

Model ARZ-1

Disk Controller

Technical Manual

FOR
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REVISION HISTORY

ECO No.	Date	Description	Pages

Technical Manual for the ARZ-1 Disk Controller

PREFACE

This manual contains information regarding installation, testing, and operation of the ZETACO Model ARZ-1 Disk Controller.

The technical contents have been written based on the assumptions that the reader 1) has a working knowledge of one of the applicable Data General mini-computers with associated AOS, or AOS/VS operating system; 2) is familiar with standard installation, power, grounding, and peripheral cabling procedures; and 3) has access to technical information describing the disk drive(s) to be installed with this controller.

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

- SECTION 1.0 PRODUCT OVERVIEW - Describes the Model ARZ-1 Disk Controller features, capabilities, specifications, power, and interface requirements.
- SECTION 2.0 INSTALLATION PROCEDURES - Describes and illustrates the procedures required to install the ARZ-1.
- SECTION 3.0 TROUBLE-SHOOTING - Contains information useful in analyzing subsystem problems, and how to get help.
- SECTION 4.0 USAGE GUIDELINES - Describes how various features and configurations are used and how they impact the performance of the controller.

NOTE: For Programming Notes and more detailed error description, please refer to:
Data General's Programmer's Reference Series
Models 6236/6237 & 6239/6240
Disk Subsystems
DG Ordering Number: 014-701001

TABLE OF CONTENTS

	Page No.
Title Page	i
Notice	ii
Revision History	iii
Preface	iv
Table of Contents	v-vi
List of Tables, List of Illustrations	vii
Section:	
1.0 PRODUCT OVERVIEW	1-1
1.1 General Description	1-1
1.2 Specifications	1-2
1.2.1 Functional	1-2
1.2.2 Computer Interface	1-3
1.2.3 Disk Drive Interface	1-4
1.2.4 Mechanical	1-6
1.2.5 Power Requirements	1-6
1.2.6 Environmental	1-6
2.0 INSTALLATION	2-1
2.1 Unpacking and Inspection	2-1
2.2 Before You Begin	2-2
2.2.1 System Hardware Requirements	2-2
2.2.2 The Software Support Tape	2-2
2.3 Prepare The Computer Chassis	2-5
2.3.1 Slot Selection	2-5
2.3.2 Priority Selection	2-5
2.4 Prepare The Controller	2-5
2.4.1 BMC Bus Termination	2-5
2.4.2 Device Code Selection	2-6
2.5 Install The Controller and Paddleboards	2-9
2.5.1 Paddleboard Installation	2-9
2.6 Connect All Cables	2-9
2.6.1 FCC-Compliant Internal Cabling	2-10
2.6.2 FCC-Compliant External Cabling	2-10
2.6.3 Non-FCC Cabling	2-11
2.6.4 BMC Bus Cabling	2-11
2.6.5 Subsystem Grounding	2-12
2.7 Turn The System On	2-15
2.8 Boot the Software Support Tape	2-15
2.9 Configure the ARZ-1	2-16

2.10	Prepare The Disk Drive	2-18
	2.10.1 Sectors Per Track Selection	2-18
	2.10.2 Unit Number and Miscellaneous Preparation	2-19
	2.10.3 Remote Drive Start	2-19
	2.10.4 Special Considerations for Dual Volume Drives	2-19
2.11	Initialize the Disk	2-19
2.12	Run Reliability to Verify the Installation	2-23
2.13	Return to the Formatter Program and Run the SURFACE ANALYSIS and INSTALL Modules	2-27
2.14	Run at Least One Half Hour of Reliability **OPTIONAL**	2-31
2.15	Building the System	2-31
	2.15.1 Loading Programs From Tape Onto Disk	2-31
3.0	TROUBLE-SHOOTING	3-1
3.1	Self-Test	3-1
3.2	Software Support Package	3-1
3.3	System Errors	3-3
	3.3.1 Test Programs To Use If The System Is Built But Problems Have Arisen	3-3
3.4	Reliability - Error Descriptions	3-4
3.5	Formatter - Error Descriptions	3-5
3.6	Product Support Hotline	3-5
3.7	Warranty Information	3-6
3.8	Product Return Authorization	3-6
4.0	USAGE GUIDELINES	4-1
4.1	Controller Features Programmed by the Configurator	4-1
	4.1.1 Configurator Aid (Help)	4-1
	4.1.2 Throttle Burst Rate	4-1
	4.1.3 Disk Drive Types	4-1
	4.1.4 BMC Bus Priority	4-2
	4.1.5 Break Count Interval	4-2
	4.1.6 Dynamic Sector Interleaving	4-3

LIST OF ILLUSTRATIONS

		Page No.
Figure 2.1	ARZ-1 Board Layout	2-4
Figure 2.2	Backplane Priority Jumpers	2-7
Figure 2.3	Device Code Switches	2-8
Figure 2.4	ARZ-1 Cabling Diagram	2-13
Figure 2.5	Subsystem Cabling	2-14

LIST OF TABLES

		Page No.
Table 1.1	I/O Only Slot Selection	1-4

1.0 PRODUCT OVERVIEW

1.1 GENERAL DESCRIPTION

The ARZ-1 Disk Controller is ZETACO's state-of-the-art bridge between DG's Eclipse and Eclipse/MV minicomputers, and today's high performance SMD, HSMD and SMDE interfaced disk drives. It fully emulates DG's Argus Disk Subsystem Controller in AOS, and AOS/VS environments.

The hallmark of the ARZ-1 is its resident "intelligence"; the Controller can handle more of the disk processing chores on its own, thus freeing the host processor from these time consuming tasks. The result is greatly improved system throughput. Flexibility of integration is also enhanced; with the ARZ-1, virtually any drive whose characteristics fall within the range of the 6236/6239 emulation can be run with nearly 100% formatted media efficiency.

The ARZ-1 has been implemented on a single 15" x 15" 10-layer printed circuit board, with two multi-layered active paddleboards to route signals to and from the disk drives. The ARZ-1 meets all FCC hardened chassis requirements, and interfaces DG's high speed bus, the Burst Multiplexor Channel (BMC).

To see the many features and advantages of the ARZ-1, please refer to the product brochure inserted in the back of this manual.

1.2 SPECIFICATIONS

1.2.1 FUNCTIONAL

Drives per Controller:	Up to 4 SMD, HSMD and/or SMDE drives
Recording Format:	ZETACO media format
Disk Transfer Rate:	Up to 3.0 Mbyte/second (24 MHz)
Sectors per Track:	Supports up to 255 physical sectors per track
Maximum # of Heads:	Supports up to 32 heads/disk
Maximum # of Cylinders:	Supports up to 4096 cylinders through a 12 bit tag bus
Maximum Capacity:	The theoretical maximum capacity supported by a single ARZ-1 is 67 Gigabytes
Device Code:	Switch selectable
Interrupt Priority Mask Bit:	Bit 7
Bus Load:	1 unit load (any "I/O ONLY" slot)
Data Channel Interface:	Not Supported
Burst Multiplexor Channel Interface:	<ul style="list-style-type: none">- less than 1 STTL load- 64ma drive at 0.7v- supports selectability of any of the 8 priority requests- selectable burst rates of 1 to 256, 16 bit words/access- selectable break count from 1 to 255 sync clock periods- maximum allowable BMC latency is 30ms (To achieve maximum performance, system overhead including BMC latency should not exceed one disk sector time).- supports BMC transfer rates equal to the fastest available BMC computers

Sector Data field: 256 - 16 bit words per sector.

Data Buffering: Two 256-word BMC buffers in a Ping-Pong configuration

Memory Address: 21 bits

56 Bit Error Correction Polynomial: $(X^{22} + 1)^*$
 $(X^{11} + X^7 + X^6 + X + 1)^*$
 $(X^{12} + X^{11} + X^{10} + \dots + X + 1)^*$
 $(X^{11} + X^9 + X^7 + X^6 + X^5 + X + 1)$

Header CRC Polynomial: $X^{16} + X^{15} + X^2 + 1$

Indicator Lights: Red: Self-Test
Green: Controller Busy
Yellow: Open Cable Detect
Yellow: BMC Transfer

1.2.2 COMPUTER INTERFACE

The ARZ-1 is designed to operate only with the BMC, and must be installed in an "I/O ONLY" slot. Table 1.1 lists the DG computers in which the ARZ-1 will function, along with the appropriate "I/O ONLY" slots.

CAUTION: THE ARZ-1 MUST BE PLUGGED INTO AN "I/O ONLY" SLOT OR DAMAGE WILL RESULT.

TABLE 1.1 "I/O Only" Slot Selection

MODEL	I/O ONLY SLOTS
S140	12-16
S280	11-20
MV4000	12-20
MV6000	2-16 (I/O Expansion Chassis)
MV7800	*See Note Below
MV8000	29-42, 48-56
MV8000-11	9-21
MV8000C	13-20
MV10000	13-24, 26-36
MV20000	19-38

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

*The MV7800 CPU can be installed in a number of different chassis. The ARZ-1 may only be installed in an I/O ONLY slot for that type of chassis.

1.2.3 DISK DRIVE INTERFACE

- Functional:
- Standard SMD, HSMD and SMDE interfaces
 - Supports Tag bit 10 on pins 30 and 60 of the "A" cable for extended cylinder addressing
 - Supports Remote Pick/Hold drive sequencing (pins 29 and 59)
 - Requires Index and Sector signals in the "A" cable
 - Supports unit select 0,1,2 and 3

Cabling: - NON-FCC

"A" Cable:

One 60-conductor round cable for the first disk drive (daisy chain).

"B" Cable:

One 26-conductor round cable for the first disk drive (radial).

FCC

"A" Cable:

INTERNAL: One 60 conductor flat ribbon cable with D connector on one end that mounts in the computer EMI/RFI backpanel. The other end plugs into the A paddleboard. See Figure 2.4.

EXTERNAL: One 60-conductor shielded round cable for the first disk drive (daisy chain).

"B" Cable:

INTERNAL: One 26 conductor flat ribbon cable with D connector on one end that mounts in the computer EMI/RFI backpanel. The other end plugs into the B paddleboard. See Figure 2.4.

EXTERNAL: One 26-conductor shielded round cable for the first disk drive (radial connection).

NOTE: The maximum cumulative length allowable for the "A" cable is 100 feet, and for the "B" cable, 50 feet, as per drive manufacturers' recommendations.

Multiple Drives: Up to four drives (Dual Volume counts as two) per controller. The "A" cable daisy chains from drive to drive, with the last drive in the chain requiring an "A" cable terminator. The "B" cable connects radially to each drive (no terminators required). Reference Figure 2.5.

1.2.4 MECHANICAL

Dimensions: 15" x 15" x 1/2"

Shipping Weight: 10 pounds - includes controller, paddleboards, cables (if ordered), diagnostics and documentation.

Paddleboards: "A" paddleboard:
Active backplane paddleboard with one 60-pin cable connector. ("A" backplane)

"B" paddleboard:
Active backplane paddleboard with four 26-pin cable connectors. ("B" backplane)

1.2.5 POWER REQUIREMENTS

+5 (+/- 5%) Volts DC @ 8.2 Amps typical
-5 (+/- 5%) Volts DC @ 0.63 Amps typical

1.2.6 ENVIRONMENTAL

OPERATING ENVIRONMENT:

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

NON-OPERATING ENVIRONMENT:

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

Exceeds all Eclipse/MV temperature and humidity specifications.

2.0 INSTALLATION

2.1 UNPACKING AND INSPECTION

The following items are shipped standard with each ARZ-1:

ITEM	P/N
a) ARZ-1 Controller with Cover	500-444-00
b) "A" Paddleboard	500-422-00
c) "B" Paddleboard	500-429-00
d) Software Support Package (9-Track magnetic tape)	400-421-00
f) Technical Manual	600-421-00
g) BMC Bus Cables	300-038-00

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

I. CABLES FOR AN FCC CHASSIS

a) Internal "A" Cable	300-104-00
b) Internal "B" Cable	300-146-00
c) External Primary "A" Cable	300-013-00
d) External "B" Cable	300-011-00
e) Daisy-Chain "A" Cable	300-081-00

II. CABLES FOR A NON-FCC CHASSIS

a) "A" Cable	300-147-00
b) "B" Cable	300-145-00

It is recommended that all packing materials and cartons be saved, in case re-shipping is necessary.

Upon receipt of the Model ARZ-1 from the carrier, inspect the shipping carton immediately for any evidence of damage or mishandling in transit.

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

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

2.2 BEFORE YOU BEGIN

This section contains the procedures necessary for proper installation of the ARZ-1 Disk Controller. We recommend that you read through it once in its entirety before you start the actual installation process.

The following subsections, beginning with 2.3, are in order of execution. Subsections 2.3 through 2.8 involve preparation and installation of the hardware components. Subsections 2.9 through 2.12 describe the programs used to complete the installation. These programs are on the Software Support Tape, the 1/2" magnetic tape reel shipped with the ARZ-1.

2.2.1 SYSTEM HARDWARE REQUIREMENTS

- a) Eclipse or MV Family CPU with minimum 32K Words Memory
- b) Magnetic Tape Subsystem
- c) ARZ-1 Controller Board(s)
- d) Disk Drive(s)
- e) Console at Device 10/11
- f) Printer at Device 17, in order to log errors and print a copy of your configuration facts (optional)

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

2.2.2 THE SOFTWARE SUPPORT TAPE

Each of the programs on the Software Support Tape have been written by ZETACO specifically for the ARZ-1 Controller. Use this tape for configuring the controller, media formatting, disk diagnostic and reliability, and installation of controller microcode onto the disk. DG's CORRESPONDING PROGRAMS MAY NOT WORK ON THIS CONTROLLER. Also note that the ARZ-1 does NOT support MVSYSYSTEMX.

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

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

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

2.3 PREPARE THE COMPUTER CHASSIS

Before installing the ARZ-1, the computer chassis must be prepared. To do so, choose an available slot and establish the correct priority.

2.3.1 SLOT SELECTION

The ARZ-1 MUST be installed in an "I/O ONLY" slot. Consult Table 1.1 to determine which slots are correct for your particular computer.

CAUTION: THE ARZ-1 MUST BE PLUGGED INTO AN "I/O ONLY" SLOT OR COMPONENT DAMAGE WILL RESULT. ZETACO'S WARRANTY IS VOID IF A SLOT OTHER THAN "I/O ONLY" IS USED.

2.3.2 PRIORITY SELECTION

The Controller must receive two priority signals from the DG minicomputer backplane: DCH Priority In (Pin A94), and Interrupt Priority In (Pin A96). If there are vacant slots between the ARZ-1 and the processor, or between the ARZ-1 and another controller already installed in the chassis, jumper wires must be installed to obtain priority continuity. To "jumper across" unused slots, connect DCH Priority Out (Pin A93) to DCH Priority In (Pin A94) and Interrupt Priority Out (Pin A95) to Interrupt Priority In (Pin A96). See Figure 2.2.

2.4 PREPARE THE CONTROLLER

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

2.4.1 BMC BUS TERMINATION

If there is more than one BMC device daisy-chained on the BMC bus, then the BMC controller at the end of the bus must have the bus terminators installed. If the ARZ-1 is to be installed as the last (or only) BMC controller, then make sure the 3 bus terminators are installed at locations E11, F11, and G11 on the controller board. Refer to Figure 2.1.

NOTE: The ARZ-1 is shipped from the factory with these terminators installed unless otherwise specified.

2.4.2 DEVICE CODE SELECTION

The standard Primary device code for the ARZ-1 is 24 octal; the Secondary is 64 octal. However, any DG device code can be selected, as long as there is not already a controller in the system with that device code.

There is a set of Device Code switches on the edge of the board that allow you to easily set the device code. Switches 3 through 8 specify device code. Switches 1 and 2 are reserved and should be placed in the "Down" position. Refer to Figures 2.1 and 2.3 for switch location and proper selection.

If, at a later date, you wish to change the device code for the ARZ-1, you need not remove the board from the computer chassis. Simply set the switches accordingly and press RESET on the computer. The new device code will then be operative.

FIGURE 2.2 Backplane Priority Jumpers

A SIDE

B SIDE

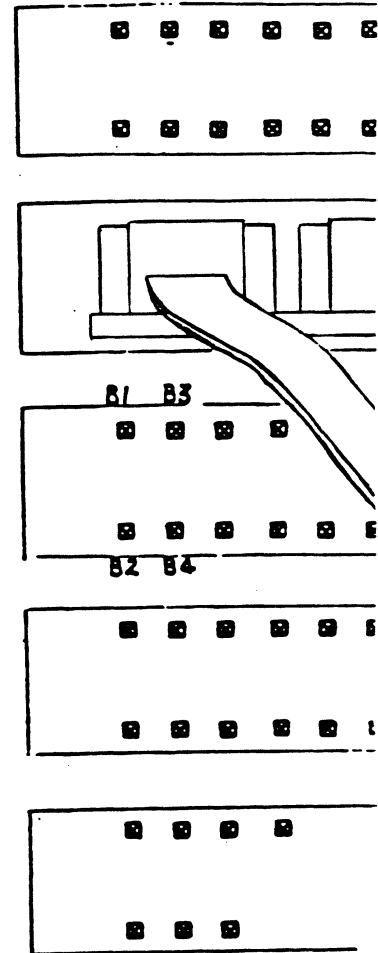
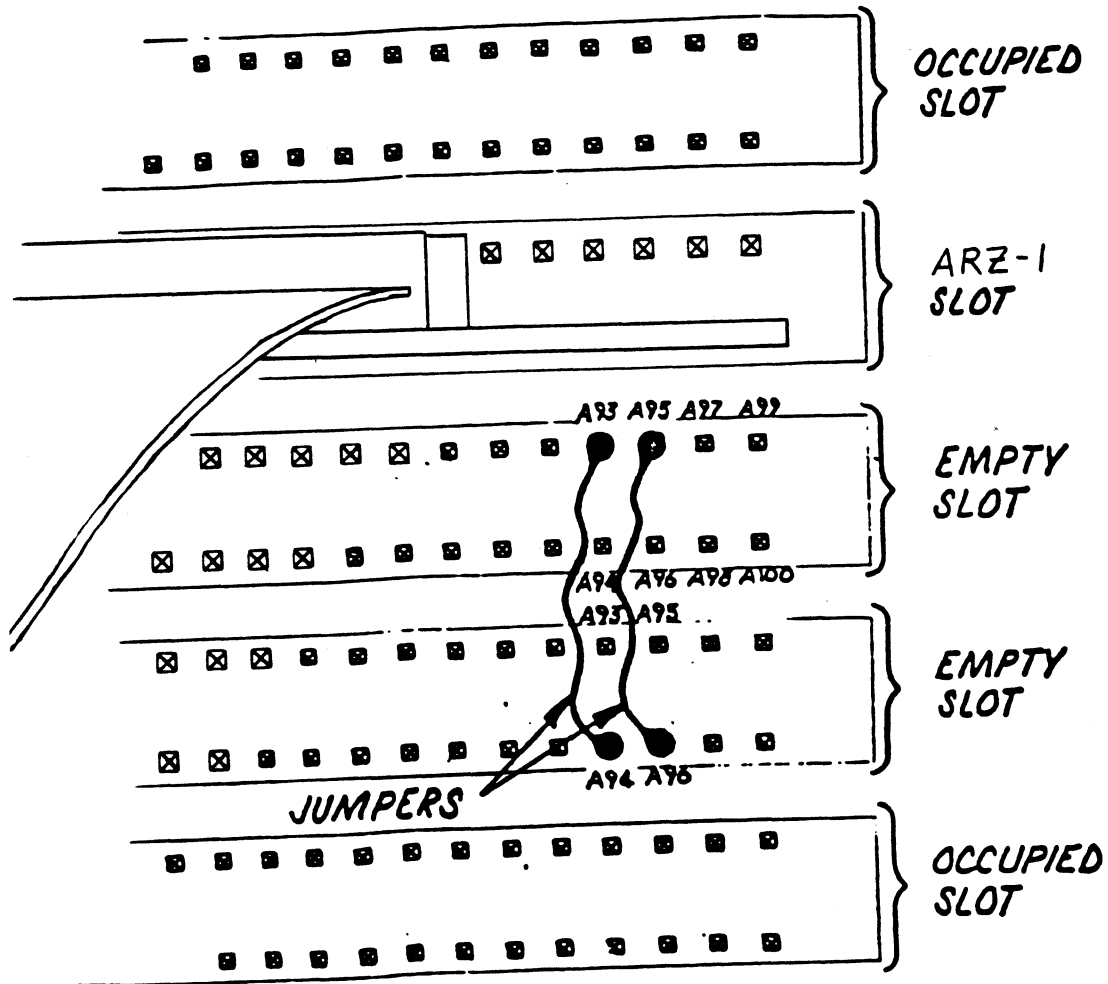
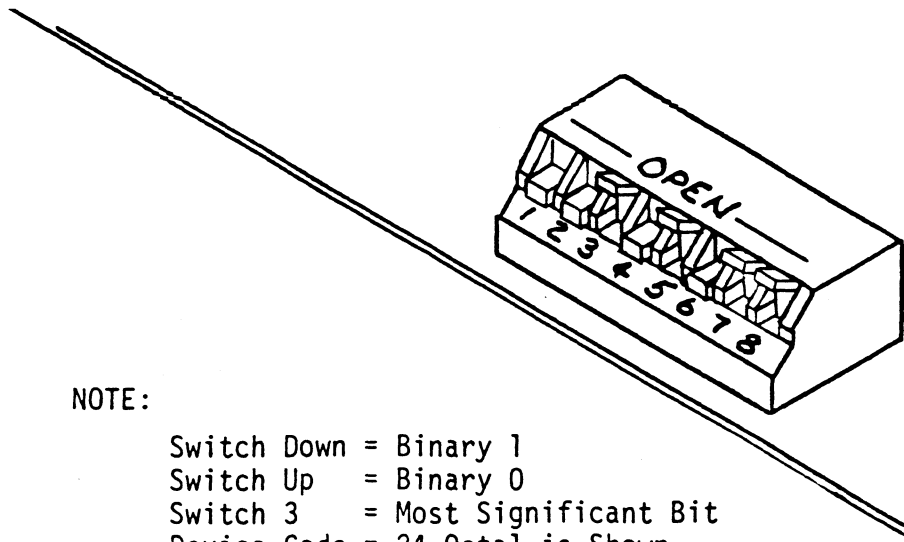


FIGURE 2.3 Device Code Switches



NOTE:

Switch Down = Binary 1
 Switch Up = Binary 0
 Switch 3 = Most Significant Bit
 Device Code = 24 Octal is Shown

DEVICE CODE	S1 RESERVED	S2 RESERVED	S3 DS0	S4 DS1	S5 DS2	S6 DS3	S7 DS4	S8 DS5
0X			UP	UP	UP			
1X			UP	UP	DOWN			
2X			UP	DOWN	UP			
3X			UP	DOWN	DOWN			
4X			DOWN	UP	UP			
5X			DOWN	UP	DOWN			
6X			DOWN	DOWN	UP			
7X			DOWN	DOWN	DOWN			
X0						UP	UP	UP
X1						UP	UP	DOWN
X2						UP	DOWN	UP
X3						UP	DOWN	DOWN
X4						DOWN	UP	UP
X5						DOWN	UP	DOWN
X6						DOWN	DOWN	UP
X7						DOWN	DOWN	DOWN

2.5 INSTALL THE CONTROLLER AND PADDLEBOARDS

First, pull the lock tabs on the two front corners of the board out as far as they will go. Next, carefully guide the Controller board into the "I/O ONLY" slot you selected in Section 2.3. Now, when the board engages the backplane connectors, gently press the lock tabs in to provide insertion leverage. Use equal pressure on both lock tabs until the board seats firmly into the backplane connectors.

2.5.1 PADDLEBOARD INSTALLATION

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

Locate the two rows of pins on the "A" side of the backplane for the slot containing the ARZ-1 Controller. Ensure that no pins are bent. Position the "A" paddleboard block connector over all 100 pins, with the header connectors facing up. Press the connector securely over the pins, making sure all pins insert and do not bend, until the guide block is flush with the backplane.

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

Repeat this procedure for mounting the "B" paddleboard on the "B" side of the backplane.

2.6 CONNECT ALL CABLES

FCC and Non-FCC compliant cabling procedures differ. If you will be using the former, follow the instructions in Sections 2.6.1 and 2.6.2; for the latter, skip to Section 2.6.3. Note that after connecting all the cables and configuring, you will prepare the disk drive.

2.6.1 FCC-COMPLIANT INTERNAL CABLING

The Internal Disk "A" cable (P/N 300-104-00) is a flat 60-conductor cable terminated on one end with a socket connector and on the other with a 'D' connector. As shown in Figure 2.4, the socket connector end plugs into the "A" paddleboard. The other end of this cable (D connector) mounts on the computer backpanel.

The Internal Disk "B" cable (P/N 300-146-00) is a flat 26-conductor cable terminated on one end with a socket connector and on the other with a 'D' connector. The socket connector end plugs into the "B" paddleboard. The other end of this cable (D connector) mounts on the backpanel. Again, refer to Figure 2.4.

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

2.6.2 FCC-COMPLIANT EXTERNAL CABLING

The External Disk "A" cable (P/N 300-013-00) is a round 60-conductor cable terminated on one end with a 60-pin socket connector and a pigtail ground lead, and on the other with a 'D' connector. As shown in Figure 2.5, it connects the appropriate backpanel 'D' connector to the first drive. The pigtail ground lead is to be connected to ground on the first disk drive.

For every additional disk drive added to this controller, one Daisy-Chain 'A' cable (P/N 300-081-00) is required between each drive. The last drive in the chain must have a terminator installed in place of the daisy-chain cable. Refer again to Figure 2.5. This terminator is located within the disk drive.

The External Disk "B" cable (P/N 300-011-00) is a round 26-conductor cable terminated on one end with a socket connector and a pigtail ground lead, and on the other with a 'D' connector. Each drive must have a 'B' cable connected between the drive and a backpanel D connector "port" in a radial fashion. The pigtail ground lead is to be connected to ground on the disk drive. See Figure 2.5.

2.6.3 NON-FCC CABLING

The cables for DG's Non-FCC chassis are round, terminated at each end with a 60-pin socket connector, an 8-inch pigtail ground lead on the disk end, and a 24-inch pigtail ground lead on the computer end. The External 'A' cable (P/N 300-081-00) is 60-conductor, and the External 'B' cable is 26-conductor (P/N 300-145-00). The "A" cable plugs directly into the "A" paddleboard, and the "B" cable plugs directly into the "B" paddleboard. The other ends go directly to the the appropriate connectors on the disk drive. The pigtail ground leads should be connected to ground at both ends.

2.6.4 BMC BUS CABLING

The two BMC bus cables provided have a single 40-pin connector on one end and a group of connectors on the other end (4-connector P/N 300-038-00; 6-connector P/N 300-131-00; or 8-connector P/N 300-132-00). This cable daisy-chains from the computer's BMC interface to the multiple BMC peripheral controllers. The controller at the end of the chain must have it's BMC terminators installed, the others must have them removed. Refer to Section 2.4.1 for BMC terminator installation.

Install the BMC bus cables as shown in Figure 2.4, by plugging the single-plug end of the cables into the DG BMC board, and the multiple-plug end of the cables into the ARZ-1 and other BMC peripheral controllers.

2.6.5 SUBSYSTEM GROUNDING

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

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.

FIGURE 2.4 ARZ-1 Cabling Diagram

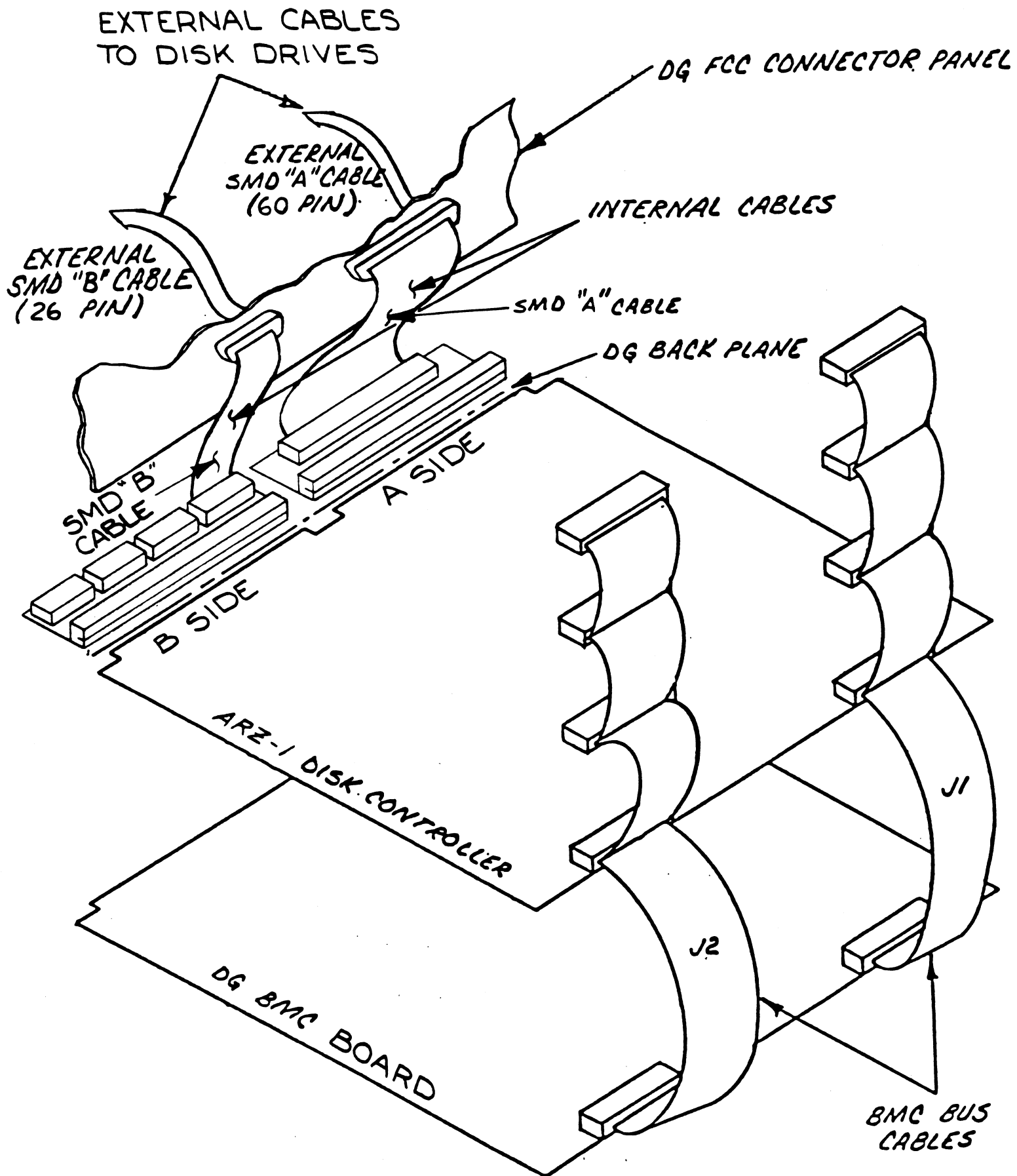
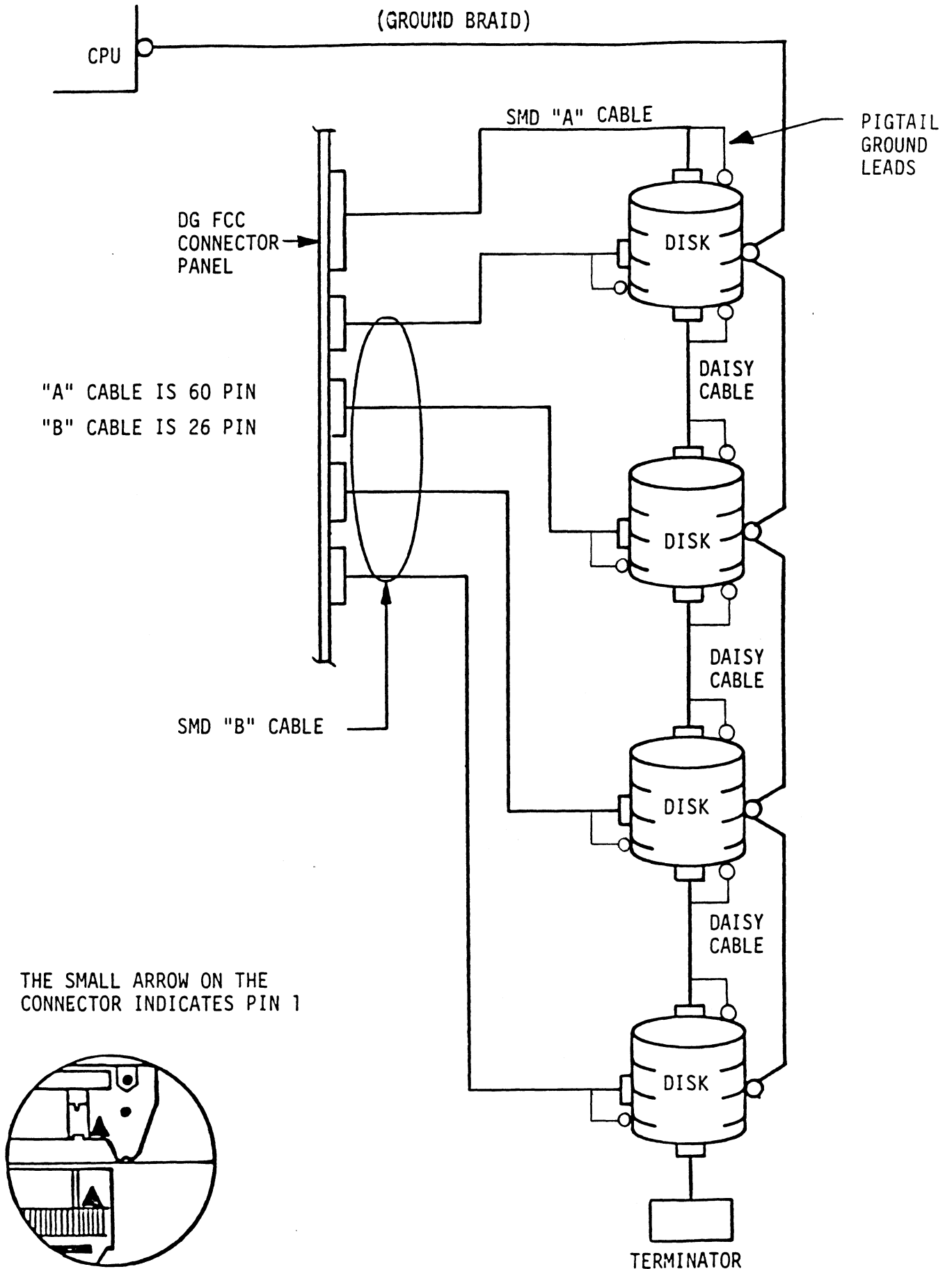


FIGURE 2.5 Subsystem Cabling



2.7 TURN THE SYSTEM ON

To find out the basic status of the controller on powerup, observe the four LED's at the front edge of the board. Their meanings from right to left are as follows:

- Red: SLFTS - Indicates disk controller is executing self-test diagnostics.
- Green: BUSY - This LED indicates the controller is executing one of the read/write commands.
- Yellow: CBL - When on, this LED indicates that none of the possible 4 units have been selected since power up.
- Yellow: XFER - When on, This LED indicates that a BMC Transfer is in progress.

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

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

The yellow LED (CBL) should be on until an operation has taken place using one of the drives attached to the controller.

The yellow LED (XFER) should be off after Self-test finishes, since no BMC activity will have been initiated immediately after Self-test.

2.8 BOOT THE SOFTWARE SUPPORT TAPE

If you are using an MV class machine, you must load the MV's microcode before booting the software support tape.

The Bootstrap Procedure for the Software Support tape is:

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

2. Program Load. Boot the tape in your normal fashion.

For the S140 virtual console, set 11A to 100022 (or 100062 for secondary tape drive). Then enter 100022L (or 100062L).

3. The Software Support Package Menu will be displayed:

FILE #	PROGRAM
2	ARZ-1 CONFIGURATOR
3	ARZ-1 INITIALIZER
4	ARZ-1 RELIABILITY
5	".SV & .LS" Files in AOS DUMP Format

File Number?

You should enter the number of the program you wish to execute. At this point in the installation procedure, enter:

2 <cr>

to load the Configurator Program.

2.9 CONFIGURE THE ARZ-1

After the Configurator program has loaded, the following message will appear on your computer screen:

```
CFARZ1-CONFIGURATOR FOR ARZ-1 CONTROLLER
      PRODUCT OF ZETACO
```

THE PURPOSE OF THE CONFIGURATOR PROGRAM IS TO ALLOW YOU TO TAILOR THE ARZ-1 CONTROLLER TO YOUR PARTICULAR ENVIRONMENT. THE ARZ-1 CONTROLLER INCLUDES AN ELECTRICALLY ERASABLE PROM (EEPROM) WHICH CONTAINS CERTAIN FACTS. THIS PROGRAM LETS YOU LIST THE CURRENT FACTS, MODIFY THOSE THAT YOU WANT CHANGED, AND RECORD THE NEW FACTS ONTO THE EEPROM.

THE HELP COMMAND ON THE MAIN MENU PROVIDES INFORMATION BOTH ON WHAT TO DO AND HOW TO DO IT. IF THIS IS THE FIRST TIME YOU HAVE RUN THIS PROGRAM, YOU MIGHT WANT TO START BY SELECTING HELP.

YOU CAN GET AN EXPLANATION OF ANY QUESTION THE PROGRAM ASKS, BY RESPONDING TO THAT QUESTION WITH AN H.

WHAT IS THE PRESENT SETTING OF THE DEVICE CODE (IN OCTAL)?

24

ENTER COMMAND (? TO SEE CHOICES):

**We have responded to the question about the device code of the controller with the primary device code.

The program returned with a prompt for a Configurator command. This indicates that the system has successfully communicated with the controller at that device code, and the controller is ready to be configured.

If the system had not returned with any prompt, that would have indicated that the system was unable to contact the controller at that device code. In such cases, turn the computer off and double-check all of the preceding installation steps. If, after doing so, you still have problems, contact ZETACO's Product Support Hotline. See Section 3.7 **.

You may now continue on through the Configurator, using the HELP command whenever you need help.

2.10 PREPARE THE DISK DRIVE

To prepare the disk drive, you will need to set the proper number of sectors, the unit number and the remote start capability. At this point, you must also ensure that the Index and Sector signals are present on the 'A' cable. If these signals are on the 'B' cable only, the ARZ-1 will not function correctly. If asked which interface to select as an option within the disk drive, choose SMD-E.

2.10.1 SECTORS-PER-TRACK SELECTION

If the disk drive you have selected is in the Configurator Program, you should set that drive to the number of sectors-per-track that the configurator said it should have. For Fujitsu disk drives, use the formula in the disk drive manual, not the table. Using the table in the Fujitsu manual will result in the last sector being too small. If your drive was not in the configurator, use the method below to determine the sectors-per-track setting for that drive and take the user defined path in the Configurator Program.

Most drive manufacturers provide jumpers or switches that allow you to select the number of sectors per track to run. The number you choose will be a function of 1) the total number of bytes per track available, and 2) the number of bytes required by the format you will be using. The total number of bytes per track for your drive will be found in the specifications in your manual.

The number of bytes required by ZETACO's high performance format is 590 (except for Fujitsu Disk Drives which require 599) bytes per sector. Therefore, to calculate the number of sectors per track use the following formula:

$$\text{Sectors Per Track} = \frac{\# \text{ of bytes per track}}{590 \text{ or } 599}$$

NOTE: The remainder, if any, can be ignored.

2.10.2 UNIT NUMBER AND MISCELLANEOUS PREPARATION

Set the drive(s) to the desired unit number(s). This is usually done via a switch in the drive or by changing lens caps on the front. For two or more drives, unit numbers assigned are usually consecutive, with unit "0" being the primary unit.

2.10.3 REMOTE DRIVE START

Upon initial power-up, the Controller will delay activating Pick/Hold (the signal that spins up the drive) for one second. This eases the initial current demand on the AC power source. This feature requires that the disk drive be set up for remote operation.

2.10.4 SPECIAL CONSIDERATIONS FOR DUAL VOLUME DRIVES

Dual Volume drives are units designed with two physical volumes. Usually, one volume is fixed, while the other is a removable cartridge. Two examples are the CDC 9448, and the Amcodyne 7110.

2.11 INITIALIZE THE DISK

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

- 1) FORMAT ONLY
- 2) SURFACE ANALYSIS
- 3) INSTALL

These modules are selectable through an opening menu, and can be run in any combination. However, you must run the Format module before or in conjunction with any of the other modules.

We recommend at this point that you run the Format and Install modules. This will load the controller microcode onto the board, format your disk and install micro code onto the disk. After verifying (in Section 2.12 below) that the media has been formatted and the subsystem is operational, you can return to the Formatter Program for a full surface analysis (Section 2.13).

The following sample dialogue will guide you through this procedure. Sample dialogues for the full Surface Analysis will be presented in Section 2.13.

To format the disk, boot the Software Support tape and load file #3. The sample dialogue below will guide you through the format and install mode of the Initializer Program.

ARZ-1 DISK INITIALIZER

THE DISPLAY MODES ARE:

- 0 - OCTAL
- 1 - DECIMAL
- 2 - HEXADECIMAL

ENTER THE NUMBER OF YOUR CHOICE:

2

This option allows you to select the numbering system in which some of your on-screen information will be displayed. Decimal numbers will be followed by a '.' (eg., 5.). Octal numbers will not. Hex numbers will be either 4 or 8 digits long, and will include any required leading zeroes. However, when entering hex numbers, you need not enter leading zeroes; when entering decimal numbers, you need not enter the '.'.

TIMEOUT IF DEVICE DOES NOT RESPOND ([YES],NO):

<cr>

The choice in brackets is the default response. To select the default response (and in this case, answer 'yes' to the question), we simply pressed CARRIAGE RETURN. If we had wished to answer 'no' to the question, we would have had to type 'NO'.

ARZ-1 DISK INITIALIZER

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	

ENTER A COMMAND SELECTION:

We wish to Enter the device that we want to format so we type E.

E

ENTER THE DEVICE CODE :(OCT):
24 <cr>

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

START INITIALIZATION OF CONTROLLER
END INITIALIZATION OF CONTROLLER

**This is just telling you that the Initializer Program is loading microcode onto the ARZ-1.

UNIT 0000 IS READY ; SELECT ([YES],NO):
<cr>

The Initializer Program has looked at the ARZ-1 and found that unit 0 is ready. It then asks you if you want to use unit 0. If you do then you would type return. If not then type NO and the Initializer Program would go on to the next ready unit.

SECTOR COUNT VERIFICATION
NUMBER OF SECTORS REPORTED BY THE DRIVE: 68.
NUMBER OF SECTORS CONFIGURED FOR THE DRIVE: 67.
WARNING! THERE IS ONE EXTRA SECTOR REPORTED.
THIS MAY BE JUST A PARTIAL SECTOR AND IS NOT A PROBLEM.

The Initializer Program finds out from the ARZ-1 how many sector pulses it sees from the drive. Then it compares that number to the number of sectors that the ARZ-1 is configured for. If there is not a match, it will print a warning. If there is only one more sector pulse then the number of sectors that the board is configured for, it is probably a sector at the end of the track which is too small to use. This is common with disk drives and is not a problem.

COMMAND CHOICES

[I]NITIALIZE DISK
[F]ORMAT ONLY
[M]ICRO-CODE INSTALL ONLY

ENTER YOUR SELECTION [I]
<cr>

****This time we do not want to analyze the disk because we want to run Reliability sooner to verify that the disk works at all. We do want to format and install micro-code onto the disk and we can do both in the initialize disk path. Later we will return and do a complete analysis of the disk.****

FORMAT? ([YES]/NO)
<cr>

****We do want to format the disk so we type a return.****

ENTER THE NUMBER OF PATTERNS TO RUN [0005] (HEX):

****We don't want to spend the time to analyze the disk now, so we will type 0 here. This will do no analyzing, but will install the micro-code onto the disk.****

0
<cr>

UNIT 0000 IS SELECTED
UNIT 0001 IS NOT READY
UNIT 0002 IS NOT READY
UNIT 0003 IS NOT READY

ARZ-1 DISK INITIALIZER

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	

ENTER A COMMAND SELECTION:
S

START ALL DEVICES ENTERED ([YES],NO):
<cr>

****This will start the program formatting. Now you may enter any other command you wish.****

ARZ-1 DISK INITIALIZER

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	

ENTER A COMMAND SELECTION:

L

As the formatting moves along you may want to see how far it has gone. Use of the L command will show you just how much has been done and the current state of each of the devices being formatted.

STATUS LIST AT RUN TIME 0.HRS. 0.MINS.
DEVICE CODE 24 UNIT NUMBER 0000
MODES :FORMAT, NO ANALYZE, NO INSTALL DEVICE STATE :ACTIVE
OF CYLINDERS FORMATTED 7. # OF CYLINDERS ANALYZED 0.
OF HARD ERRORS REPORTED 0. # OF SOFT ERROR REPORTED 0.

BAD BLOCK LOG

END OF BLOCK LOG

This tells us that we have formatted 7 cylinders with no errors.

ANALYZE FINISHED!
INSTALL CODE DONE!!!
INSTALL MAP DONE!!!

When this message is printed, the program has finished. The install map message is telling you that the map of all the bad sectors, that the program has found, has been stored on the disk.

2.12 RUN RELIABILITY TO VERIFY THE INSTALLATION

At this point, run Reliability for several minutes, just to verify that the subsystem is operating after the initial format. To do so, boot the Software Support tape and load file #4. The sample dialogue below will guide you in getting the program started.

ARZ-1 RELIABILITY UTILITY

THE DISPLAY MODES ARE:

- 0 - OCTAL
- 1 - DECIMAL
- 2 - HEXADECIMAL

ENTER THE NUMBER OF YOUR CHOICE:

2

This option allows you to select the numbering system in which some of your on-screen information will be displayed. Decimal numbers will be followed by a '.' (eg., 5.). Octal numbers will not. Hex numbers will be either 4 or 8 digits long, and will include any required leading zeroes. However, when entering hex numbers, you need not enter leading zeroes; when entering decimal numbers, you need not enter the '.'.

TIMEOUT IF DEVICE DOES NOT RESPOND ([YES],NO):

<cr>

The choice in brackets is the default response. To select the default response (and in this case, answer 'yes' to the question), we simply pressed CARRIAGE RETURN. If we had wished to answer 'no' to the question, we would have had to type 'NO'.

ENABLE MAPPING (YES,[NO]):

<cr>

EXECUTION MODE:

[R]RANDOM RELIABILITY [S]SEQUENTIAL RELIABILITY

ENTER YOUR CHOICE [R]:

<cr>

This question refers to the order in which the disk will be written to or read from for all of the devices tested in Reliability. If R is entered the program will chose random places and amounts of data to write and read. If S is entered the program will write the entire disk first and then read and verify the entire disk. We will chose the default "R".

ARZ-1 RELIABILITY UTILITY

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	[F]LAGS

E
ENTER THE DEVICE CODE:
24 <cr>

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

START INITIALIZATION OF CONTROLLER
END INITIALIZATION OF CONTROLLER

This is just telling you that the Reliability Program is loading microcode onto the ARZ-1 from the disk.

UNIT 0000 IS READY ; SELECT ([YES],NO):
<cr>

The Reliability Program has looked at the ARZ-1 and found that unit 0 is ready. It then asks you if you want to use unit 0. If you do then you would type return. If not then type NO and the Reliability Program would go on to the next ready unit.

TOTAL NUMBER OF BLOCKS [8A20F] (HEX):
<cr>

This is the number of usable sectors on your drive selected via the Configurator Program in Section 2.9.

WRITE ONLY (YES,[NO]):
<cr>

READ ONLY (YES,[NO]):
<cr>

VERIFY DATA ([YES],NO):
<cr>

SELECT DATA TYPE:

0 - LOGICAL BLOCK ADDRESS	1 - FLOATING ZERO
2 - FLOATING ONE	3 - ALTERNATE ZEROS (52525)
4 - ALTERNATE ONES (125252)	5 - ALL ZEROS
6 - ALL ONES	7 - RANDOM (ONLY IN RANDOM REL I)
8 - ROTATING (125252)	9 - RUN ALL PATTERNS

SELECT DATA TYPE [0]:

<cr>

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	[F]LAGS

S

DO YOU WANT TO START ALL ENTERED DEVICES ([YES],NO):

<cr>

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	[F]LAGS

At this point you have finished ENTERing your device and have commanded the program to START running. The green and yellow (BMC Transfer) LEDs on the front of the controller board should now be ON (they are actually flashing very rapidly) signifying that the controller is active. You may at any time initiate another command from the list simply by typing it's letter.

L

DEVICE CODE 24 UNIT NUMBER 0000 MAPPING NOT ENABELED
MODES: RANDOM, R/W, DATA CHECK-ADDRESS
#OF SECTORS WRITTEN 00000451 #OF SECTORS READ 0004
#OF HARD CB ERRORS 0000 #OF SOFT CB ERRORS 0000
#OF DATA ERRORS 0000

ENTER A COMMAND SELECTION:

**We selected LIST to get a printout of the system's activity. In this case, there are no errors logged. If you select LIST again, you should see that the number of sectors written and read has increased; this confirms that the subsystem is operational. You needn't be concerned at this point if there are some data or soft CB errors. Hard CB errors, however, will require further trouble-shooting before you return to the Formatter program to do a full surface analysis. For trouble-shooting help, see Section 3.0. We recommend that you run this for at least five minutes.

2.13 RETURN TO THE INITIALIZER PROGRAM AND RUN THE SURFACE ANALYSIS

To analyze the disk, boot the Software Support tape and load file #3. The sample dialogue below will guide you through the analyze and install mode of the formatter program.

ARZ-1 DISK INITIALIZER

THE DISPLAY MODES ARE:

- 0 - OCTAL
- 1 - DECIMAL
- 2 - HEXADECIMAL

ENTER THE NUMBER OF YOUR CHOICE:

2

This option allows you to select the numbering system in which some of your on-screen information will be displayed. Decimal numbers will be followed by a '.' (eg., 5.). Octal numbers will not. Hex numbers will be either 4 or 8 digits long, and will include any required leading zeroes. However, when entering hex numbers, you need not enter leading zeroes; when entering decimal numbers, you need not enter the '.'.

TIMEOUT IF DEVICE DOES NOT RESPOND ([YES],NO):

<cr>

The choice in brackets is the default response. To select the default response (and in this case, answer 'yes' to the question), we simply pressed CARRIAGE RETURN. If we had wished to answer 'no' to the question, we would have had to type 'NO'.

ARZ-1 DISK INITIALIZER

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	

ENTER A COMMAND SELECTION:

**We wish to Enter the device that we want to format
so we type E.**

E

ENTER THE DEVICE CODE :(OCT):

24 <cr>

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

START INITIALIZATION OF CONTROLLER

END INITIALIZATION OF CONTROLLER

**This is just telling you that the Initializer Program
is loading microcode onto the ARZ-1.

UNIT 0000 IS READY ; SELECT ([YES],NO):

<cr>

**The Initializer Program has looked at the ARZ-1 and
found that unit 0 is ready. It then asks you if you
want to use unit 0. If you do then you would type
return. If not then type NO and the Initializer
Program would go on to the next ready unit.**

SECTOR COUNT VERIFICATION

NUMBER OF SECTORS REPORTED BY THE DRIVE: 68.

NUMBER OF SECTORS CONFIGURED FOR THE DRIVE: 67.

WARNING! THERE IS ONE EXTRA SECTOR REPORTED.

THIS MAY BE JUST A PARTIAL SECTOR AND IS NOT A PROBLEM.

The Initializer Program finds out from the ARZ-1 how many sector pulses it sees from the drive. Then it compares that number to the number of sectors that the ARZ-1 is configured for. If there is no a match, it will print a warning. If there is only one more sector pulse then the number of sectors that the board is configured for, it is probably a sector at the end of the track which is too small to use. This is common with disk drives and is not a problem.

COMMAND CHOICES

[I]NITIALIZE DISK
[F]ORMAT ONLY
[M]ICRO-CODE INSTALL ONLY

ENTER YOUR SELECTION [I]

<cr>

We want to find all the bad spots on the disk so we must analyze the disk. This is done in the Initialize Disk Path.

FORMAT? ([YES]/NO)

NO

<cr>

We have already formatted the disk so we type a NO and a return.

ENTER THE NUMBER OF PATTERNS TO RUN [0005] (HEX):

You may analyze the disk using from 0 to 5 different patterns. We recommend that you use 5 patterns. If this disk is the disk that will hold the microcode, the Formatter will install the code after the analyze is done.

<cr>

UNIT 0000 IS SELECTED
UNIT 0001 IS NOT READY
UNIT 0002 IS NOT READY
UNIT 0003 IS NOT READY

ARZ-1 DISK INITIALIZER

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	

ENTER A COMMAND SELECTION:

S

START ALL DEVICES ENTERED ([YES],NO):

<cr>

This will start the program analyzing. Now you may enter any other command you wish.

ARZ-1 DISK INITIALIZER

COMMAND LIST

[E]NTER A DEVICE	[D]ELETE A DEVICE
[S]TART A DEVICE	[H]ALT A DEVICE
[R]ESTART THE PROGRAM	[L]IST ERROR TOTALS
[C]OMMAND LIST	[P]RINTER CONTROL
[B]SOFTWARE DEBUGGER	

ENTER A COMMAND SELECTION:

L

As the analyzing moves along you may want to see how far it has gone. Use of the L command will show you just how much has been done and the current state of each of the devices.

STATUS LIST AT RUN TIME 0.HRS. 0.MINS.

DEVICE CODE 24 UNIT NUMBER 0000

MODES :NO FORMAT, ANALYZE, INSTALL DEVICE STATE :ACTIVE

OF CYLINDERS FORMATTED 0. # OF CYLINDERS ANALYZED 7.

OF HARD ERRORS REPORTED 0. # OF SOFT ERROR REPORTED 0.

BAD BLOCK LOG

END OF BLOCK LOG

This tells us that we have analyzed 7 cylinders with no errors.

ANALYZE FINISHED!

INSTALL CODE DONE!!!
INSTALL MAP DONE!!!

When this message is printed, the program has finished. The install map message is telling you that the map of all the bad sectors, that the program has found, has been stored on the disk.

2.14 RUN AT LEAST ONE HALF HOUR OF RELIABILITY ** OPTIONAL **

While it is not necessary, we recommend that you run at least one half hour of Reliability to assure yourself that the subsystem is working dependably. If it is not, it will be easier to isolate and solve the problems now, rather than in the system build phase.

If you encounter any problems, turn to the Troubleshooting section. If you choose not to run Reliability at this time, simply proceed to Section 2.15, Building the System.

2.15 BUILDING THE SYSTEM

The disk is now ready to be initialized by running DG's DFMTR program for AOS or AOS/VS operating systems. Consult your DG manuals for guidance on these programs and on system installation. ZETACO does not supply DFMTR.

2.15.1 LOADING PROGRAMS FROM TAPE ONTO DISK

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

Once your basic system has been built, you can load this file onto your disk for quick access.

To load files from File 5, use the standard CLI Command for loading from tape.

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

LOAD/R/V @MTC0:5
REW @MTC0
SUPERUSER OFF

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

3.0 TROUBLE-SHOOTING

The ARZ-1 is supported by ZETACO in the following ways:

- Microprocessor-based selftest of over 90% of the board each time it is powered up, with an LED status report.
- Reliability Program on 9-track tape for use during installation and trouble-shooting.
- Customer Support Hotline, manned from 8:00 a.m. to 5:00 p.m. (Central Time) to answer your questions. (612-941-9480)
- Factory-trained personnel in our Authorized Distributor and Authorized Service organizations.
- 48-hour turnaround on most factory repairs or replacement.
- Up to a two year warranty on workmanship and materials.

3.1 SELF-TEST

Self-test checks out 90% of all the internal functions of the controller board once every time power is applied to the board. The test takes about one second to execute.

If Self-test has passed, the red LED will go out. If a failure was detected, the LED will blink a number of times which corresponds to the subtest that failed. If you have an error code, please call ZETACO's Product Support Hotline for help.

If the Self-test LED remains on, then the +5v supplied from the backplane is below 4.75v.

3.2 SOFTWARE SUPPORT PACKAGE

In addition to the diagnostic functions provided by the ARZ-1 Controller via on-board Self-test, ZETACO provides Reliability and Utility software. The Software Support Package on a magnetic tape included with the controller contains these programs.

Each of the programs on the Software Support Tape has been written by ZETACO specifically for the ARZ-1 Controller. You should use this tape for loading controller microcode, media formatting, disk diagnostic and reliability, and configuration of the controller. DG'S CORRESPONDING PROGRAMS MAY NOT WORK ON THIS CONTROLLER. Also note that the ARZ-1 does not support MVSYSTEMX.

The Software Support Tape is structured so that the programs on Files 2 through 4 can be loaded and executed directly from the tape. Each is a Stand/Alone Program; this means that they do not need, and cannot have, an operating system running when they are executed. Files 0 and 1 contain the software that enables you to boot from the tape and select the particular program you want loaded into the system. The boot procedure is detailed in Section 2.8.

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

If you are using an MV class machine, you must load the MV's microcode before booting the software support tape.

The Bootstrap Procedure for the Software Support tape is:

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

For the S140 virtual console, set 11A to 100022 (or 100062 for secondary tape drive). Then enter 100022L (or 100062L).

3. The Software Support Package Menu will be displayed:

FILE #	PROGRAM
2	ARZ-1 CONFIGURATOR
3	ARZ-1 FORMATTER
4	ARZ-1 RELIABILITY
5	".SV & .LS" Files in AOS DUMP Format

File Number?

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

3.3 SYSTEM ERRORS

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

3.3.1 TEST PROGRAMS TO USE IF THE SYSTEM IS BUILT BUT PROBLEMS HAVE ARISEN

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

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

Go through the enter procedure as you would normally, except when it asks you "READ ONLY (YES/[NO]):" answer YES. Then when it asks you "VERIFY DATA ([YES]/NO):" answer NO. Now start RELI with the S command.

This will test the controller's ability to seek, read data from the disk and transfer data on the BMC without destroying the data on the disk.

3.4 RELIABILITY - ERROR DESCRIPTION

If self-test was successful, but there are still problems with the subsystem, run the Reliability program. Reliability will display PIO errors, CB errors and Data Compare errors.

PIO errors will be of the format:

```
**** ERROR **** AT RUN TIME 0. : 1.
DEVICE CODE 24 UNIT NUMBER 0
MODES :FORMAT, ANALYZE, INSTALL CODE DEVICE STATE :ACTIVE
          REG A      REG B      REG C
OPERATION      0      3400      201
STATUS         0         0         0
PIO STATUS, OR TIMEOUT ERROR !
```

CB errors will have the following format:

```
**** ERROR **** Run time 0.hrs. 5.mins.
Device Code 24 Unit number 0000 Mapping NOT enabled
State: Active
Modes :RANDOM, READ/WRITE, DATA CHECK, ADDR
Logical Block      00036D3B Sector Count      0004
Memory Address    00004AB9 Command          Write
Page Table Address 00000000 Returned Xfer Count 0000
ASYNC STATUS      :      0003
CB Execution Error : Hard Errors
CB STATUS         :      8001
Any CB hard execution error
CB Done bit
CB ERROR          :      0001
Header Noncompare
CB UNIT STATUS    :      2400
Ready
Port Reserved Bit 1
```

Data compare errors will have the following format:

```
***** DATA COMPARE ERROR *****
DEVICE CODE 24 UNIT NUMBER 0 MAPPING NOT ENABLED STATE: ACTIVE
MODES :RANDOM, READ/WRITE, DATA CHECK-ADDR
DISK BLOCK      1165346 SECTOR COUNT      3
PAGE TABLE ADDRESS      0 LOGICAL XFER ADDRESS 56271
PHYSICAL XFERS ADDRESS 56271
EXPECTED RECEIVED OFFSET
165346 165347 1
165346 165347 3
165346 165347 5
TOTAL ERROR COUNT: 610
```

For a further description of the error status refer to Data General Programmer's Reference Series: Models 6236/6237 and 6239/6240 Disk subsystems.

3.5 FORMATTER - ERROR DESCRIPTION

If Reliability fails, you can try reformatting the disk drive. This will destroy any data on the disk, but it may get the subsystem working again. You could then rebuild your system on the the disk. The only errors displayed by Formatter are PIO errors which are fatal. The format of the display is as follows:

```
**** ERROR **** AT RUN TIME 0. : 1.
DEVICE CODE 24 UNIT NUMBER 0
MODES :FORMAT, ANALYZE, INSTALL CODE DEVICE STATE :ACTIVE
          REG A      REG B      REG C
OPERATION      0      3400      201
STATUS         0         0         0
PIO STATUS, OR TIMEOUT ERROR !
```

For a further description of the error status refer to Data General Programmer's Reference Series: models 6236/6237 and 6239/6240 Disk subsystems.

3.6 PRODUCT SUPPORT HOTLINE

ZETACO, Inc. provides a Product Support Hotline (612-941-9480) to answer technical questions and to assist with installation and trouble-shooting problems. The Hotline is manned by a technical team from 8:00 a.m. to 5:00 p.m. (Central Time) Monday through Friday.

Please review the General Installation Checklist before calling the Hotline.

3.7 WARRANTY INFORMATION

All ZETACO controllers and couplers are warranted free from manufacturing and material defects when used in a normal and proper manner for a period of up to two years from date of shipment. Except for the express warranties, stated above, ZETACO disclaims all warranties, including all implied warranties of merchantability and fitness. The stated express warranties are in lieu of all obligations of liabilities on the part of ZETACO for damages, including but not limited to, special, indirect or consequential damages arising out of or in connection with the use or performance of ZETACO's products.

3.8 PRODUCT RETURN AUTHORIZATION

When a controller malfunction has been confirmed using the tests outlined in Sections 3.1 to 3.5 above, the board can be returned to ZETACO for warranty repair or for time-and-material repair if it is out of warranty. A Return Material Authorization (RMA) number is required before shipment and should be referenced on all packaging and correspondence.

To ensure prompt response, the information outlined in the Material Return Information form on the following page should be gathered before calling the Authorized Distributor from whom you purchased the unit, or the ZETACO Hotline for the RMA number. Please include a completed copy of the Material Return Information form with the product. Each product to be returned requires a separate RMA number and Material Return Information form.

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

GENERAL INSTALLATION CHECKLIST

CPU _____ Operating System and Rev. _____

Is board replacing a previously installed subsystem? _____

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

Configuration Facts _____

Problem Description _____

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

Intermittent or consistent problem? _____

Does Self-test pass? _____

Priority of Board in CPU (Slot) _____

BMC Priorities of other BMC Devices _____

Reviewed Interrupt and Priority Jumpers on Vacant Slots? _____

Tried Different Slot? _____

Cleaned gold-fingered contact points of board and reset board? _____

Supplied ZETACO 1/2" Tape "Boot" correctly? _____

Is disk drive set to correct unit number, and is terminator in? _____

What is sector switch setting on the disk drive? _____

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

Result of ZETACO Reliability or Diagnostics: _____

MATERIAL RETURN INFORMATION

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

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

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

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

1. Does the problem appear to be intermittent or heat sensitive? (If yes, explain).
2. Under which operating system are you running? (AOS, AOS/VS) Include revision number.
3. Describe the system configuration (i.e. peripherals, I/O controllers, model of computer, etc.).

To be filled out by CUSTOMER:

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

Returned by:

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

4.0 CONTROLLER USAGE GUIDELINES

4.1 CONTROLLER FEATURES PROGRAMMED BY THE CONFIGURATOR

4.1.1 CONFIGURATOR AID (HELP)

The ARZ-1 Configurator Program includes two "HELP" commands: one for OPERATIONAL questions and one that suggests WHAT you might want to do. You can get an explanation for any item by responding with an "H" to the question. Please use these functions whenever you are uncertain as to what to do.

4.1.2 THROTTLE BURST RATE

This is defined as the number of word transfers that take place over the BMC during a single bus access by the disk controller. Throttle adjustment is dependent upon the type of system configuration in which the controller is installed. Too low a throttle setting could result in slow disk performance and too high a setting could cause a data late on another BMC device. The controller may be set to burst rates of 1, 2, 4, 8, 16, 32, 64, 128 and 256 words per access. A burst rate of 32 is recommended for most applications.

To maximize overall performance the Burst rate should be set to the largest value that doesn't cause interference on other controllers, such as "data lates".

4.1.3 DISK DRIVE TYPES

The ARZ-1 is capable of controlling virtually any disk drive that meets the SMD interface specification (including HSMD and SMD), or the SMDE specification. The controller may be configured to assign drives of varying capacities and transfer rates to any of the four ports. The ARZ-1 can take advantage of the full capacity of most disk drives.

This section of the Configurator Program allows the operator to assign drive characteristics on a unit-by-unit basis.

A warning will be issued when a potentially illegal configuration is attempted. "HELP" information is available throughout. Notes regarding Dual Volume drives:

The type of drive we refer to as "Dual Volume" has two actual physical disks combined in one unit. Often, one "volume" is a fixed disk, while the other is a removable cartridge. Two examples are the Control Data Corporation 9448 (CMD), and Amcodyne's 7110.

Dual Volume drives must be assigned consecutive unit numbers. A Dual Volume drive is treated as two logical units, so a maximum of two Dual Volume drives or one Dual Volume and two single volume drives may be attached to the controller.

Dual Volume drives must have each logical unit formatted independently by the initializer programs (DFMTR for AOS or AOS/VS).

4.1.4 BMC BUS PRIORITY

The ARZ-1 has the capability of functioning with up to seven other BMC peripheral controllers. However, some DG computers, such as the MV/4000 and S-280 only support up to four BMC devices. In this case you must select priorities 0 thru 3, 3 being the highest priority. The lower the priority number the lower the priority level. If there is more than one BMC device, make sure you select a priority level that is different than the other BMC devices.

4.1.5 BREAK COUNT INTERVAL

The Break Count Interval is defined as the period of time that the ARZ-1 is off the BMC bus. This period is a multiple of the BMC Sync Clock period, which in turn varies from computer to computer. A Break Count Interval setting of 1 is equal to one Sync Clock period. The maximum setting is 255. A setting of 4 is recommended.

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

4.1.6 DYNAMIC SECTOR INTERLEAVING

Interleaving may be desired to fine tune a system's performance. This is to avoid going a full revolution on the disk when the CPU cannot respond fast enough to catch the next consecutive sector.

If the system does not send it's read or write commands fast enough to access the next physical sector on the disk, the ARZ-1 gets the next REQUESTED sector, and picks up the skipped one the next time around. This feature is automatic and not adjustable by the user.

