
COMMAND           :  GET UNIT INFO

ENTER A COMMAND (MENU TO LIST COMMANDS): L
```

Figure 3.4c
PIO Type Error Report - Tape

```
********************** ERROR REPORT **********************

RUN TIME  0. HRS.   4. MINS.   7. SECS.  4 TENTHS.
DEVICE CODE:   64     UNIT #:    0.   MAPPING NOT ENABLED
STATE:  **ACTIVE**
MODES:  RANDOM, READ/WRITE, DATA CHECK-ADDR
                REG A       REG B        REG C
OPERATION         0         11554          73
STATUS            0            10       144073
DEVICE STATE      :  FULLY INITIALIZED
CB BUFFER STATE   :  NOT FULL
EXECUTION STATUS  :  EXECUTION ERROR
COMMAND           :  GET UNIT INFO
UNABLE TO GET UNIT INFORMATION.
```

Figure 3.4d
PIO Type Error Report - Disk

With the Reliability program it is never necessary to look up the bit meaning of status returned from the program because it is interpreted for you.

If a PIO command never completes, the controller will never issue an interrupt to report completion and a Timeout error message will be reported by the program in a PIO Type Error Report.

Tape Hard Error Messages

As tapes are used, they develop bad spots. It is up to the tape drive to handle as much of the bad portion as possible and report an error when it cannot. For example, the Exabyte tape drive has excellent ECC and a generous retry algorithm. The ECC recovers read data on bad spots. The retries ensure a good write. Therefore, a Hard Error that occurs most often would mean you should clean the tape heads or use new media.

Data Compare Errors Can also Occur

When the VERIFY option of the Reliability program is selected, the program writes data, reads it back and compares the data read into memory with what should have been written. If the data doesn't agree, an error report is generated.

```
******************** DATA ERROR REPORT **********************

RUN TIME  0. HRS.    0. MINS.    31. SECS.    9.TENTHS
DEVICE CODE:  23     UNIT NUMBER 0.
FILE #:         0    RECORD #:          0
REQUESTED # OF RECORDS:          1     BYTES/RECORDS:   200
PAGE ADDR:  0      XFER ADDR:   42630     ACTUAL ADDR: 42630
ACTIVE DATA TYPE:  ALLZ
EXPECTED      RECEIVED      OFFSET
    0          177777           0
    0          177777           1
    0          177777           2
    0          177777           3
    0          177777           4
    0          177777           5
    0          177777           6
    0          177777           7
    0          177777          10
    0          177777          11

TOTAL ERROR COUNT:     64.
```

Figure 3.4e
RELI Data Compare Error - Tape

```
******************** DATA COMPARE REPORT **********************

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

Figure 3.4f
RELI Data Compare Error - Disk

When Data Compare errors occur, the Controller is the most probable cause. You could also try different BMC cables or replace the paddleboard and cables to the drive.

This type of error does not indicate bad media or dirty tape heads; those would cause a tape hard error or a disk ECC uncorrectable hard error.

3.5 Error Messages From the System

Errors that occur while running the operating system are sometimes an annoyance and sometimes a catastrophe. Depending on the problem, the system will either react gracefully by informing you and continuing, or it will crash in a PANIC state.

Recovering From a PANIC

It is difficult to know what causes a system crash. The software just gets to an operational dead-end and shuts down. A PANIC code is usually reported; it may or may not offer significant help. In this situation two things can be helpful:

1. Assuming your system once did work, look at what you have recently changed. You may have changed something significant when installing the new peripheral. It could be something in the new GEN or a serious BMC conflict. Have you modified user software? Has something in the computer environment changed: temperature/humidity or a new electrical system? Try to narrow down, focus your suspicions and eliminate possibilities.

2. If you suspect that one of the devices in the system has a hardware problem, it is beneficial to run diagnostic tests. Data General's MVSYSTEMX works on the system as a whole. Individual subsystems can be tested using a Reliability program such as Zetaco provides with its products.

Using MVSYSTEMX

This test is valuable to run because you don't need to involve your operating system (which may help to eliminate variables in trouble-shooting the problem) and it tests all the hardware. It is like a mini operating system. Refer to the system user documentation for instructions on how to run MVSYSTEMX and interpret its error messages.

Using CONTEST

The primary purpose of Data General's CONTEST, which is a diagnostic tool that runs under the operating system, is to test the disk drive. If you are dealing with a panic situation, you will have to bring up your operating system.

To test the disk portion of the controller using CONTEST, your current directory must reside on the disk unit to be tested. For example, if the SCZ-5 is a data disk whose LDU name is DATA1, "DIR" over to DATA1 and type CONTEST. Your searchlist must include :UTIL.

CONTEST also tests the primary tape device if the tape is an MTJ device. If you have an MTA, MTC, or an MTD drive enabled for your system, you will not be able to run an MTJ device under CONTEST.

Even if you have an MTJ as the primary tape device, you will not be able to run an MTJ secondary device. The only solution to this limitation would be to have a special version of the system, with only the driver of tape device you want to test enabled. This may be more bother than it is worth.

System Error Without PANIC Crash

When the system is able to read error status from a function it is performing, report it, and continue, you will have a better chance of determining what the problem is. For one thing, the device code of the device in an error state is reported.

Quite often the error can be the fault of another device. For example, if a high priority BMC device has a high burst rate configured with a low break count, other devices may have difficulty getting on the bus and will report errors. Changes may have to be made to both device configurations.

The error reported from the system may take a cryptic form. It may be a CB status or a PIO status taking the form of an octal number. Use Section 3.51 to help decipher these.

3.51 Interpreting MTJ CB and PIO Status

MTJ driver status returned from the system usually takes the form of an octal number that needs to be deciphered.

The Difference Between CB Status & PIO

The MTJ driver borrows from Argus its use of two kinds of command structures:

CONTROL BLOCK (CB): Formal structures built in memory containing command and address information.

PROGRAMMED INPUT/OUTPUT (PIO): Single word registers containing different information depending on when you read or write them.

The address of the CB to be executed is passed from system to controller via a PIO register command.

Once either type of command is completed, the SCZ-5 Multifunction Controller issues one of two types of interrupt to the system: asynchronous after a CB completes, and synchronous after a PIO command is done.

CB Status Meaning

Generally, if the completed command was a CB, you will get back: CB status, Error status or Unit status. These are written by the controller into a special part of the CB reserved for status, and are read by the system.

Table 3.51a

Meaning of CB Status Word

The CB status word is reported in word 11 of the CB status block:

BIT		
	0	CB hard execution error
	1	CB Interpretation error
	2	Soft error executing CB
	3	Not used
	4	ECC correction used to recover
	5	ECC correction tried but failed
	6	Actual record count does not match request
	7-14	Not used
	15	CB done

Table 3.51b

Meaning of Error & Unit Status Words from a CB

The CB Error word is reported in word 14 of the CB status block:

BIT	0	Controller interrupt timeout
	1	Controller/unit interface fault
	2	Controller timeout
	3	Data late
	4	Not used
	5	Unit error
	6	BMC timeout
	7	BMC ending memory address error
	8	Bad spot on tape
	9	Write protection fault
	10	Density mismatch
	11	Read/verify error
	12	BMC address/data transfer parity
	13	Controller to unit transfer parity
	14	Unit to media transfer parity
	15	Bad tape preamble

Table 3.51c

Meaning of CB Unit Status

The Unit Status word is reported in word 15 of the CB status block:

BIT	0	Unit command failed
	1	Unit power fail
	2	Unit READY
	3	Not used
	4	Reserved by other port
	5	Reserved by this port
	6	Hard unit failure
	7,8,9	Not used
	10	Indecipherable dump format
	11	BOT
	12	EOF
	13	Logical EOT
	14	Physical EOT
	15	Not used

The Sense Key and Error Byte sense data returned from the drive. Refer to your drive manufacturer's SCSI specifications for detail.

PIO Status Meaning

The PIO registers also get status written into them. When a CB completes, the PIO register C is used. When a PIO command, (which mostly has to do with getting a CB issued) completes in error, PIO register B is used.

Table 3.51d

Meaning of PIO Register C

Bits 6 through 15 of REGISTER C after an asynchronous interrupt:

ASYNC OCTAL CODE	INTERRUPT NAME
0	Null interrupt
1	Controller panic
2	Soft error
3	Hard error (restart required)
4	Ibit set
5	Completed without error
6	Cancel list
7	Sbit set (restart required)
10	Interpretation error; CB status word not 0
11	Interpretation error; Illegal command
12	Interpretation error; Range error
13	Interpretation error; Illegal unit
14	Interpretation error; Illegal Link address
15	Interpretation error; Illegal Page address
16	Interpretation error; Illegal Transfer address
17	Interpretation error; Illegal Trans byte count
20	Unreadable CB
21	Unwritable CB
22	Map slot load request
23	Unit status change
24	Position status (EOF, EOT, LEOT, PEOT) no restart
25	Interpretation error; Illegal transfer count

Table 3.51e

Meaning of PIO Register B

A PIO Get, Set or Program Load command error may set a bit in REGISTER B:

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

3.52 Interpreting DPJ Commands, CB and PIO Status

DPJ driver status returned from the system usually takes the form of an octal number that needs to be deciphered.

DPJ Commands

There are some DPJ commands that are interpreted and executed differently than Argus by the SCZ-5 Multifunction Controller.

Table 3.52a PIO Commands Implementation

The following list includes PIO commands implemented in a different manner than Data General protocol, and the result of executing the command.

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

Table 3.52b Control Block Command Implementation

Some CB Commands that are redefined by the SCZ-5 are listed below with the result of execution.

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

Status Information

At the conclusion of command processing, there are two types of interrupts to the host that can be generated by the SCZ-5 following Argus protocol: synchronous and asynchronous. An asynchronous interrupt occurs when the controller completes a CB or CB LIST, or when an error occurs during CB EXECUTION. A synchronous interrupt, when enabled, occurs after a PIO Command executes.

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

The status words produced by the various reporting mechanisms are:

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

Table 3.52c

PIO Register Status Implementation

Asynchronous interrupt codes are written into bits 6-15 of status register C. The codes and their meaning reported by the SCZ-5 are as follows:

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

When a PIO command execution error occurs after issuing a Get or Set or Program Load command, status register B will contain a word with the following bit meanings from the SCZ-5.

Table 3.52d

PIO Register B Status

DIB BIT	MEANING
0 - 6	Not Used
7	Ending Memory Address error
8 - 11	Not Used
12	BMC error
13 - 15	Not Used

CB Status Implementation

There are two parts to a control block: Host-supplied (command) information and Return/Error information. There are three words in the controller Return/Error section of a CB returned by the SCZ-5. They are: CB Status in word 11, Error Status in word 14, and Unit Status in word 15.

Table 3.52e

The CB Status Word

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

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

The Sense Key and Error Byte sense data returned from the drive. Refer to your drive manufacturer's SCSI specification for detail.

Table 3.52f

The CB Error Word

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

CB ERROR WORD BIT	MEANING
0	Not Used
1	Drive Interface fault *
2-4	Not Used
5	Drive error **
6	BMC Timeout error
7	Ending Memory Address error
8-10	Not Used
11	Verify error
12	BMC error
13	Not Used
14	ECC detected
15	Header error

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

** This error can be caused by:

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

Table 3.52g

The Unit Status Word

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

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

3.6 Help is Available for Problem Situations

An 800 number is available to OEMs for assistance, and Zetaco has a 48-hour turnaround policy on controller repairs.

You Can Use the Customer Support Hotline

Zetaco provides a Customer Support Hotline to answer technical questions and to assist with installation and help trouble-shoot problems. The Hotline technical team is available from 8:00 a.m. to 5:00 p.m. (CST), Monday through Friday.

Within the U.S. dial 1-800-537-5292

Outside the U.S. dial 1-612-941-5825

How to Get a Return Material Authorization (RMA)

A Return Material Authorization number is required before shipping anything back to Zetaco. It should be referenced on the package and in any correspondence about the return. To get an RMA number:

1. Fill out a copy of the Material Return Information form shown on the next page and be prepared to give some of this information on the phone if asked. A copy of the filled out form should also be sent with any return package.

2. Call the Customer Support Hotline to request an RMA number from them.

Each product being returned needs a separate RMA number and Material Return Information form. It should be shipped to Zetaco, 6850 Shady Oak Road, Eden Prairie, MN, 55344, freight prepaid.

Upon Zetaco's verification of defect, defective parts shall be repaired or replaced, and returned surface freight prepaid to the customer. In most cases, the Controller will be shipped back to you within two working days.

To safeguard the product during shipment, please use packaging that is adequate to protect it from damage. It would be a good idea to keep the original packaging for this purpose. Mark the box: *Delicate Instrument.* Indicate the RMA number(s) on the shipping label.

Information About Warranty

The SCZ-5 is warranted free from manufacturing and material defects, when used in a normal and proper manner, for a period of two years from date of shipment.

Except for the express warranties stated above, Zetaco disclaims all warranties including all implied warranties of merchantability and fitness. The stated express warranties are in lieu of all obligations of liabilities on the part of Zetaco for damages, including but not limited to, special, indirect or consequential arising out of or in connection with the use or performance of Zetaco's products.

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

Material Return Information

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

TEST **RESULT**

Power-up self-test _____

_____

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

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

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

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

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

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

To be filled out by CUSTOMER:

MODEL NUMBER: _____

SERIAL NUMBER: _____

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

Returned by:

Your Name: _____ **Firm:** _____

Address: _____ **Phone:** _____