Model LRS-10

Optical Disk Subsystem

Technical Manual

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If installation problems arise after you thoroughly review the manual, please contact the ZETACO Customer Support Hotline at (612) 941-9480.

REVISION HISTORY

ECO No.	Date	Description	Pages
0936	7/22/87	Refer to ECO.	

PREFACE

This manual contains information regarding installation, testing, and operation of the ZETACO LRS-10 Optical Storage Subsystem. It has been written with the following assumptions in mind: 1) You have a working knowledge of Data General (DG) minicomputers, operating systems, and diagnostic and utility software; 2) you have access to full hardware and software documentation for your particular system; 3) you are familiar with standard installation, power, grounding, and peripheral cabling procedures.

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

SECTION 1.0 PRODUCT OVERVIEW - Describes the LRS-10 features, capabilities, specifications, power, and interface requirements.

SECTION 2.0 INSTALLATION PROCEDURES - Describes and illustrates the procedures required to install the LRS-10.

SECTION 3.0 USAGE GUIDELINES - Discusses the unique features of optical storage and their practical application with the LRS-10.

SECTION 4.0 TROUBLE-SHOOTING - Contains information useful in analyzing subsystem problems, and how to get help.

NOTE: For Programming Notes, please refer to the following DG document:
Programmer's Reference Series
Models 6236/6237 and 6239/6240 Disk Subsystems
DG Ordering Number: 014-701001

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1.0 PRODUCT OVERVIEW

1.1 GENERAL DESCRIPTION

The LRS-10 Optical Storage Subsystem is a digital data storage and retrieval system designed for interface with DG BMC-equipped minicomputers. It utilizes Write-Once Read-Many (WORM) optical disk technology. Data is stored on a removable double-sided optical platter with an approximate capacity of one gigabyte per side.

The subsystem is composed of a controller, a cached optical drive that is both readable and writable, and up to three additional optical drives that are read-only. The cached optical drive consists of an optical drive, and a Winchester magnetic disk drive that acts as the cache.

The controller pairs ZETACO's emulation of the DG Argus 6236/6239 Disk Subsystem with the SCSI peripheral interface on a single 15" x 15", 10-layer printed circuit board. Data transfers take place over the Burst Multiplexor Channel (BMC) on DG's Eclipse and MV Series computers.

ZETACO provides a rack-mountable enclosure to house the magnetic drive and its power supply. The optical disk drives are also rack-mountable. All components are connected by a daisy-chain cabling system designed to meet FCC shielding requirements.

1.2 FEATURES AND ADVANTAGES

* Single controller is compatible with DG's full range of BMC-equipped computers
* Simultaneous control of up to four optical disk drives, for a total of 4 gigabytes of on-line data
* Device code is easily selected, even after installation, via switches accessible at the board edge
* High speed dual-microprocessor design and BMC Ping-Pong buffering support maximum transfer rates with minimum controller latency
* On-board self-test with error reporting and LED display
* Removable optical media, in the form of cartridges
* On-board Sector Scrub/Append allows data already stored on an optical disk to be "re-written"
* Magnetic disk cache minimizes need to scrub sectors
* Media management entirely resident on controller
* User-friendly software configuration

1.3 SPECIFICATIONS

1.3.1 LRS-10 CONTROLLER

1.3.1.1 FUNCTIONAL - GENERAL

Drives per Controller:	Up to 5 SCSI drives: 1 magnetic, up to 4 optical	
Maximum On-line Capacity:	4 Gb: 1 Gb Read/Write, 3 Gb Read-Only	
Transfer Rate:	Maximum SCSI burst rate of 1 Mb/second	
Indicator Lights:	Red (Left):	Self-Test - SCSI Module
	Red (Right):	Self-Test - HOST Module
	Yellow:	Self-Test - CABLE Module
	Green (Left):	SCSI Busy
	Green (Right):	Host Busy
Device Code Selection:	Switch-selectable	

1.3.1.2 FUNCTIONAL - COMPUTER INTERFACE

DG Emulation: 6236/6239 Disk Subsystem

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

Data Channel Interface: Not supported

Burst Multiplexor Channel (BMC) Interface:

- less than 1 STTL load
- 64ma drive at 0.7v
- supports selectability of any of the 8 priority requests
- selectable burst rates of 1 to 256, 16-bit words/access
- selectable break between access of 1-256 sync clock periods
- Maximum allowable BMC latency is 30ms.
- supports transfer rates equal to the fastest available BMC computers (16.16 Mbyte/sec)

1.3.1.3 FUNCTIONAL - DRIVE INTERFACE

Small Computer Systems Interface (SCSI):

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

1.3.1.4 MECHANICAL

Controller Dimensions:

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

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

1.3.1.5 POWER REQUIREMENTS

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

1.3.1.6 ENVIRONMENTAL

OPERATING ENVIRONMENT:

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

NON-OPERATING ENVIRONMENT:

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

Exceeds all Eclipse and Eclipse/MV temperature and humidity specifications.

1.3.2 MAGNETIC DISK DRIVE MODULE

1.3.2.1 FUNCTIONAL

Recording Technology:	Winchester (non-removable)
Interface:	SCSI
Capacity (Formatted):	155.9 MB
Tracks per Surface:	969
# of Platters:	5
# of Data Surfaces:	9
Rotational Speed:	3600 RPM
Rotational Latency:	8.33 ms
Transfer Rate:	1.25 MB/sec
Access Time:	Track to Track: 5 ms Average: 18 ms Full Stroke: 43 ms

1.3.2.2 MECHANICAL

Enclosure Dimensions:	
Width:	19 inches (48.26 cm)
Height:	3.4 inches (8.6 cm)
Length:	15 inches (38.1 cm)
Shipping Weight:	32 pounds (14.5 kg)

1.3.2.3 POWER REQUIREMENTS

AC Input:	120 Volts
Frequency:	60 Hz
Max. AC Operating Current:	1.5 Amps
Fuse:	3 Amp Slo-Blo

1.3.2.4 ENVIRONMENTAL

OPERATING ENVIRONMENT:

Temperature:	+10 to +50 degrees C
Relative Humidity:	+10% to +80% (non-condensing)
Altitude:	-1000 to +10000 ft

NON-OPERATING ENVIRONMENT:

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

1.3.3 OPTICAL DRIVE MODULE

1.3.3.1 FUNCTIONAL

Data Cartridge Storage Capacity (per Side):	1048 MB
Minimum Usable Capacity (per Side):	1000 MB
Tracks per Side:	32000
Sectors per Track:	32
Bytes per Sector:	1024
Average Access Time:	150 ms
Maximum Track Seek:	330 ms
Rotational Speed:	480 RPM
Average Rotational Latency:	62.5 ms
Maximum Rotational Latency:	127.6 ms
Average Data Transfer Rate:	262 KB/sec

Burst Data Transfer Rate (Read Mode):	1.33 MB/sec
SCSI Data Buffer:	44 Sectors

1.3.3.2 MECHANICAL

Dimensions	
Width:	19 Inches (48.26 cm)
Height:	5.3 Inches (13.5 cm)
Depth:	25.6 Inches (65 cm)
Weight:	55 Pounds (25 kg)

1.3.3.3 POWER REQUIREMENTS

AC Input:	120 Volts @ 3 Amps
Frequency:	60 Hz

1.3.3.4 ENVIRONMENTAL

OPERATING ENVIRONMENT:

Temperature:	+10 to +40 degrees C
Relative Humidity:	+20% to +80% (non-condensing)
Altitude:	-983 to +8200 ft

NON-OPERATING ENVIRONMENT:

Temperature:	-40 to +60 degrees C
Relative Humidity:	+5% to +95% (non-condensing)

1.3.4 CABLING

1.3.4.1 INTERNAL

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

1.3.4.2 EXTERNAL

Cables:

- 50-conductor shielded round cable connecting backpanel to Optical Drive
- 50-conductor shielded round cable connecting Optical Drive to Magnetic Disk Drive
- Optional 50-conductor shielded round cable(s) connecting additional optical drives

The maximum cumulative cable length allowable for a fully populated subsystem (4 optical drives) is 6 meters (single-ended), or 19.68 feet.

2.0 INSTALLATION

2.1 BEFORE YOU BEGIN

This section contains the procedures necessary for proper installation of the LRS-10. We recommend that you read through it once in its entirety before you begin.

The following sections, beginning with 2.2, are in order of execution. In Sections 2.2 through 2.4 you will select a slot and device code for the Controller, establish slot priority and BMC termination, and install the board and paddleboard. Sections 2.5 and 2.6 cover rack-mounting of the modules and cable connections. Section 2.7 details the power-up sequence.

In Sections 2.8 through 2.15 you will use programs on the Software Support Tape (the 1/2" magnetic tape reel shipped with the LRS-10) to complete the installation. You will first configure the Controller, then format the Magnetic Disk Drive. Finally, you will run DFMTR on the subsystem and bring it into full system operation.

You will need the following tools to install the LRS-10:

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

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

In the installation instructions we assume that you have on hand at least one blank data cartridge, which will become your first "active platter." In addition, we recommend that you have a second blank data cartridge to use as a Maintenance Platter. The procedure for creating a Maintenance Platter is covered in Section 4.3.3.

NOTE: ONLY DATA CARTRIDGES MANUFACTURED BY OPTICAL STORAGE INTERNATIONAL (OSI) WILL WORK WITH YOUR OPTICAL DRIVE MODULE.

2.1.1 UNPACKING AND INSPECTION

The LRS-10 consists of the following parts:

QTY	DESCRIPTION	ZETACO P/N
1	Optical Disk Controller	500-435-00
1	Magnetic Disk Drive Module	850-008-00
1	Optical Drive Module	901-435-00
1	'A' Paddleboard	500-411-00
1	Internal Cable	300-148-00
1	External SCSI Cable 9'	300-152-03
1	External SCSI Cable 2'	300-152-04
1	BMC Terminator Block	300-156-00
2	BMC Bus Cables	300-038-00

In this procedure, we assume that you are installing an LRS-10 that has one optical drive.

Also shipped with the LRS-10 are:

1	Software Support Tape (9-track magnetic tape)	400-435-01
1	Subsystem Manual	

Upon receipt of the LRS-10 from the carrier, inspect the shipping cartons immediately for any evidence of damage or mishandling in transit.

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

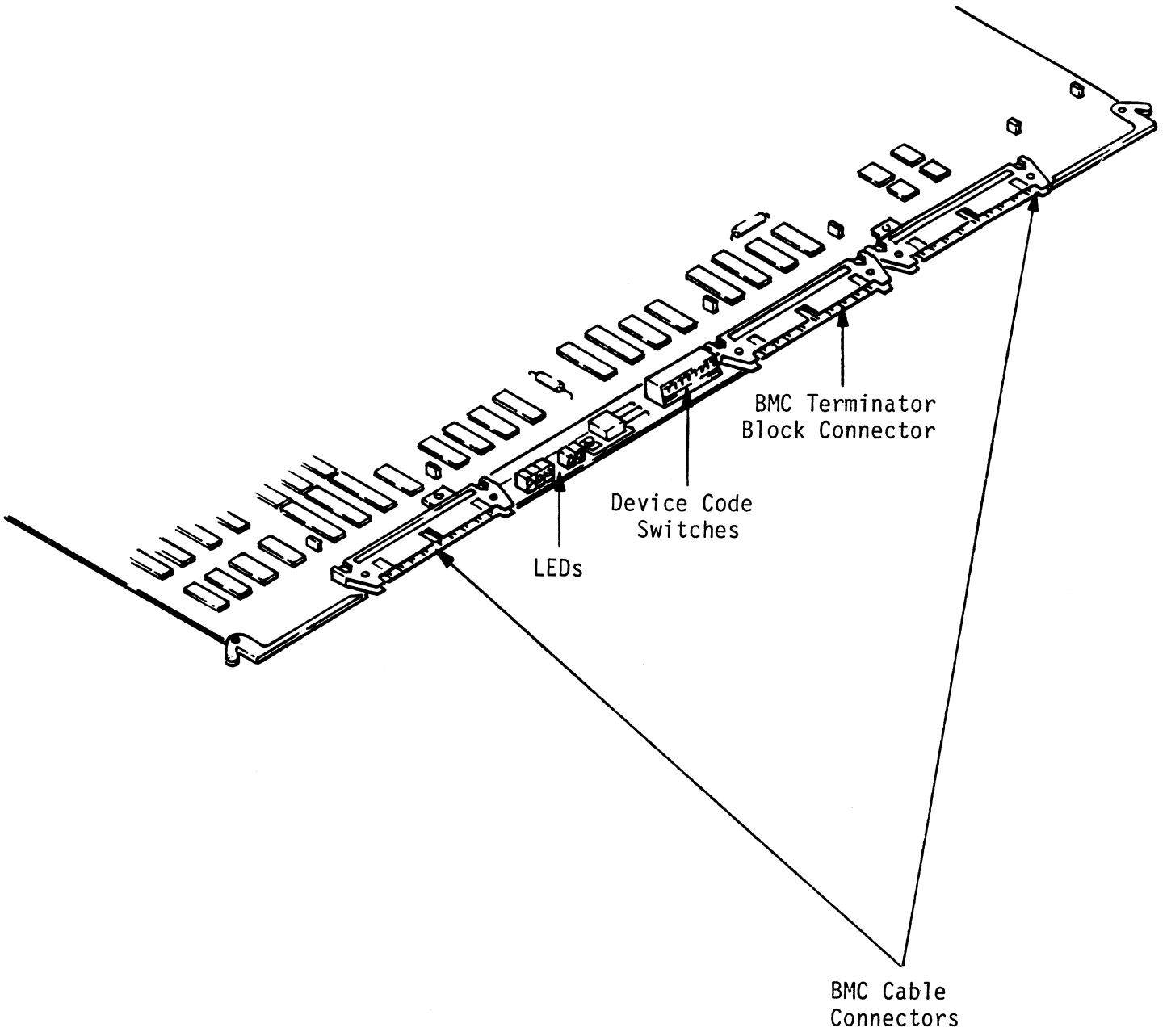
ZETACO'S warranty does not cover shipping damage.

For repair or replacement of any ZETACO product damaged in shipment, call ZETACO to obtain return authorization instructions. See Section 4.7.

2.1.2 SYSTEM HARDWARE REQUIREMENTS

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

FIGURE 2.1 Optical Disk Controller



2.1.3 THE SOFTWARE SUPPORT TAPE

The programs on the Software Support Tape have been written by ZETACO specifically for the LRS-10. You will use these programs to configure the Controller, format the magnetic disk, install Controller microcode onto the disk, trouble-shoot the system if necessary, and manage its resources.

NOTE: THIS TAPE CONTAINS YOUR ONLY PERMANENT COPY OF THE CURRENT REVISION OF THE LRS-10 MICROCODE.

The Software Support Tape is structured so that the programs on Files 2 through 4 can be loaded and executed directly from the tape. Each is a stand-alone program; this means that they do not need, and cannot have, an operating system running when they are executed. There is also a program (file 6 for AOS/VS, file 7 for AOS) that you will install on your system disk that runs under the operating system.

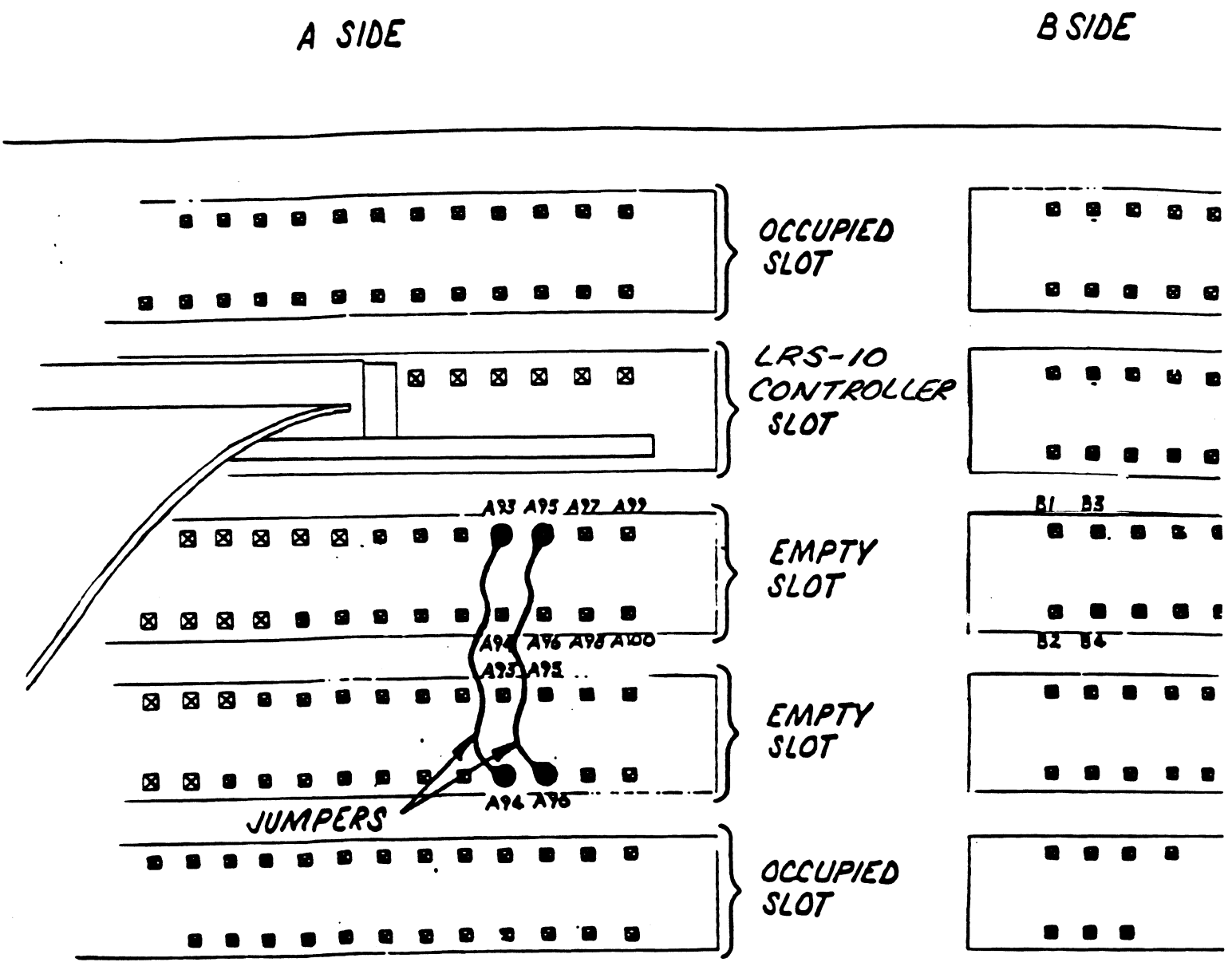
Files 0 and 1 contain the software that enables you to boot from the tape and select the particular program you want to load into the system. The boot procedure is detailed in Section 2.9.

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

2.2 SELECT A SLOT FOR THE CONTROLLER

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

FIGURE 2.2 Backplane Priority Jumpers



2.2.1 PRIORITY SELECTION

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

2.3 INSTALL THE CONTROLLER

FIRST, BE SURE THE COMPUTER IS TURNED OFF. Pull the lock tabs on the two front corners of the board out as far as they will go. Next, carefully guide the Controller board into the I/O slot you selected in Section 2.2. When the board engages the backplane connectors, gently press the lock tabs in to provide insertion leverage. Use equal pressure on both lock tabs until the board seats firmly into the backplane connectors.

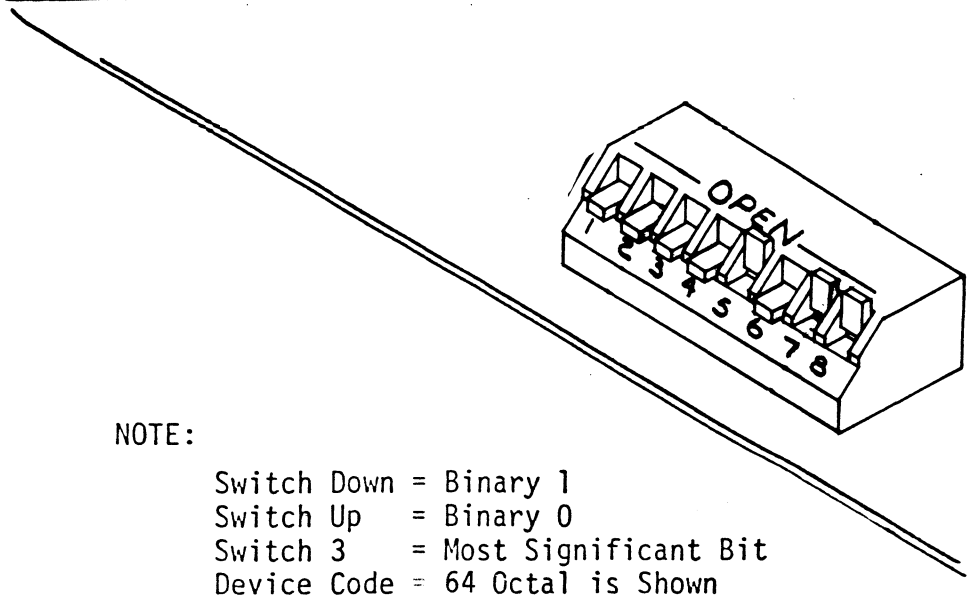
2.3.1 DEVICE CODE SELECTION

The recommended device code for the LRS-10 Controller is 64 (octal). However, any useable device code can be selected, as long as there is not already a controller in the system with that code.

There is a set of switches on the edge of the board that allows 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 Figure 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 Controller, you need not remove the board from the computer chassis. Simply set the switches accordingly and press RESET on the computer. The new device code will then be operative.

FIGURE 2.3 Device Code Switches



NOTE:

Switch Down = Binary 1
Switch Up = Binary 0
Switch 3 = Most Significant Bit
Device Code = 64 Octal is Shown

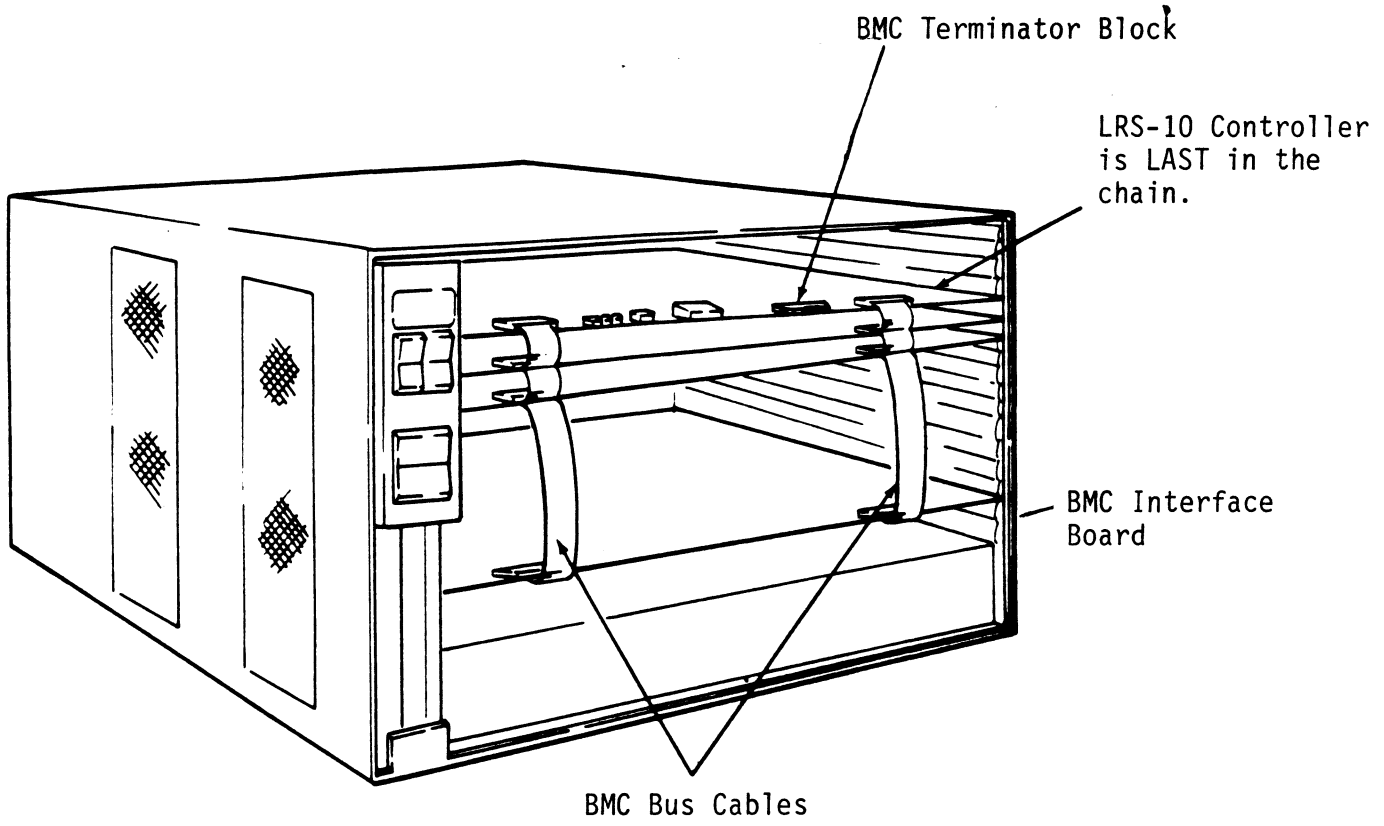
DEVICE CODE	S1 RESERVED	S2 RESERVED	S3 DS0	S4 DS1	S5 DS2	S6 DS3	S7 DS4	S8 DS5
0X			UP	UP	UP			
1X			UP	UP	DOWN			
2X			UP	DOWN	UP			
3X			UP	DOWN	DOWN			
4X			DOWN	UP	UP			
5X			DOWN	UP	DOWN			
6X			DOWN	DOWN	UP			
7X			DOWN	DOWN	DOWN			
X0						UP	UP	UP
X1						UP	UP	DOWN
X2						UP	DOWN	UP
X3					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

2.3.2 BMC BUS CABLING AND TERMINATION

The two BMC bus cables daisy-chain from the computer's BMC interface board to the various BMC peripheral controllers, as shown in Figure 2.4. The controller at the end of the chain must have a BMC terminator block installed; the others must not. If the LRS-10 Controller is to be installed as the last (or only) BMC controller, then make sure the terminator block is installed in the appropriate header connector, located as shown in the figure. For another view of this connector, see Figure 2.1. The Controller is shipped from the factory with the terminator block installed.

Install the BMC bus cables as shown in the figure by plugging the single-plug end of the cables into the DG BMC interface board, and the multiple-plug end of the cables into the LRS-10 Controller and other BMC peripheral controllers.

FIGURE 2.4 BMC Bus Cabling



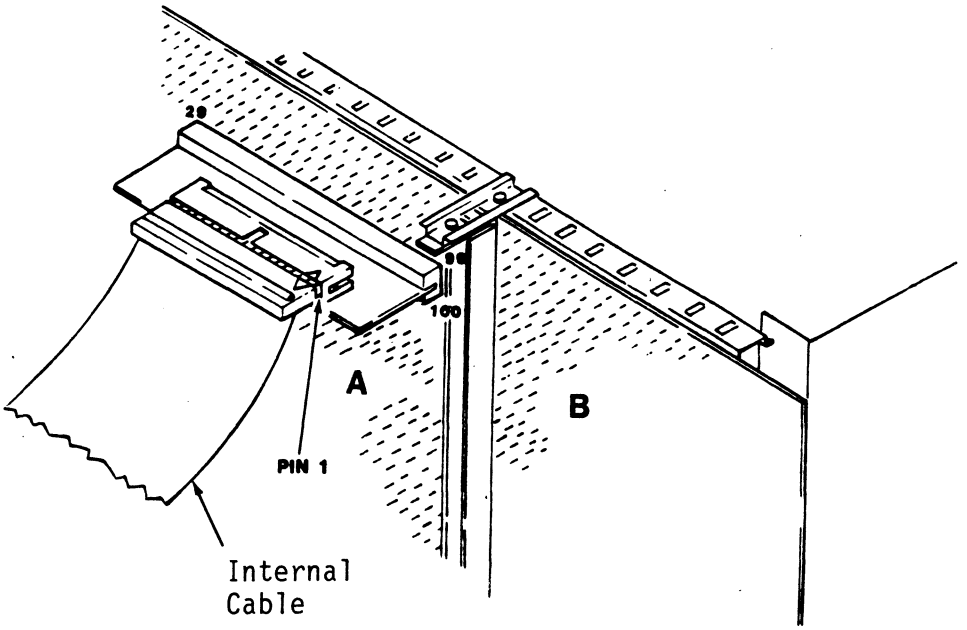
2.4 INSTALL THE PADDLEBOARD

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

Locate the two rows of pins on the "A" side of the backplane for the slot containing the Controller. Ensure that no pins are bent. Position the "A" paddleboard connector block so that it covers the pins on the right-most end of the rows (pins 29 through 100). Be sure that the header connector on the paddleboard is facing up. Press the connector securely over the pins, making sure all pins insert and do not bend, until the connector block is flush with the backplane. See Figure 2.5.

CAUTION: COMPONENT DAMAGE MAY OCCUR IF THE PADDLEBOARD IS MISALIGNED. MAKE SURE THE BLOCK IS NOT SHIFTED RIGHT OR LEFT. ALSO, MAKE SURE THAT THE BLOCK IS POSITIONED OVER THE CORRECT TWO ROWS OF PINS, AND NOT BETWEEN SLOTS. IT MAY BE NECESSARY TO COUNT PAIRS OF ROWS TO DETERMINE CORRECT POSITIONING.

FIGURE 2.5 Paddleboard and Internal Cable Installation



2.5 INSTALL THE MODULES IN THE CABINET

ZETACO recommends that the LRS-10 modules be installed one directly above the other in the system cabinet, with the Optical Drive Module on the top. You will need approximately nine inches of vertical space for the two modules. You can position the pair anywhere in the cabinet according to the dictates of your present configuration.

2.5.1 OPTICAL DRIVE MODULE INSTALLATION

ZETACO has provided a system of extendable slides for mounting the Optical Drive Module in the system cabinet. There are two slide assemblies; each slide assembly in turn consists of a part that attaches to the vertical mounting rails in the cabinet (the OUTER SLIDE MEMBER), and a part that attaches to the module itself (the INNER SLIDE MEMBER). See Figure 2.6. Also, for each slide assembly there are two L-shaped slotted-hole brackets. Mounting hardware is included.

To mount the module in the cabinet:

1. On each slide assembly, lift up the latch on the front end of the INNER SLIDE MEMBER and fully extend the slide.

2. Attach a front and rear mounting bracket to each of the two OUTER SLIDE MEMBERS, using the hardware provided. At this point, the screws should only be "finger tight."

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

4. Check the slide assemblies for binding. Pressing on the latch near the center of the INNER SLIDE MEMBERS will allow the slides to retract. Move them in and out several times; they should move freely. Leave them in the fully extended position.

5. Locate the three mounting holes on each INNER SLIDE MEMBER. There are access slots on each intermediate slide member through which you can reach the mounting holes. Have the six screws for these holes WITHIN REACH and ready to install.

NOTE: THE NEXT STEP INVOLVES LIFTING THE UNIT. TWO PEOPLE ARE NEEDED TO FINISH THE INSTALLATION.

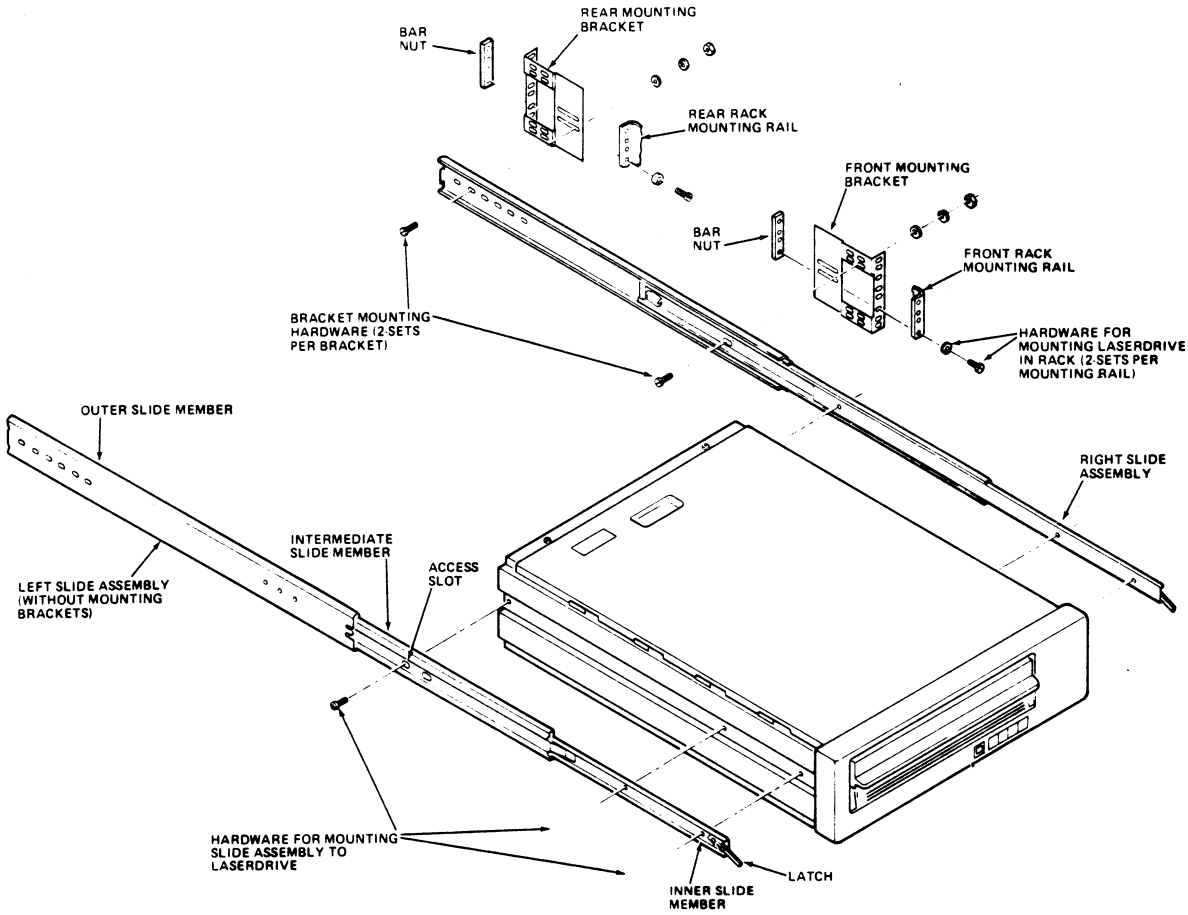
6. Carefully lift the drive between the slide assemblies.

7. WHILE SUPPORTING THE UNIT, install the six screws through the access slots, securing the INNER SLIDE MEMBERS to the unit.

8. Test the ease of travel of the slides by moving the unit back and forth a few times. If all motion is free and easy, slide the module into the cabinet. The installation is now complete.

To extend the module, first lift the latch at the front of each slide assembly. Now that the slides are installed, you must remove the front panel of the drive to do so. See Appendix C, PREVENTIVE MAINTENANCE, for instructions on how to remove the panel.

FIGURE 2.6 Optical Drive Module Slide Assembly



2.5.2 MAGNETIC DISK DRIVE MODULE INSTALLATION

Like the Optical Drive Module, there are two slide assemblies for each Magnetic Disk Drive Module (See Figure 2.7). Again, each slide assembly consists of an OUTER SLIDE MEMBER that attaches to the vertical mounting rails in the cabinet and an INNER SLIDE MEMBER that attaches to the module itself. See Figure 2.7a. For the Magnetic Disk Drive Module, each slide assembly requires one L-shaped slotted-hole bracket for attaching the OUTER SLIDE MEMBER to the rear vertical rails. Again, mounting hardware is included.

The Magnetic Disk Drive Module is shipped from the factory with the slide assemblies attached. To complete the installation of the module:

1. Attach the L-bracket to the rear end of each OUTER SLIDE MEMBER. On the inside of each L-bracket there is a quarter-turn fastener that mates with a receptacle in the rear of the module. Insert this fastener and turn it so that the L-bracket is locked to the module. Then attach the L-bracket to the OUTER SLIDE MEMBER using the supplied hardware. See Figure 2.7b and c. At this point, the screws should only be "finger tight."

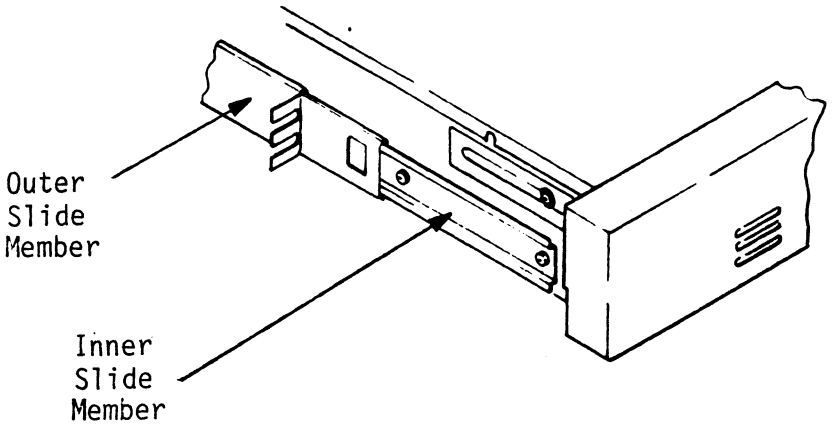
2. Unlock the fasteners at the rear of the module and disconnect the OUTER SLIDE MEMBER from the INNER SLIDE MEMBER of each slide assembly by fully extending the slides and then pressing the release clips.

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

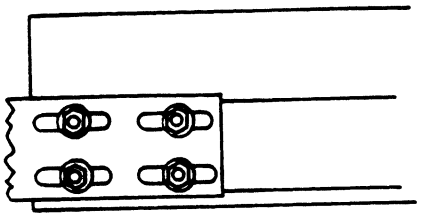
4. Extend the slides of both OUTER SLIDE MEMBERS until they have reached their maximum position. Lift the module and carefully guide the INNER SLIDE MEMBERS into the OUTER SLIDE MEMBERS, adjusting the OUTER SLIDE MEMBERS towards or away from the module as required to obtain accurate alignment. Slowly slide the module into the cabinet a few inches, taking care that the slides travel smoothly.
When satisfied, and while CONTINUING TO SUPPORT MOST OF THE WEIGHT OF THE MODULE, fully tighten the OUTER SLIDE MEMBERS to the vertical rails.

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

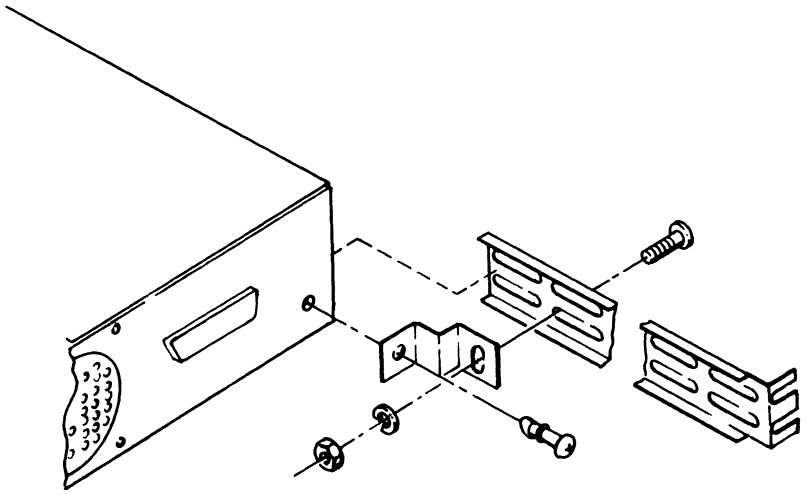
FIGURE 2.7 Magnetic Disk Drive Module Slide Assembly



(a)



(c)



(b)

2.6 CONNECT THE CABLES

The inter-module cabling scheme for the LRS-10 consists of two parts: an internal cable, and a set of external cables.

2.6.1 INTERNAL CABLING

The Internal Cable is a flat 50-conductor cable with a socket connector on one end and a "D" connector on the other. As shown in Figure 2.5, the socket connector plugs into the "A" paddleboard. The other end of this cable (the "D" connector) mounts on the computer bulkhead.

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

If the computer chassis is not FCC-compliant and therefore has no bulkhead, simply fasten the "D" connectors of the Internal and External cables together.

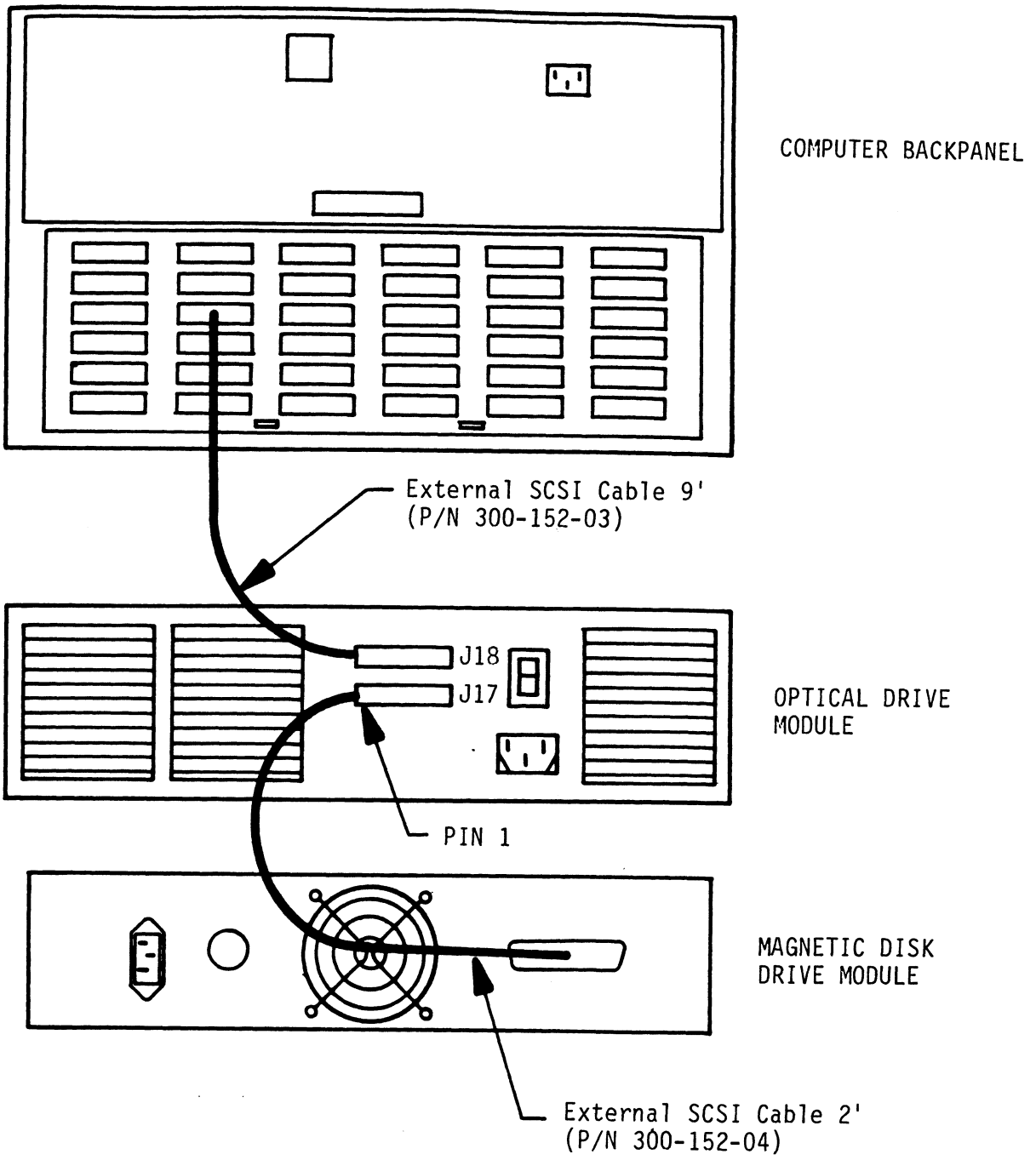
2.6.2 EXTERNAL CABLING

Two external cables, identical except for length, are required to operate the LRS-10 in its basic configuration. These cables, the External SCSI Cables, have at one end a 50-pin 'D' connector and at the other a 50-pin connector block. The 9' cable is connected from the computer bulkhead to the connector labelled "J18" on the rear panel of the Optical Drive Module. The 2' cable is connected from "J17" on the rear panel of the Optical Drive Module to the connector on the rear panel of the Magnetic Disk Drive Module.

Figure 2.8 illustrates this connection scheme. Be sure to observe the orientation of the connector block with respect to the location of pin 1.

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

FIGURE 2.8 Cabling for LRS-10 with one Optical Drive Module (Rear View)



2.7 POWER UP THE SUBSYSTEM

2.7.1 MAGNETIC DISK DRIVE MODULE OPERATION

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

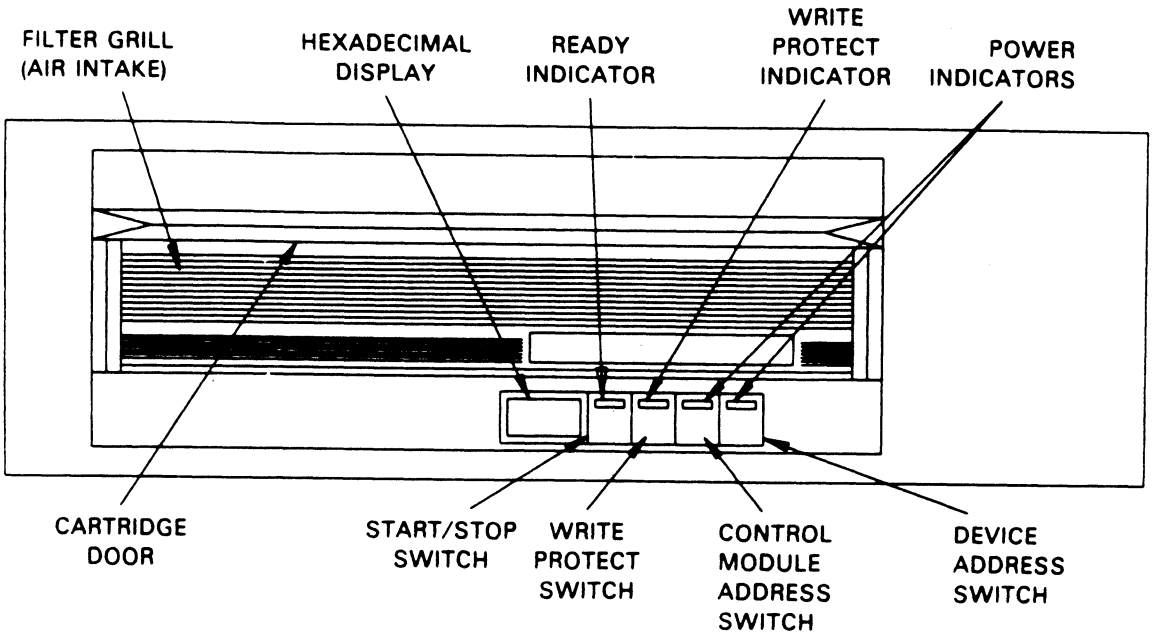
The magnetic disk drive should now be spinning. It will take approximately 35 seconds for the disk to reach full rotational speed and become ready. At that time, the READY LED will go out.

If there are any problems at this point, see Section 4.1.1.

2.7.2 OPTICAL DRIVE MODULE OPERATION

Place the ON/OFF rocker switch on the rear panel of the Optical Disk Drive in the ON position. Verify that the two Power Indicators on the Operator Panel (see Figure 2.9) become illuminated, and that air is flowing out of the rear panel filter grill. The Hexadecimal Display should be blank.

FIGURE 2.9 Optical Drive Module Operator Panel



Before spinning-up the Optical Drive Module, you must insert a data cartridge. First, be sure that the START/STOP switch on the front of the drive is in the STOP (OUT) position and the READY LED

Imbedded in the switch is off. Next open the cartridge door at the front of the drive and insert the data cartridge, with the optical access doors to the rear and facing down. Push it in gently until it snaps into place. Then close the cartridge door by lifting the handle.

Now, press the START/STOP switch to the START (IN) position. Since the unit runs Automatic Self-Tests, it may take approximately 3-4 minutes to reach operational speed and become ready. The READY indicator will flash while the unit spins-up, and remain steadily on when the unit becomes ready. The Hexadecimal Display should be blank.

If you encounter any problems, see Sections 4.1.2 and 4.1.3 in the

TROUBLE-SHOOTING section.

2.7.3 COMPUTER POWER-UP

Once your drive modules have been turned on and are ready for operation, you can power-up the computer . After you press the computer's power switch, you will notice that some of the LEDs on the front edge of the LRS-10 Controller will be active. They are indicating the status of the board's automatic self-tests.

At the end of the sequence all LEDs should be off. This indicates

that the Controller has successfully passed its self-tests and is ready to receive commands from the system.

If the LED sequence "hangs" with the yellow LED on, you may have forgotten to turn on your drive modules first. If so, turn them on in the manner described above. The Controller is actually waiting for a response from the drives; when the drives become ready, the LEDs will complete their sequence.

If any LEDs still "hang", or if any are flashing, turn to Section 4.1.4, CONTROLLER SELF-TEST ON POWER-UP.

2.8 BOOT THE SOFTWARE SUPPORT TAPE

The Bootstrap Procedure for the Software Support Tape is:

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

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

3. The Software Support Tape menu will be displayed:

```
FILE #          PROGRAM
 2              LRS CONFIGURATOR
 3              LRS OFF-LINE UTILITIES
 4              LRS RELIABILITY
 5              DUMP FILES FOR LRS
 6              AOS/VS ON-LINE UTILITY PROGRAM
 7              AOS ON-LINE UTILITY PROGRAM

FILE NUMBER?

     2
```

** You should enter the number of the program you wish to execute. At this point in the installation procedure, we entered "2" to load the Configurator program. **

2.9 CONFIGURE THE LRS-10 CONTROLLER

The Configurator program allows you to tailor some of the operating parameters of the Controller to suit your system without having to resort to cumbersome on-board switches or jumpers. The parameters are stored on the Controller in an EEPROM (Electrically Erasable Programmable Read-Only Memory). They are preserved even when power is removed from the board, and are changeable only through the Configurator program.

Once you have given the program the device code of the Controller (the octal number of the switch settings established in Section 2.3.1), the program will return with a request that you enter a command. This prompt indicates that the program has successfully communicated with the Controller at that device code, and the Controller is ready to be configured.

If the program had not returned with this prompt, that would have indicated that the system was unable to contact the Controller at that device code. If such is the case, turn everything off and double-check all of the preceeding installation steps. If, after doing so, you still have problems, contact ZETACO's Customer Support Hotline. See Section 4.5.

As the program's opening message points out, help with all aspects of the program's operation is available on-screen. The "W" command (HELP-WHAT TO DO) gives an overview of the program's use. The "H" command (HELP-OPERATIONS) gives details on some of its operational characteristics. Brief explanations of most of the parameters themselves are available by selecting the parameters from the main menu and entering an "H" instead of the requested values. For further information, see Appendix A.

Most of the parameters come from the factory preset with recommended values. The ones you will need to establish now are the BMC Bus Priority, Break Count Interval, Throttle Burst Rate, Platter ID, and the number of optical drives in your subsystem. The most efficient way to do this is to select the CHANGE ALL FACTS option from the menu. Explanations and configuration recommendations for the first three are available on-screen or in Appendix A as noted above.

The Platter ID is a user-selected alphanumeric name, with a maximum length of 32 characters. It is intended as an aid in helping you to organize your data. For example, the records for School District 5 might be on a platter designated "DISTRICT 5", or on several platters with the same ID. If you do not wish to assign a specific Platter ID, simply press "New Line" to select the default "empty" value.

The number of optical drives can be any number between one and four. We recommend that you enter the number of drives on that controller.

To fine-tune the controller, select T, Tuning Features/Platter Segmenting. Two things should be considered; R - Set Read Ahead Enable/Disable and W - Write Direct Enable/Disable. The Read Ahead will reduce the rotational latency time of the optical drive. The Write Direct will put data directly onto the optical platter with the directory going into the cache. This will speed up the Write command.

2.10 FORMAT THE MAGNETIC DISK DRIVE

The data cartridges for the Optical Drive Module require no special preparation before they are used, but you will need to format the media in the magnetic disk drive.

To do so, boot the Software Support Tape and load file #3, the Off-Line Utility program. We will first use the "I" option (INQUIRY THE DRIVE) to verify that we can communicate with the magnetic disk drive. Then we will select the "A" option (DO ALL) to load the Controller's operating microcode onto the board from the tape, format the magnetic disk drive, and install the microcode onto it.

CAUTION: INSTALLATION OF THE MICROCODE ONTO THE MAGNETIC DISK DRIVE IS ESSENTIAL TO PROPER OPERATION OF THE SUBSYSTEM. DO NOT CHOOSE THE "B" OPTION (FORMAT MAGNETIC DISK) ALONE AT THIS TIME. SEE APPENDIX A, UTILITY PROGRAMS, FOR A DISCUSSION OF THE OTHER PROGRAM OPTIONS.

Use the sample dialogue below to guide you.

```
LRSU - UTILITY FUNCTIONS FOR OPTICAL STORAGE SUBSYSTEM
                    REV. LEVEL = X.XX
                    PRODUCT OF ZETACO

THIS PROGRAM CONTAINS THE UTILITY FUNCTIONS FOR AN LRS OPTICAL
SUBSYSTEM.  FOR AOS AND AOS/VS IT REPLACES FORMATTING BUT NOT
DFMTR.

ENTER C TO CONTINUE:
     C

AVAILABLE FUNCTIONS ARE:
A - DO ALL:  FORMAT, INSTALL FIRMWARE
B - FORMAT MAGNETIC DISK
C - INSTALL ARZ FIRMWARE ON MAGNETIC DISK
D - INSTALL SCSI FIRMWARE ON MAGNETIC DISK
I - INQUIRY THE DRIVE
J - SET MAGNETIC KEY TO ACTIVE
R - (RE)INITIALIZE CONTROLLER
P - PLATTER COMPLETION (PURGE OF MAGNETIC)
K - REINITIALIZE THE MAGNETIC KEY
H - HELP
L - LOGGING TO PRINTER
Q - QUIT
CHOICE?

     I
```

```
ENTER DEVICE CODE FOR DISK CONTROLLER [64]

     <cr>
```

** The characters in brackets are the default response. To enter the default response we pressed <cr>. If our Controller had been at another device code, we would have entered that number instead. **

```
--CONTROLLER INIT ROUTINE
--INQUIRY COMMAND
ENTER UNIT NUMBER:

     3

- VENDOR ID IS CDC
- PRODUCT ID IS 94161-155
- PRODUCT REVISION LEVEL IS xxx
ENTER C TO CONTINUE:
```

** This response indicates successful communication with the magnetic disk drive. Note that a product revision level may or may not be given. If you receive any other response, TURN EVERYTHING OFF and review all of the preceeding installation steps. If the problem persists, call the ZETACO Hotline (see Section 4.5). Since in our sample we received the correct response, we now enter a "C" to go on to the DO ALL option. **

```
     C

AVAILABLE FUNCTIONS ARE:

A - DO ALL:  FORMAT, INSTALL FIRMWARE
B - FORMAT MAGNETIC DISK
C - INSTALL ARZ FIRMWARE ON MAGNETIC DISK
D - INSTALL SCSI FIRMWARE ON MAGNETIC DISK
I - INQUIRY THE DRIVE
J - SET MAGNETIC KEY TO ACTIVE
R - (RE)INITIALIZE CONTROLLER
P - PLATTER COMPLETION (PURGE OF MAGNETIC)
K - REINITIALIZE THE MAGNETIC KEY
H - HELP
L - LOGGING TO PRINTER
Q - QUIT

CHOICE?

     A
```

```
THIS FUNCTION WILL ERASE THE DATA CURRENTLY ON THE MAGNETIC
DISK.  YOU SHOULD ONLY RUN IT IF YOU DO NOT HAVE AN ACTIVE
PLATTER ASSOCIATED WITH THE MAGNETIC DISK.  ANY PLATTERS WHICH
HAVE BEEN "COMPLETED" ARE NOT ACTIVE.

**  See Section 3, USER GUIDELINES, for an explanation of
"active" and "completed" platters.  **

ENTER Y IF YOU WISH TO PROCEED WITH THIS FUNCTION.
     Y

-- INQUIRY COMMAND
-- FORMATTING
-- INSTALLING ARZ FIRMWARE
-- INSTALLING SCSI FIRMWARE
-- ALL FUNCTIONS COMPLETE

ENTER C TO CONTINUE:

**  The entire series of operations will take approximately 15
minutes to complete.  You can verify that the program is indeed
operating by observing the LEDs on the front of the Controller;
the right-most green LED (Host Busy) should be on.  To exit
from the program at this point, enter a "C" and select the "Q"
(QUIT) option from the menu.  **

AVAILABLE FUNCTIONS ARE:

A - DO ALL:  FORMAT, INSTALL FIRMWARE
B - FORMAT MAGNETIC DISK
C - INSTALL ARZ FIRMWARE ON MAGNETIC DISK
D - INSTALL SCSI FIRMWARE ON MAGNETIC DISK
I - INQUIRY THE DRIVE
J - SET MAGNETIC KEY TO ACTIVE
R - (RE)INITIALIZE CONTROLLER
P - PLATTER COMPLETION (PURGE OF MAGNETIC)
K - REINITIALIZE THE MAGNETIC KEY
H - HELP
L - LOGGING TO PRINTER
Q - QUIT

CHOICE?

     Q
```

YOUR MAGNETIC DISK HAS BEEN INITIALIZED AND SHOULD NOT NEED TO BE INITIALIZED AGAIN, EXCEPT IN SPECIAL CIRCUMSTANCES. SOME CIRCUMSTANCES MIGHT BE:

- INSTALLING A NEW MAGNETIC DISK IN THE SUBSYSTEM.
- IF THE FORMAT OR SUBSYSTEM DATA ON THE MAGNETIC IS LOST.
- TO UPDATE THE MAGNETIC DISK WITH A NEW REVISION OF FIRMWARE.

ALL OPTICAL PLATTERS ARE PREFORMATTED WHEN SHIPPED. WHENEVER A NEW PLATTER IS USED IN YOUR SYSTEM, YOU MUST RUN DFMTR ON EACH NEW OPTICAL PLATTER.

YOU MUST SPECIFY THAT NO PATTERNS ARE TO BE RUN IN DFMTR.
THE OPTICAL STORAGE SUBSYSTEM IS A WRITE-ONCE MEDIUM.

The magnetic disk drive is now prepared for operation.

If you encounter any errors, see Section 4.2, ERRORS DURING SYSTEM OPERATION.

2.11 VERIFY THE INSTALLATION ** OPTIONAL **

The best way to verify that the LRS-10 has been successfully installed is to run the Reliability program on the subsystem for 30 minutes or more. While this is not required to begin full operation, we strongly recommend it, since it is preferable to identify and trouble-shoot problems before going fully on-line.

If you choose not to run the program at this time, go on to Section 2.12.

The Reliability program requires that CPU microcode (for MV-family computers) be already resident in the CPU. If you have an MV computer and have not previously loaded the microcode, you must do so now.

To run the Reliability program, boot the Software Support Tape and load file #4.

CAUTION: MAKE SURE THE OPTICAL DRIVE IS WRITE-PROTECTED AT THIS TIME, SINCE YOU DO NOT INTEND TO PERFORM ANY WRITE TESTING ON IT. DO THIS BY PRESSING THE SWITCH ON THE OPERATOR PANEL LABELED WRITE PROTECT TO THE "ENABLED" (IN) POSITION. SEE APPENDIX E FOR ADDITIONAL INFORMATION ON WRITE PROTECTION.

Although the Reliability program provides a number of options for exercising the subsystem, at this point you can take a simple path through the program questions in order to run basic tests. Use the sample dialogue below to guide you.

For more information on the other options available in the Reliability program, see Section 4.3 in the TROUBLE-SHOOTING section.

THE DISPLAY MODES ARE:

0 - OCTAL
1 - DECIMAL
2 - HEXADECIMAL

ENTER THE NUMBER OF YOUR CHOICE [0] (OCT):

<cr>

** The choice in brackets is the default response. To select the default response -- in this case "0", or Octal -- we simply pressed CARRIAGE RETURN (<cr>).

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

<cr>

ENABLE MAPPING (YES,[NO]);

<cr>

EXECUTION MODE:
[R]ANDOM RELIABILITY [S]EQUENTIAL RELIABILITY
ENTER YOUR CHOICE [R]:

<cr>

THIS CONTROLLER CAN BE RUN IN ONE OF TWO MODES. THE FIRST IS RUNTIME MODE. IN THIS MODE THE CACHEING SCHEME IS USED AND THE MAGNETIC DRIVE CANNOT BE ACCESSED DIRECTLY. ALSO, THE MICROCODE WILL BE READ FROM THE DISK SO IT MUST HAVE BEEN INSTALLED ON THE DISK PREVIOUSLY.
THE SECOND MODE IS THE MAINTENANCE MODE. IN THIS MODE THE CACHEING SCHEME IS NOT USED AND THE MAGNETIC CAN BE ACCESSED DIRECTLY. ALSO, THE MICROCODE MUST HAVE ALREADY BEEN DOWNLOADED ONTO THE CONTROLLER BY RUNNING THE "R" SELECTION IN THE UTILITY PROGRAM.

SHOULD THE CONTROLLER BE RUN IN THE RUNTIME MODE (YES,[NO]):

<cr>

```
                    LRS-10 RELIABILITY UTILITY
                           REV. X.XX

                          COMMAND LIST

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

ENTER A COMMAND SELECTION:

     E

** This command allows you to enter into the program's "memory"
information about the device or devices you want to run.

ENTER THE DEVICE CODE [64] (OCT):

     <cr>

** In this case, the program is telling you that it requires
that your response be in octal. For this sample, we chose the
default device code of 64. **

START INITIALIZATION OF CONTROLLER.

END INITIALIZATION OF CONTROLLER.
UNIT   0000   IS READY; SELECT (YES,[NO]):

     <cr>

** In Maintenance Mode (which you are now in) the program
identifies the Optical Drive Module as Unit 0. We will not test
it now.**

UNIT   0001   IS READY; SELECT (YES,[NO]):

     <cr>

UNIT   0002   IS READY; SELECT (YES,[NO]):

     <cr>

UNIT   0003   IS READY; SELECT (YES,[NO]):

     yes
```

```
THE SELECTED DISK IS THE MAGNETIC DISK.  YOU MAY WRITE AND READ
TO THIS DISK, BUT IF YOU REDUCE THE LOWER BLOCK LIMIT YOU WILL
LOSE DATA THAT IS ON THIS DISK IF IT IS "ACTIVE" OR NOT
"COMPLETE".

THE MINIMUM LOGICAL DISK BLOCK IS [400642] (OCT):

     <cr>

** The default value is the start of an area on the disk
designated as a maintenance area.  Logical blocks below this
point are used in Runtime Mode for current data.  See Section
4.4, TESTING A DISK WITH DATA ON IT, for a broader discussion of
the maintenance area. **

THE MAXIMUM LOGICAL DISK BLOCK IS [456437] (OCT):

     <cr>

WRITE ONLY (YES,[NO]):

     <cr>

READ ONLY (YES,[NO]):

     <cr>

VERIFY DATA ([YES],NO):

     <cr>

DATA TYPES
0-LOGICAL BLOCK ADDRESS       1-FLOATING ZERO
2-FLOATING ONE                3-ALTERNATE ZEROES (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.] (DEC):

     9

**  This choice will allow us to thoroughly test the unit by
automatically running all of the available data patterns.  **
```

```
                    LRS-10 RELIABILITY UTILITY
                            REV. X.XX

                            COMMAND LIST

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

ENTER A COMMAND SELECTION:

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

     <cr>
```

** When the test is running, the green LEDs on the front of the Controller will be flashing in random patterns. The READY LED on the front panel of the Magnetic Disk Drive Module may also glow faintly or appear to pulse. **

```
                    LRS-10 RELIABILITY UTILITY
                            REV. X.XX

                            COMMAND LIST

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

     L

STATUS LIST: RUN TIME xx. HRS    xx. MINS.
DEVICE CODE 24 UNIT NUMBER03 MAPPING NOT ENABLED STATE:ACTIVE
MODES: MAINTENANCE, RANDOM, READ/WRITE, DATA CHECK-DO ALL
PATTERNS
BLOCKS WT    xx  BLOCKS RD    xx    TOTAL ERRORS         x

ENTER A COMMAND SELECTION:
```

** At any time while the program is running you can request a list of errors that may have been logged. **
To stop the test, select the "H" command. If you wish to obtain a hard copy of the error log, select the "P" command, and then the "L" command.

If you encounter errors while running the program, turn to Section 4.2, ERRORS DURING SYSTEM OPERATION. If not, installation is now complete and you are ready to bring the LRS-10 on-line. Before doing so, however, you may wish to do one other thing: Create a Maintenance Platter.

A Maintenance Platter is an optical platter designated especially for running tests on the Optical Drive. Creating one now will accomplish two things for you. First, it will allow you to verify the functionality of the optical drive before going on-line. Second, by creating one now you will have one ready when and if you need to use it for trouble-shooting.

The creation of the Maintenance Platter is covered in detail in Section 4.3.3. If you are going to do it now, turn to that section, and when done, return to Section 2.12.

2.12 "GEN" IN THE NEW DEVICE

Before going on-line, you must introduce the new device into your operating system configuration. To do this, start up your operating system and run the AOSGEN program (or VSGEN for AOS/VS). Specify the device name as "DPJx", where x is the number of the device. At the device code of 64 recommended in Section 2.3.1, this number can be 10 (for Unit 0 at that device code) through 13 (for Unit 3 at that device code).

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

2.13 RUN DFMTR ON THE SUBSYSTEM

Before running the DFMTR program, be sure that the optical platter is write-enabled. The WRITE PROTECT switch on the Optical Drive Module Operator Panel must be OUT, and the Write Protect Tab on the Data Cartridge must be in the "Write" position. See Appendix E.

WARNING: WHEN YOU RUN DFMTR, THE PROGRAM WILL ASK YOU WHETHER YOU WANT TO DO A SURFACE ANALYSIS. YOU MUST ANSWER NO TO THIS QUESTION OR YOU WILL DESTROY YOUR OPTICAL PLATTER.

In the future, each time you begin a new optical platter you will need to run DFMTR on that platter.

Make note of the LOGICAL DISK NAME that you assign when you run the program, as you will need to specify it when you MOUNT your platter in Section 2.15. If you need help with the DFMTR program, consult your DG system management documentation.

2.14 STORE THE SOFTWARE SUPPORT PROGRAMS ON YOUR SYSTEM DISK

The Software Support Tape contains files that in turn contain the On-Line Utility program for AOS/VS (file #6) or AOS (file #7). These files are in the standard system DUMP format. You MUST load one or the other (depending on your operating system) onto your system disk so that the On-Line Programs will be accessible under the operating system.

To load the file, use the standard CLI commands for loading from tape:

For AOS and AOS/VS, working from root (:):

```
SUPERU ON
CREATE/DIR LRS
DIR LRS
LOAD/V/R @MTzx:y, where:

z is the type of mag tape controller (A,B,C,D, OR J);
x is the unit number;
y is the number of the file on the tape.
```

There is another file (#5) that contains the Configurator, Off-Line Utilities, Reliability programs and On-Line Utility macros, again in the standard DUMP format. You must load this file onto your system disk as well, so that those programs will be accessible.

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

Once the programs have been installed on the system disk, to load or run one of the Stand-Alone programs you should specify its pathname as follows:

```
:LRS:<program name>
```

2.15 MOUNT A PLATTER

The final step in bringing your LRS-10 on-line is "mounting" the platter. This means introducing the platter into the system as the logical disk unit you created by running DFMTR in Section 2.13. The method described here uses the On-Line Subsystem Utility MOUNT operation. For more information on the mounting concept, see Section 3, USAGE GUIDELINES.

The On-Line Subsystem Utility program runs only under the operating system. You loaded it onto your system disk in Section 2.14 above. To run the program, "DIR" to ":" and type:

```
LRS:LRS
```

Select the MOUNT option from the menu. The program will ask you to specify your drive and platter. Your drive is the DPJx device that you "gen'd in" in Section 2.12. The platter is equivalent to the LOGICAL DISK NAME you assigned when you ran DFMTR in Section 2.13.

When you have answered these questions, the program will return with a report on the current usage of your platter and a message that the MOUNT operation succeeded. At this point, your LRS-10 is fully on-line and ready to receive data.

3.0 USAGE GUIDELINES

The LRS-10 subsystem has been designed to perform as a conventional mass storage subsystem, emulating DG's Argus/6236 magnetic disk subsystem. However, it is NOT a conventional mass storage device, but rather, one based on an entirely different type of recording technology -- laser optics. And this technology, which brings significantly greater storage capacity, also brings with it new considerations regarding usage.

The most efficient use of the LRS-10 is not as a "normal" data disk. Data "burned into" the optical platter by the laser is permanent; it is not erasable and cannot be written over, as is the case with magnetically recorded data. The term that has come to describe this current state of the art of optical recording is "Write Once/Read Many," or WORM.

The best applications are those in which archived records -- records that don't change -- need to be efficiently stored and retrieved for reference. Such applications might include CAD/CAM drawings, libraries, medical records, and legal records. Note that the platter records only digitized data.

To offset the write-once limitation, the LRS-10 employs two techniques -- a magnetic disk "cache" and "Sector Scrub/Append." Both features are entirely transparent to the user. The cache acts as a buffer between the system and the storage media, controlling when data is written onto the optical platter by evaluating it according to certain guidelines. "Sector Scrub/Append" actually allows the system to circumvent the WORM limitation and re-write a previously written sector. However, this "re-writing" is apparent rather than real. The new data is actually written on a different part of the optical platter that has been reserved for this purpose, and then appears to the system as the "actual" sector.

ZETACO has provided utility programs to facilitate doing most of the things you will want to do with your LRS-10. We strongly recommend that you use these programs. They will help reduce any chance of operator error, lend organization and structure to the process of storing large amounts of data, and enable you to most efficiently use your platters.

Should you choose to access the LRS-10 in other ways (through a specially written application, for example), there is one general rule to follow: DO NOT DELETE. In the CLI, do not use the DELETE command, or the /D or /R switches. Do not use the /S switch with the FILESTATUS command, since this involves the "hidden" deletion of a temporary file. Deleting files and directories on the optical platters may render the platter useless.

In day-to-day operations with the LRS-10, you will primarily be "mounting" and "dismounting" platters, storing data on them, and accessing that data. Below we will offer some guidelines for doing these tasks. In this discussion we assume you are familiar with DG system software and have access to documentation on it. References to the ZETACO Utility programs here are somewhat brief; for details see Appendix A.

3.1 MOUNTING AND DISMOUNTING PLATTERS

The term "mount" actually refers to the common AOS and AOS/VS practice of grafting an independently formatted LDU (in this case, your optical platter) onto the system LDU in order to work with it. It is a system-level logical operation, and does NOT mean physically putting a data cartridge into the optical drive.

You must mount a platter before you try to access the LRS-10 at the system level.

In ZETACO's On-Line Utility program, this is done with the MOUNT option. You must know the Logical Disk Name (asked for in the program as the "Platter Name") and the device name. The Logical Disk Name is the name you assigned to the platter when you ran DFMTR. The device name is the "DPJx" name you assigned at the same time.

In the CLI the operation is done with the INITIALIZE command. For example, if you had run DFMTR on your optical platter as device DPJ10, the CLI command would be "INIT @DPJ10." The system would then print on the screen the Logical Disk Name of the platter.

The term "dismount" of course refers to the logical disconnection of the grafted LDU when you are through using it. Again, this does not mean physically removing the data cartridge from the optical drive. We recommend that you dismount whenever you finish the series of operations for which you mounted the subsystem. In the On-Line Utility choose the DISMOUNT option; in the CLI, use the RELEASE command.

3.2 ACTIVE AND COMPLETED PLATTERS

When you run DFMTR on a blank platter, the Controller automatically executes a series of operations that "bind" that platter to the magnetic disk drive cache unit. That platter is then considered "active" and can be written to. It remains so until a special completion operation is run that terminates the relationship by moving all information from the cache to the optical platter. The platter is then considered "completed" and becomes a read-only platter. Platter completion should not be done until that side of the platter (about 1GB capacity) is full, or contains as much data as you ever want to have on it (see Section 3.3). The Platter Completion operation can only be done by using either the On-Line or Off-Line Utility program.

Once a platter becomes active, you must complete it before you can write to a new platter. You cannot switch back and forth between active platters, because there can only be one active platter at a time per subsystem. However, you can switch back and forth at will between completed platters in order to retrieve previously stored data. You can also switch between the current active platter and any completed platters.

3.3 MONITORING AVAILABLE SPACE ON AN OPTICAL PLATTER

To know when to complete a platter, you must closely monitor the amount of space remaining on it. When the amount of space remaining is not sufficient to hold all of the data to be transferred in the next transfer operation, it is time to complete that platter.

If you use ZETACO's On-Line Utility program to do your tasks, then you will receive a report on available space with the execution of each option. If you do not use the On-Line Utility, then use the CLI SPACE command before you begin to transfer data.

3.4 TRANSFERRING DATA TO AN ACTIVE PLATTER

The ARCHIVE option in the On-Line Utility program will automate the process of transferring files from the system disk or a data disk to the LRS-10. If you wish to use the CLI, use the MOVE or COPY commands, but:

DO NOT APPEND THE /D OR /R SWITCHES TO THESE COMMANDS, AND DO NOT USE THE CLI DELETE COMMAND. DELETING FROM THE CLI WILL RESULT IN WASTED PLATTER SPACE.

Where you may once have wished to replace an older version of a file with an updated one, you will now have to preserve the older version and write the new one in a different place. This may mean giving the latest version of the file a new name. For example, suppose you previously MOVEd a file called WIDGET, containing a CAD drawing, from your system disk to your active platter. If you recently updated the file on the system disk by changing the drawing, you might use the COPY command to copy the updated version of WIDGET to a file on the active platter called WIDGET_1. You will then have to remember which is the latest version of the original file.

Another possible solution to this problem is to organize your optical platter into subdirectories, so that you can in fact store two files under the same name.

3.5 ORGANIZING YOUR OPTICAL PLATTERS

You can create a directory structure on an active platter just as you would on any other LDU, except that once a subdirectory has been created it cannot be deleted. In the CLI use the CREATE/DIR command; in the On-Line Utility program, use the CREATE SUBDIRECTORIES option.

To see how this might work, let us return to the example cited above. First, we might create subdirectories on our active platter called "QUARTER186", QUARTER286, QUARTER386, and QUARTER486. The original version of WIDGET could be saved under QUARTER186. Then updated versions could be saved under the same name in the other three subdirectories. Thus, the version of WIDGET under QUARTER486 would be the latest version.

4.0 TROUBLE-SHOOTING

The LRS-10 is supported by ZETACO in the following ways:

- Microprocessor-based self-test of over 90% of the Controller each time it is powered up, with an LED status report.
- Utility programs on 9-track tape for use during installation and trouble-shooting.
- Customer Support Hotline, manned from 8:00 a.m. to 5:00 p.m. (Central Time) to answer your questions.
- Quick turnaround on subsystem components returned to the factory for repair or replacement.
- Warranties on workmanship and materials

4.1 POWER/SPIN-UP PROBLEMS

4.1.1 MAGNETIC DISK DRIVE MODULE POWER-UP

-- The indicator imbedded in the ON/OFF switch on the front panel does not illuminate.

1. Ensure the AC power cord is firmly seated in the power receptacle on the module.
2. Check the fuse. If replacement is necessary, use ONLY a 3 Amp Slo-Blo.
3. Ensure the AC wall receptacle is "live."
4. Call the ZETACO Hotline, or your maintenance organization.

-- The READY LED on the front panel flashes.

1. Turn the module off and repeat the power-up sequence.
2. Call the ZETACO Hotline, or your maintenance organization.

-- The fan does not turn, turns slowly, or makes excessive noise.

1. Call the ZETACO Hotline, or your maintenance organization.

WARNING: DO NOT OPERATE THE UNIT WITH A DEFECTIVE FAN.

4.1.2 OPTICAL DRIVE MODULE POWER-UP

-- The power indicators (in the CONTROL MODULE and DEVICE ADDRESS switches) on the Operator Panel do not illuminate.

Is air flowing out of the rear panel Filter Grill?

NO
1. Ensure the AC power cord is firmly seated in the power receptacle on the module.
2. Ensure the AC wall receptacle is "live."
3. Call the ZETACO Hotline, or your maintenance organization.

YES
1. Ensure the ambient room temperature is not over 40°C (104°F).
2. Call the ZETACO Hotline, or your maintenance organization.

-- The power indicators illuminate, but there is no air flow.

1. Check the Air Filter and clean if necessary. See Appendix C.
2. Call the ZETACO Hotline, or your maintenance organization.

-- The Hexadecimal Display on the Operator Panel is not blank.

1. Record the contents of the display and call the ZETACO Hotline, or your maintenance organization.

4.1.3 OPTICAL DRIVE MODULE SPIN-UP

-- The READY indicator (in the START/STOP switch) does not illuminate.

Does the Hexadecimal Display show "FA"?

YES
1. Call the ZETACO Hotline, or your maintenance organization.

NO
1. Press the START/STOP switch once to put it in the STOP position. Replace the data cartridge. If the problem disappears, mark the first data cartridge "bad". If the problem re-occurs, call the ZETACO Hotline, or your maintenance organization.

-- The Hexidecimal Display contains an error code.

1. Record the error code and call the ZETACO Hotline, or your maintenance organization.

4.1.4 CONTROLLER SELF-TEST ON POWER-UP

SELF-TEST checks out 90% of all the internal functions of the Controller once every time power is applied. SELF-TEST is actually composed of three independent modules, each of which is associated with an LED on the front of the board. The LEDs are grouped (three on the left, two on the right) according to which "side" of the board they are reporting on. See Figure 2.1.

SCSI Module	Red LED (Left)
HOST Module	Red LED (Right)
CABLE Module	Yellow LED (Left)

The entire set takes approximately 10 seconds to execute. Once SELF-TEST has passed, all LEDs will go out.

If a failure is detected in either the SCSI or HOST module, one or both red LEDs will flash a repeating numerical series; the number of flashes in the series corresponds to the specific subtest that failed. Tables F.1 and F.2 in Appendix F identify the subtests for the SCSI and HOST modules. If the CABLE Module fails, the yellow LED will remain steadily lit.

-- Both red LEDs remain steadily lit.

1. TURN OFF THE COMPUTER, remove the Controller, and re-install it. Be sure it is firmly seated in the backplane connectors.
2. TURN OFF THE COMPUTER, remove the Controller, and install it in a different slot. To do so, you will need to rearrange your priority jumpers. See Section 2.3.
3. Call the ZETACO Hotline, or your maintenance organization.

-- The yellow LED remains steadily lit.

Are both drive modules powered-up?

NO
1. Turn on the module(s). If they do not power-up properly, proceed to the appropriate trouble-shooting section above.

YES
1. Check for secure cable connections.
2. Call the ZETACO Hotline, or your maintenance organization.

-- Either or both red LEDs flash an error code.

1. TURN OFF THE COMPUTER, clean the gold fingers on the edge connector, and re-install the board.
2. Record the error code and call the ZETACO Hotline, or your maintenance organization.

4.2 ERRORS DURING SYSTEM OPERATION

When an error is displayed during system operation, write down the message that appears on the screen. Then follow the trouble-shooting guide below.

Is "FA" displayed in the Hexadecimal Display on the Operator Panel of the Optical Drive Module?

YES
1. Call the ZETACO Hotline, or your maintenance organization.

NO — Is the left red LED on the Controller flashing?

YES — Is it flashing error code 12?

YES — Are both drives powered on?

NO
1. Turn on the drive(s) and press Reset on the computer front panel to clear the error. If the drives do not power-up normally, see the appropriate trouble-shooting section for that drive.

YES
1. Check all cable connections.
2. Call the ZETACO Hotline, or your maintenance organization. See Table F.3 in Appendix F for a description of the error associated with error code 12.

NO
1. TURN OFF THE COMPUTER, remove the Controller, and re-install it. Be sure it is firmly seated in the backplane connectors.
2. TURN OFF THE COMPUTER, remove the Controller, and install it in a different slot. To do so, you will need to rearrange your priority jumpers. See Section 2.2.1.

3. Record the error code and call the ZETACO Hotline, or your maintenance organization. See Table F.3 in Appendix F for a list of error codes reported during operation, and descriptions of the errors associated with them.

NO Is the right red LED flashing?

YES
1. TURN OFF THE COMPUTER, remove the Controller, and re-install it. Be sure it is firmly seated in the backplane connectors.
2. TURN OFF THE COMPUTER, remove the Controller, and install it in a different slot. To do so, you will need to rearrange your priority jumpers. See Section 2.2.1.
3. Record the error code and call the ZETACO Hotline, or your maintenance organization. See Table F.3 in Appendix F for a list of error codes reported during operation, and descriptions of the errors associated with them.

NO
1. Verify that neither the Optical Drive Module nor the data cartridge are write-protected. See Appendix E.
2. Use ZETACO's utility programs to isolate the failing module. A basic test strategy is outlined in the following sections.

4.2.1 BASIC TROUBLE-SHOOTING USING THE UTILITY PROGRAMS

The programs you will be using are the Configurator, the Off-Line Utility, and the Reliability Utility. They are originally supplied with the LRS-10 on the Software Support Tape (see Section 2.1.3). The programs can be loaded from either the Software Support Tape or the system disk (if you previously saved them there, as described in Section 2.14). The loading procedure for each is given below.

Note that, in order to run properly, the Reliability program requires that CPU microcode (for MV-family computers) be already resident in the CPU. Also note that these are stand-alone programs. Therefore, if you are running at the system level, you must first shut down the operating system (according to standard AOS or AOS/VS practice) before loading them.

In the test sequence described in Section 4.2.1.3, the Configurator and Off-Line Utility are used minimally, to test very specific operations. The Reliability Utility, on the other hand, will be used more extensively. In the test sequence we will outline a test strategy using it; in Section 4.3 the program is discussed in more detail.

4.2.1.1 LOADING THE PROGRAMS FROM THE SYSTEM DISK

Do a "Program Load" to your system disk. This procedure differs for the various DG computers; if you are unsure of the procedure for your system, consult your DG system documentation.

When the system prompts for a system pathname, enter:

```
:LRS:<program name>
```

The program names are:

```
CFLRS.SV -- Configurator
LRSU.SV  -- Off-Line Utilities
LRSR.SV  -- Reliability Utility
```

4.2.1.2 LOADING THE PROGRAMS FROM THE SOFTWARE SUPPORT TAPE:

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

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

3. The Software Support Tape menu will be displayed. You should enter the number of the program you wish to execute.

4.2.1.3 TEST SEQUENCE

First, load the Configurator. Enter the device code of the Controller (the octal number of the switch settings established in Section 2.3.2).

Does the program respond with a request that you enter a command?

NO
1. Verify that the entered device code matches the switch settings.
2. TURN OFF THE COMPUTER, remove the Controller, and re-install it. Be sure it is firmly seated in the backplane connectors.
3. Call the ZETACO Hotline, or your maintenance organization.

YES — Do an "L" command. Does the program list your configuration facts?

NO
1. TURN OFF THE COMPUTER, remove the Controller, and re-install it. Be sure it is firmly seated in the backplane connectors.
2. Call the ZETACO Hotline, or your maintenance organization.

YES — Do the facts displayed accurately reflect your system configuration?

NO
1. Reconfigure the Controller. Be sure to do a "U" command before you leave the program in order to store the new facts.
2. Call the ZETACO Hotline, or your maintenance organization.

YES
1. Leave the Configurator and proceed to the Off-Line Utilities.

Load the Off-Line Utilities program. Choose the "R" function to re-initialize the Controller.

Does the program report a successful completion of the initialization function?

NO
1. Verify that the BMC cables are correctly and securely installed. If the BMC is terminated on the LRS-10 Controller, be sure the terminator block is correctly installed. Refer to Section 2.3.2.

2. Call the ZETACO Hotline, or your maintenance organization.

YES 1. Proceed to Reliability Utility.

Your first step in using the Reliability program to trouble-shoot a problem will be to run tests on the Magnetic Disk Drive. Use the following test parameters:

1. Execution Mode: Random
2. Controller Mode: Maintenance
3. Min/Max Logical Blocks: default both
4. Read/Write/Verify: All
5. Data Pattern: Random

After running the Reliability tests, call the ZETACO Hotline and report your findings.

To gather additional data you may wish to test the Optical Disk Drive. To get the most out of such testing with minimum use of valuable platter space, we recommend that you use a Maintenance Platter. See Section 4.3.3 for guidance on creating one, if you have not already done so.

If you already have a Maintenance Platter, begin by attempting to read the pre-written data patterns documented in your Platter Log. If you are successful there, try writing to your pre-defined Write Space. (Remember to update your Platter Log.)

4.3 THE RELIABILITY UTILITY

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

In order to run the program, the magnetic disk drive must have been previously formatted, and the Controller microcode must have been loaded onto the board. In Runtime mode this will happen automatically if you have installed the microcode on the magnetic disk drive. If you haven't installed the microcode on the disk, or if you will be running in Maintenance Mode, you will need to issue the "R" command in the Off-Line Subsystem Utility program to load microcode onto the board. See Appendix A.

The Reliability Utility is a stand-alone program, which means that it does not need, and cannot have, an operating system running when it is executed. It has been written by ZETACO specifically for the LRS-10. DG RELIABILITY, DIAGNOSTIC, AND MVSYSTEMX PROGRAMS WILL NOT WORK ON THIS SUBSYSTEM.

All of ZETACO's software has been designed to be as "user-friendly" as possible. Messages about many of the options and program features are displayed on-line, expected or possible responses are suggested, commands are shortened for quick entry. The discussion of the Reliability program that follows is intended as a companion to your on-screen display.

At several points you will find sample dialogues. 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 preceeded and followed by the characters "**".

4.3.1 GLOBAL PARAMETERS

These are the over-all operating conditions of the program under which the specific tests for each device must run. They are the display mode, timeout enable, mapping enable, program execution mode, and controller mode.

1. The DISPLAY MODE 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 any number, you need not enter leading zeroes; when entering decimal numbers, you need not enter the ".".

   Note that whenever the program asks for a numeric response, the required numbering system is displayed in parentheses.
   Wherever the program asks for an input, it displays a possible response in brackets []. This is the default response, and is selected simply by entering a carriage-return or new-line.

2. The MAPPING features are defined in the DG Programmer's Reference Series: Models 6236/6237 and 6239/6240 Disk Subsystems.

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

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

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

4. The two CONTROLLER MODES are Maintenance and Runtime.

   In Maintenance Mode:
   Unit 0 = read/write optical drive 0
   Unit 1 = read/write optical drive 1
   Unit 2 = read/write optical drive 2
   Unit 3 = magnetic disk
   (Optical drive 3 not accessible)

   In Runtime Mode:
   Unit 0 = cached read/write optical drive 0
   Unit 1 = read-only optical drive 1
   Unit 2 = read-only optical drive 2
   Unit 3 = read-only optical drive 3

4.3.2 THE COMMAND LIST

Basically, when you run the program, you:

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

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

1. ENTER A DEVICE

For each device the program will ask you to specify minimum and maximum logical block limits within which you want the program to operate. The default value reported for the maximum block will always be the highest useable logical block for that device. The default value for the minimum block is variable:

- In Runtime Mode it will be zero, or whatever you previously set it to.

- In Maintenance Mode, if your device is Unit 3 (the magnetic disk), it will always be the first block of the maintenance area of the magnetic disk. IF YOU HAVE DATA ON THE MAGNETIC DISK THAT YOU WANT TO PRESERVE, DO NOT CHANGE THE MINIMUM BLOCK TO SOMETHING LESS THAN THE DEFAULT. You can, of course; set it higher.

- In Maintenance Mode, if your device is any other unit (ie., an optical drive), it will be zero, or whatever you previously set it to.

The program will ask you if you want to read and/or write, and verify data. In Maintenance Mode, you can only write to your optical drive if you select Sequential testing. You can always read, but if you elect to verify, you must know what data pattern you'll be reading. If you want to test your optical drive in Maintenance Mode, see Section 4.3.3 on creating and using a Maintenance Platter.

In Maintenance Mode, the program reports each of the four allowable units (units 0-3) as ready and asks you to select, even though some of those units may not actually exist. In Runtime Mode, if a device does not exist, the program reflects this fact by simply reporting the unit not ready.

If you try to select a device that isn't there, the program accepts the entry. However, when you try to run that device, the program will report errors. You will notice that the left-hand red LED on the Controller is flashing Error Code 12 (see Appendix F, Table F.3) and/or the right-hand Green LED (Host Busy) is solid on. To get out of this error condition you will have to press the CPU reset switch. When the monitor prompt appears, you can restart the program at 500.

If, after running, you want to enter another device, you will have to re-enter the devices you currently have along with the new one.

2. START A DEVICE

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

3. LIST ERROR TOTALS

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

4. COMMAND LIST

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

5. HALT A DEVICE

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

6. DELETE A DEVICE

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

7. PRINTER CONTROL

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

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

8. RESTART THE PROGRAM

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

9. FLAGS

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

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

The flag can be changed while the program is running.

10. SOFTWARE DEBUGGER

This is a tool for software maintenance and trouble-shooting. It is intended for ZETACO service personnel only.

11. QUIT

This command allows you to leave the Reliability program.

4.3.3 THE MAINTENANCE PLATTER

Since optical platters are write-once media it is impractical to use them for random write testing. Furthermore, unless you know the data previously written to a platter, even read testing is limited. Nevertheless, it is desirable to be able to test the read and write functionality of your drives.

The solution is to dedicate a platter to read/write testing and manage it in such a way as to maintain strict control over its usage. We will call such a platter the Maintenance Platter.

The key to proper management of the Maintenance Platter is the Platter Log. This is actually a map of how the available space on the platter is used. We will allocate a certain portion to write testing and another portion to read testing. Each time we write data to the write area we will update the log to show the remaining space available for future writes. Precise segments of the read space will be further allocated to specific data patterns.

Table 4.1 shows a sample Platter Log. The maximum number of usable logical disk blocks on this optical platter is 1958271 (dec). We chose to allocate approximately 50% to write space, 1% to small blocks of a variety of data patterns, and another 49% to larger blocks of the same patterns.

TABLE 4.1 Sample Platter Log

	USED
WRITE SPACE: 0-979135	0 - 120203
SMALL READ PATTERNS: SIZE 2392 EACH	
0 LOGICAL BLOCKS	979136 - 981527
1 FLOATING ZERO	981528 - 983919
2 FLOATING ONE	983920 - 986311
3 ALTERNATE ZEROS (52525 OCT)	986312 - 988703
4 ALTERNATE ONES (125252 OCT)	988704 - 991095
5 ALL ZEROS	991096 - 993487
6 ALL ONES	993488 - 995879
7 ROTATING (125252 OCT)	995880 - 998271
LARGE READ PATTERNS: SIZE 120000 EACH	
0 LOGICAL BLOCKS	998272 - 1118271
1 FLOATING ZERO	1118272 - 1238271
2 FLOATING ONE	1238272 - 1358271
3 ALTERNATE ZEROS (52525 OCT)	1358272 - 1478271
4 ALTERNATE ONES (125252 OCT)	1478272 - 1598271
5 ALL ZEROS	1598272 - 1718271
6 ALL ONES	1718272 - 1838271
7 ROTATING (125252 OCT)	1838272 - 1958271

To create a Maintenance Platter, you MUST be in the Sequential execution mode, and the Controller must be in Maintenance Mode. The sample dialogue below will guide you in beginning to set up your platter.

```
THE DISPLAY MODES ARE:
     0 - OCTAL
     1 - DECIMAL
     2 - HEXADECIMAL

ENTER THE NUMBER OF YOUR CHOICE [0] (OCT):

     1

**  We chose decimal because the Platter Log in Table 4.1 is
in decimal.  **

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

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

     <cr>

EXECUTION MODE:
     [R]ANDOM RELIABILITY  [S]EQUENTIAL RELIABILITY
ENTER YOUR CHOICE [R]:

     S

     THIS CONTROLLER CAN BE RUN IN ONE OF TWO MODES.  THE
FIRST IS RUNTIME MODE.  IN THIS MODE THE CACHEING SCHEME IS
USED AND THE MAGNETIC DRIVE CANNOT BE ACCESSED DIRECTLY.
ALSO, THE MICROCODE WILL BE READ FROM THE DISK SO IT MUST
HAVE BEEN INSTALLED ON THE DISK PREVIOUSLY.
     THE SECOND MODE IS THE MAINTENANCE MODE.  IN THIS MODE
THE CACHEING SCHEME IS NOT USED AND THE MAGNETIC CAN BE
ACCESSED DIRECTLY.  ALSO, THE MICROCODE MUST HAVE ALREADY
BEEN DOWNLOADED ONTO THE CONTROLLER BY RUNNING THE "R"
SELECTION IN THE UTILITY PROGRAM.

SHOULD THE CONTROLLER BE RUN IN THE RUNTIME MODE (YES,[NO]):

     <cr>

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               COMMAND LIST

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

```
ENTER A COMMAND SELECTION:

     E

ENTER THE DEVICE CODE [64] (OCT):

     <cr>

START INITIALIZATION OF CONTROLLER.

END INITIALIZATION OF CONTROLLER.
UNIT   0000    IS READY; SELECT (YES,[NO]):

     yes

THE SELECTED DISK IS AN OPTICAL DISK.  YOU MAY WRITE (SEQ.
REL) AND READ TO THIS DISK, BUT YOU SHOULD NOT ATTEMPT TO
WRITE TO THE SAME AREA ON THE DISK MORE THAN ONCE.

THE MINIMUM LOGICAL DISK BLOCK IS [0000] (OCT):

     979136

**  Refer to Table 4.1.  We are going to leave blocks
0-979135 blank for future writing, so at this point we
designate the start of our first small read pattern.  **

THE MAXIMUM LOGICAL DISK BLOCK IS [617577] (OCT):

     981528

ON THE OPTICAL DISK IN MAINTENANCE MODE THE UPPER BLOCK
ADDRESS MUST BE AN ODD NUMBER

THE MAXIMUM LOGICAL DISK BLOCK IS [617577] (OCT):

     981527

**  Since we previously decided each of these pattern spaces
would be 2392 blocks, we first added 2392 to 979136 to get
our maximum block.  However, because of the way disk blocks
are organized on the platter, the upper block MUST be an odd
number.  Therefore, we must add the number of blocks we want
MINUS 1 (2392 - 1 = 2391).  Now, 979136 + 2391 = 981527.  The
resulting number matches what is in our Platter Log.  Note
also that the lower block MUST be even.  **

WRITE ONLY (YES, [NO]):

     <cr>
```

** Since we are primarily concerned at this point with getting our data patterns out on the disk, we could have answered yes at this point. If we had, the next question would have been the verify question. **

```
READ ONLY (YES, [NO]):

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

     yes
```

** We do this to be sure that we are writing good data onto the platter. **

```
DATA TYPES
0-LOGICAL BLOCK ADDRESS     1-FLOATING ZERO
2-FLOATING ONE              3-ALTERNATE ZEROES (52525)
4-ALTERNATE ONES (125252)   5-ALL ZEROS
6-ALL ONES                  7-RANDOM (ONLY IN RANDOM REL1)
8-ROTATING (125252)         9-RUN ALL PATTERNS
SELECT DATA TYPE [0.] (DEC):

     <cr>
```

** This is the first data pattern, according to our log. **

```
UNIT 0 IS SELECTED

UNIT   0001    IS READY; SELECT (YES,[NO]):

     <cr>

UNIT   0002    IS READY; SELECT (YES,[NO]):

     <cr>

UNIT   0003    IS READY; SELECT (YES,[NO]):

     <cr>

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                COMMAND LIST

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

```
ENTER A COMMAND SELECTION:

     S

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

     <cr>

**  After the operation is completed, a status list will be
displayed.  **

STATUS LIST: RUN TIME  0. HRS    0. MINS.
DEVICE CODE 24 UNIT NUMBER00 MAPPING NOT ENABLED STATE:HALTED
MODES: MAINTENANCE, SEQUENTIAL, READ/WRITE, DATA
CHECK-LOGICAL BLOCKS
BLOCKS WT  2392  BLOCKS RD  2392    TOTAL ERRORS          0
SEQUENTIAL RELIABILITY FINISHED ON THIS UNIT.
ENTER A COMMAND SELECTION:

**  At this point we would select the "E" command again and
write our next block of data onto the platter.  Note that if
for some reason you cannot write to a particular area of the
disk (ie., you get disk errors), write the boundaries of the
bad area down in your log, go on to write your patterns to a
different area, and record its boundaries.  **

After you have finished writing all your patterns, you may
wish to try writing to the write space.  Consider the
following example.

ENTER A COMMAND SELECTION:

     E

ENTER THE DEVICE CODE [64] (OCT):

     <cr>

START INITIALIZATION OF CONTROLLER.

END INITIALIZATION OF CONTROLLER.
UNIT   0000   IS READY; SELECT (YES,[NO]):

     yes

THE SELECTED DISK IS AN OPTICAL DISK.  YOU MAY WRITE (SEQ.
RELI) AND READ TO THIS DISK, BUT YOU SHOULD NOT ATTEMPT TO
WRITE TO THE SAME AREA ON THE DISK MORE THAN ONCE.

THE MINIMUM LOGICAL DISK BLOCK IS [0000] (OCT):

     120204
```

** Since we have already used blocks 0 - 120203, we specified the NEXT unused block. If we had inadvertantly entered 120203, we would have gotten an error when we tried to run the program. ON AN OPTICAL PLATTER YOU CANNOT WRITE TO A BLOCK THAT HAS ALREADY BEEN WRITTEN TO. **

THE MAXIMUM LOGICAL DISK BLOCK IS [617577] (OCT):

120303

** We decided to write 100 blocks. 100 - 1 = 99, which we added to our minimum block of 120204. **

WRITE ONLY (YES, [NO]):

<cr>

READ ONLY (YES, [NO]):

<cr>

VERIFY DATA (YES,[NO]):

yes

DATA TYPES

0-LOGICAL BLOCK ADDRESS	1-FLOATING ZERO
2-FLOATING ONE	3-ALTERNATE ZEROES (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.] (DEC):

<cr>

** You can choose any pattern except 7 or 9. In Sequential Mode you cannot run random patterns. Do not run ALL patterns because this option will automatically go back and try to write the next pattern over the previous one. On an optical drive this will cause an error.

UNIT 0 IS SELECTED

UNIT 0001 IS READY; SELECT (YES,[NO]):

<cr>

UNIT 0002 IS READY; SELECT (YES,[NO]):

<cr>

```
UNIT   0003   IS READY; SELECT (YES,[NO]):

     <cr>

           LRS-10 RELIABILITY UTILITY
                  REV. X.XX

                COMMAND LIST

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

ENTER A COMMAND SELECTION:

     S

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

     <cr>

STATUS LIST: RUN TIME  0. HRS    0. MINS.
DEVICE CODE 24 UNIT NUMBER00 MAPPING NOT ENABLED STATE:HALTED
MODES: MAINTENANCE, SEQUENTIAL, READ/WRITE, DATA
CHECK-LOGICAL BLOCKS
BLOCKS WT   100  BLOCKS RD   100    TOTAL ERRORS         0
SEQUENTIAL RELIABILITY FINISHED ON THIS UNIT.
ENTER A COMMAND SELECTION:
```

Once you've completed your writing, be sure to update the write space portion of your log.

	USED
WRITE SPACE: 0-979135	0 - 120303

4.3.4 EXAMPLES OF ERRORS REPORTED BY THE PROGRAM

The program will display PIO errors, CB errors, and Data Compare errors.

1. A sample PIO error:

```
**** ERROR **** AT RUN TIME  0. : 1.
DEVICE CODE 24 UNIT NUMBER03 MAPPING NOT ENABLED STATE:ACTIVE
MODES :MAINTENANCE, RANDOM, READ ONLY, DATA CHECK-ROT
            REG A     REG B     REG C
OPERATION     0          0         5
STATUS        0          0     14005
STATUS ERROR ON PIO COMMAND!
```

The display mode is octal

2. A sample CB error:

```
**** ERROR **** : RUN TIME 0. HRS.    0. MINS.
DEVICE CODE 24 UNIT NUMBER03 MAPPING NOT ENABLED STATE:ACTIVE
MODES :MAINTENANCE, RANDOM, READ/WRITE, DATA CHECK-ROT
LOGICAL BLOCK        038A6993     SECTOR COUNT        0004
MEMORY ADDRESS       00005E17     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      :           0400
     DRIVE ERROR
CB UNIT STATUS:           2000
     READY
```

The display mode is hexadecimal.

3. A sample Data Compare error:

```
***** DATA COMPARE ERROR *****
DEVICE CODE 24 UNIT NUMBER03 MAPPING NOT ENABLED STATE:ACTIVE
MODES :MAINTENANCE, RANDOM, READ/WRITE, DATA CHECK-ROT
DISK BLOCK           038A6993     SECTOR COUNT          0004
PAGE TABLE ADDRESS   00000000     LOGICAL XFER ADDRESS 00000
PHYSICAL XFERS ADDRESS  00006417
EXPECTED   RECEIVED   OFFSET
  AAAA       8000       0000
  5555       4000       0001
  AAAA       2000       0002
TOTAL ERROR COUNT:    0600
```

The display mode is hexadecimal.

For a complete description of the error statuses refer to the DG Programmer's Reference Series: Models 6236/6237 and 6239/6240 Disk Subsystems.

4.4 TESTING A MAGNETIC DISK WITH DATA ON IT

Occasionally you may wish to run off-line tests on your magnetic disk, even though you have current data stored on it. In this section we will briefly describe two ways you can do this, using the Reliability program.

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

Boot the program and respond to its questions as outlined in Section 2.13, with two exceptions: 1) When it asks, "READ ONLY (YES/[NO]):", answer YES. 2) When it asks, "VERIFY DATA ([YES]/NO):", answer NO. Now start the Reliability program with the "S" command.

The second method allows writing as well as reading, but only tests a portion of the disk. This portion is called the "maintenance area". It is an unused area on the disk that can essentially be used as a "scratch pad" for testing. The starting block of this area is always the default minimum logical block when you are in Maintenance Mode. The ending block is the last useable block on the magnetic disk, given as the default maximum logic block.

To use the maintenance area you MUST be in Maintenance Mode. Enter ("E" command) unit 3. Select the defaults for the minimum and maximum logical blocks by entering "<cr>". Of course, you can enter a disk block GREATER THAN the minimum block default, but DO NOT ENTER ONE LESS THAN THE DEFAULT OR YOU WILL WRITE OVER SYSTEM DATA. You can now run the program as you normally would.

4.5 CUSTOMER SUPPORT HOTLINE

ZETACO, Inc. provides a Customer 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.

4.6 WARRANTY INFORMATION

The Magnetic Disk and Optical Drive Modules are warranted free from manufacturing and material defects, when used in a normal and proper manner, for a period of six months from date of shipment.

The LRS-10 Controller is warranted free from manufacturing and material defects, when used in a normal and proper manner, for a period of two years from date of shipment.

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

If a part is no longer under warranty, or if the problem is not warranted (as set forth above), then repair will be on a time-and-material basis.

4.7 PRODUCT RETURN AUTHORIZATION

All possible effort to test a suspected malfunctioning component of the LRS-10 should be made before returning the It to ZETACO for repair. However, if Controller or module malfunction has been confirmed using the tests outlined in Sections 4.1 through 4.4, you should return the part to ZETACO, Eden Prairie, MN., freight prepaid.

A Return Material Authorization (RMA) number is required before shipment and should be referenced in all future correspondence about the part in question. RMA numbers are obtained by calling the Customer Support Hotline (see Section 4.5). To ensure prompt response, the information outlined in the Material Return Information form on the following page should be gathered before calling the ZETACO Hotline for the RMA number. Please include a completed copy of the Material Return Information form with the product. Each product to be returned requires a separate RMA number and Material Return Information Form.

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

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

MATERIAL RETURN INFORMATION

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

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? (ERDOS, AOS, AOS/VS) Include revision number.

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

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

To be filled out by CUSTOMER:

Model # :_____

Serial #:_____

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

Returned by:

Your name:_____

Firm: _____

Address: _____

_____

Phone: _____

APPENDIX A

A.0 UTILITY PROGRAMS

In this appendix you will find descriptions of the two Subsystem Utility programs and the Configurator. The Reliability Utility is treated in detail in Section 3.3

The two Subsystem Utility programs will allow you to manage all of the tasks associated with maintaining and using the LRS-10. They operate differently, and do different things for you. For a more detailed discussion of these tasks, see Section 3, USAGE GUIDELINES.

The Off-Line Subsystem Utility performs functions primarily concerned with installation and maintenance of the subsystem. The Off-Line Subsystem Utility is a stand-alone program, which means that you cannot run it under the control of the operating system. Instead, you must shut down the operating system and load the program, either from the Software Support Tape or your system disk.

The On-Line Utility, on the other hand, helps you use the LRS-10 at the system level. It is run under the operating system the way you would any other program. In order to run it you MUST have previously loaded it onto your system disk from the Software Support Tape (See Section 2.14).

The Configurator program allows you to tailor some of the operating parameters of the Controller to suit your system without having to resort to cumbersome on-board switches or jumpers. The parameters are stored on the Controller in an EEPROM (Electrically Erasable Programmable Read-Only Memory). They are preserved even when power is removed from the board.

For each of the programs, on-screen help is available, and important facts about the options are provided. This brief description of the programs is intended as a companion to your on-screen display.

A.1 THE OFF-LINE SUBSYSTEM UTILITY

A.1.1 LOADING AND RUNNING THE PROGRAM

In Section 2.14 you loaded LRS-10 software onto your system disk. Therefore, you will probably want to load the program from your system disk, rather than from the Software Support Tape. To do so, you must first shut down the operating system according to standard AOS or AOS/VS practice.

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

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

A.1.2 THE PROGRAM OPTIONS

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

1. DO ALL: FORMAT, INSTALL FIRMWARE

   This option automates the basic initialization of the Controller and magnetic disk. The individual options are covered below.

2. FORMAT MAGNETIC DISK

   Of course, you must format the disk before you can either install the firmware on it or run DKINIT. It takes about 15 minutes to complete the formatting operation.

   If you have not previously run the INITIALIZE CONTROLLER option, it will be run for you before the formatting operation begins. If you later run the format option again, the initialize routine will NOT run again, unless the Controller has been powered down.

3. INSTALL ARZ FIRMWARE ON MAGNETIC DISK

4. INSTALL SCSI FIRMWARE ON MAGNETIC DISK

In normal operating mode (Runtime Mode -- see Section 4, THEORY OF OPERATION), the Controller automatically loads its microcode from the magnetic disk. Therefore, in Runtime Mode, THE FIRMWARE MUST BE ON THE MAGNETIC DISK OR THE SYSTEM WILL NOT WORK. If you choose to do a format alone, you must run both of the INSTALL options before you return to normal system operation.

5. INQUIRY THE DRIVE

The INQUIRY command belongs to the Common Command Set of of the SCSI Interface. When issued, it returns information about the vendor and product for the specified unit. If a vendor has chosen not to provide any information, a program message will report that no data is available.

For more information on the SCSI Inquiry command, see the SCSI Specification ANSI X3T9.2/82-2

6. (RE)INITIALIZE CONTROLLER

This option transfers the ARZ microcode from the tape onto the Controller. If you do not run it before any of the other options, then the first time you run another option it will run automatically.

You may wish to run this option if for some reason you cannot load the Controller microcode from the magnetic disk, as is normally the case.

7. PLATTER COMPLETION (PURGE OF THE MAGNETIC)

Select this option when you have determined that your active optical platter is nearly full. After you run this option, the platter will be read-only.

8. SET MAGNETIC KEY ACTIVE

This option is used under special circumstances in conjunction with the PLATTER COMPLETION command. It is intended for ZETACO service personnel only.

WARNING: INDISCRIMINATE USE OF THIS COMMAND WILL RESULT IN PERMANENTLY LOST DATA.

---

9. SET MAGNETIC KEY EMPTY

This option is used under special circumstances in conjunction with the PLATTER COMPLETION command. It is intended for ZETACO service personnel only.

WARNING: INDISCRIMINATE USE OF THIS COMMAND WILL RESULT IN PERMANENTLY LOST DATA.

---

10. HELP

This option provides on-screen help with the operation of the program

11. LOGGING TO PRINTER

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

12. QUIT

This command provides for an orderly termination of the program.

A.2 THE ON-LINE SUBSYSTEM UTILITY

A.2.1 RUNNING THE PROGRAM

To run the program, "Dir" to your system root and type :LRS:LRS.

In everyday operation, you will generally be using the MOUNT and DISMOUNT options much as you would the CLI INIT and RELEASE commands. Also, you will use the ARCHIVE option to actually transfer data to the LRS-10. The CREATE SUBDIRECTORY and PLATTER COMPLETION options will be used less frequently, for specialized functions.

A.2.2 THE PROGRAM OPTIONS

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

1. MOUNT A PLATTER

The MOUNT option performs a function similar to the CLI INIT command. You must therefore run it before you try to access the LRS-10 at the system level. The program will ask you to enter your drive and platter names. The drive name, of course, is the DPJ device you "gen'd" into your system during installation. The platter name is equivalent to the LOGICAL DISK NAME that you assigned during DFMTR. The program will also report how much space is left on the active platter named.

2. DISMOUNT A PLATTER

The DISMOUNT option performs a function similar to the CLI RELEASE command. You should run it whenever you finish the series of operations for which you MOUNTed a platter.

3. CREATE A SUBDIRECTORY ON AN OPTICAL PLATTER

This option allows you to organize your platters so that you will be able to retrieve your data more efficiently.

4. HELP

This option provides on-screen help with the operation of the program

5. ARCHIVE FILE(S) TO OPTICAL PLATTER

To archive files you must know 1) the working directory on your system disk which holds the source files, 2) the names of the files you want to move, and 3) the destination directory on your optical platter. If you want your destination to be a subdirectory and you have not already created it, choose option 3 above before you begin the archiving process. You can, of course, choose to not have any subdirectory structure.

The input format for pathnames and file names is the standard CLI format.

6. PLATTER COMPLETION

Select this option when you have determined that your active optical platter is nearly full. After you run this option, the platter will be READ-ONLY.

7. RUN STAND-AMONG DFMTR

This option allows you to load the on-line DG DFMTR program without leaving the On-Line Utility. This is convenient if you have just run a PLATTER COMPLETION and are getting ready to start a new active platter.

After you select the option, the program will remind you to not do a surface analysis in DFMTR (see Section 2.13). Then you will automatically leave the On-Line Utility and enter the DFMTR. Once DFMTR is finished, you will automatically return to the On-Line Utility.

8. EXIT

This command provides for an orderly termination of the program.

A.3 THE CONFIGURATOR

A.3.1 RUNNING THE PROGRAM

In Section 2.14 you loaded LRS-10 software onto your system disk. Therefore, you will probably want to load the program from your system disk, rather than from the Software Support Tape. To do so, you must first shut down the operating system according to standard AOS or AOS/VS practice.

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

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

A.3.2 THE PROGRAM OPTIONS

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

1. CHANGE ALL FACTS

This option automatically presents all of the configurable features available in the main menu for modification. These are the Platter ID (#4 below), BMC Priority (#2), Throttle Burst Rate (#6), Break Count (#7), Base Platter Number (#8), number of optical drives connected to the Controller (#5), and the Operating System (#3). After all values have been entered, a List (#11) is run so that you can verify the configuration.

Note that running this option will automatically set all of the tuning features (see #14 below) to their default states.

2. BMC PRIORITY

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

3. OPERATING SYSTEM

This choice allows you to specify whether the operating system under which the LRS-10 will be running will be AOS or AOS/VS, or RDOS.

4. PLATTER ID

The Platter ID is a user-selected alphanumeric name, with a maximum length of 32 characters. It is intended as an aid in helping you to organize your data. For example, the records for School District 5 might be on a platter designated "DISTRICT 5", or on several platters with the same ID. If you do not wish to assign a specific Platter ID, simply press "New Line" to select the default "empty" value.

5. NUMBER OF OPTICAL DRIVES

The number of optical drives can be any number between one and four. We recommend that you enter the maximum number. This will allow you to add more drives later without having to change this configuration parameter each time you do so.

6. THROTTLE BURST RATE

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

7. BREAK COUNT

The Break Count interval is defined as the period of time that the LRS-10 Controller is off the BMC bus. This period is a multiple of the BMC Sync Clock period, which in turn varies from computer to computer. A Break Count interval setting of 0 is equal to one Sync Clock period.. The maximum setting is 256. A setting of 4 is recommended.

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

8. MODIFY BASE PLATTER NUMBER

Each active platter is automatically assigned a unique number by the Controller. When the magnetic disk is formatted, it is initialized to the configured Base Platter Number, and active platter numbers increment from this value. If you need to reformat the magnetic disk, but wish to continue numbering platters sequentially, you should first run the Configurator and set the Base Platter Number to the number of the last completed platter. Then reformat the magnetic disk.

9. HELP - OPERATIONS

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

10. HELP - WHAT TO DO

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

11. LIST ALL CONFIGURATION FACTS

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

12. START LOGGING TO PRINTER

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

13. STOP LOGGING TO PRINTER

This option stops sending information to the printer.

14. TUNING FEATURES/PLATTER SEGMENTING

This option provides access to a "sub-menu" containing an additional set of configurable features. These features are explained below.

-- LIST "TUNING" FACTORS

This command displays the current states of the Segment, Read Ahead, and Write Direct features. It also reports the current segment (if the platter has been segmented).

To return to the main menu, simply respond to the command prompt with a carriage return.

-- S - SEGMENT THE PLATTER (10 SEGMENTS)

This command permanently divides a platter into 10 "virtual platters." It is intended for testing and evaluation purposes only. The default state for this feature is "No."

WARNING: INDISCRIMINATE USE OF THIS COMMAND WILL RESULT IN UNUSABLE PLATTERS. NOTE THAT THE COMMAND WORKS IN A "TOGGLE" FASHION; TO SELECT IT FROM THE MENU IS TO EXECUTE IT.

Once you have changed the state of this feature to "YES", the only way to change it back to "NO" is to select "N" in this menu or return to the main menu and select the "CHANGE ALL FACTS" option.

-- M - MOVE TO A NEW SEGMENT ON PLATTER

This command enables you to shift your "working" segment to any of the 10 segments. The default value is the current segment plus one.

-- N - RESET PLATTER FOR NO SEGMENTING

This command will disable and turn off the platter segmenting set-up.

-- R - SET READ AHEAD ENABLE/DISABLE

When Read Ahead is enabled, the Controller actually reads more sectors than requested by the host in the current read command, and temporarily saves them. This is done on the assumption that the NEXT read command will request the next contiguous block of sectors. If the assumption proves to be true, the block of sectors is immediately available in disk memory, eliminating an additional disk rotational latency. If the assumption proves to be false, the saved sectors are abandoned.

The default state for this feature is enabled.

-- W - WRITE DIRECT ENABLE/DISABLE

When Write Direct is enabled, the caching scheme is temporarily bypassed, and data can be written directly onto the optical platter; the bit map and directory will go into the cache.

The default state for this feature is enabled.

15. UPDATE EEPROM

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

16. QUIT THE PROGRAM

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

APPENDIX B

B.0 ADDING ADDITIONAL OPTICAL DRIVES

Since the LRS-10 Controller is capable of controlling up to 4 optical drives, you may at some point wish to add additional drives to your subsystem. This Appendix will provide you with the details to do so.

B.1 SET UP THE SCSI ADDRESS OF THE NEW UNIT

The SCSI Address of an Optical Drive Module is determined by a switch cap labelled "Control Module Address x", where 'x' is a number from 0 to 3. This switch cap is located on the front panel of the drive (see Figure 2.9). With the new unit you will have received a set of four caps (0-3). Control Module Address 0 will have been installed at the factory.

To change caps, simply pull out the presently installed one and gently push the new one into place. The caps have been designed so that they only fit one way. The following table shows which cap to use.

TABLE B.1 SCSI Unit Addressing

LOGICAL UNIT	CONTROL MODULE ADDRESS
First	0
Second	1
Third	2
Fourth	3

NOTE: The SCSI Address of the Magnetic Disk Drive has been set to 4 at the factory.

B.2 CONNECT THE CABLES

1. Disconnect the two-foot External SCSI Cable (300-152-04) from both the Magnetic Disk Drive Module and J17 of the primary (or previous) Optical Drive Module.

2. Locate the new drive between the primary (or previous) Optical Drive Module and the Magnetic Disk Drive Module. Since the Magnetic Disk Drive Module has the SCSI bus terminators installed, it must be at "the end of the line" in the daisy-chain cabling scheme described here.

3. Connect the SCSI Daisy-Chain Cable (P/N 300-151-00) shipped with the new unit from J17 on the rear panel of the previous unit to J18 on the rear panel of the new unit. This FCC-compliant cable has a 50-pin connector block on both ends.

4. Re-connect the two-foot External SCSI Cable between J17 of your new Optical Drive Module and the Magnetic Disk Drive Module.

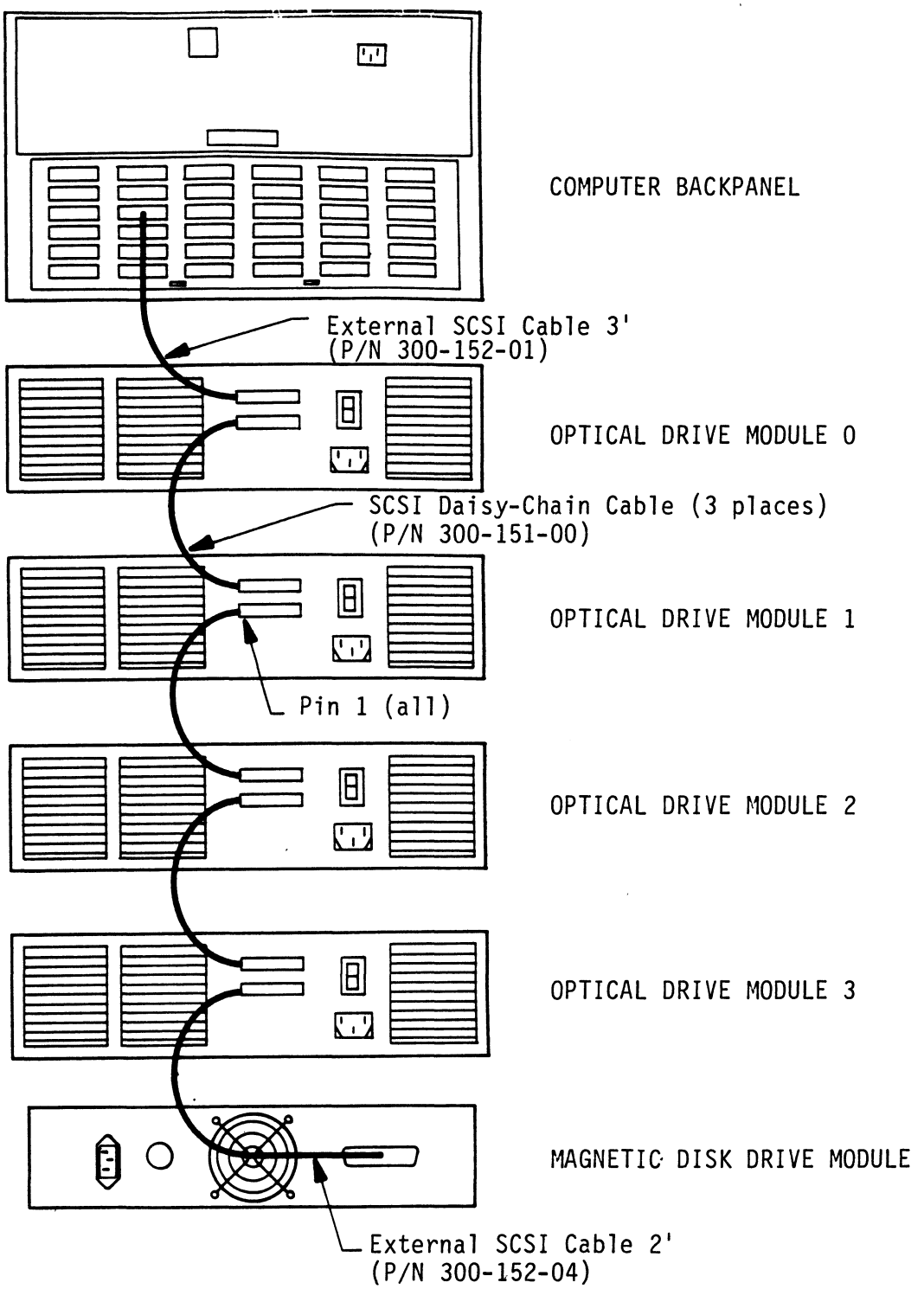
5. If you are only adding a second drive, you can leave the 9-foot cable from the computer bulkhead to the primary Optical Drive Module (P/N 300-152-03) in place. However, if you are adding a third drive, this cable MUST BE REPLACED by the 3-foot External SCSI Cable (P/N 300-152-01) shipped with the new unit. This is done to ensure that a three- or four-drive subsystem will adhere to the maximum cumulative cable length of 6 meters (19.68 feet) specified for the SCSI interface.

Figure B.1 illustrates the daisy-chain arrangement of a fully populated LRS-10.

B.3 CHECK CURRENT CONTROLLER CONFIGURATION

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

FIGURE B.1 Fully Populated LRS-10 (Rear View)



APPENDIX C

C.0 PREVENTIVE MAINTENANCE

C.1 CLEAN THE MAGNETIC DISK DRIVE MODULE AIR FILTER

This should be done AT LEAST every six months, but, depending on site conditions, may be required more frequently.

1. Unplug the AC power cord.

2. Loosen the screws on both sides of the Magnetic Disk Drive Module that hold the front panel in place. Gently slide the front panel forward.

3. The air filter is located inside the front panel. See Figure C.1a. Remove it by sliding it out from the top of the panel.

4. Vacuum the filter to remove accumulated dust and debris

5. Replace the filter in the front panel and re-attach the panel to the unit.

WARNING: DO NOT OPERATE THE MAGNETIC DISK DRIVE MODULE WITHOUT THIS FILTER.

C.2 INSPECT THE MAGNETIC DISK DRIVE MODULE FAN

This should be done at least every month. The fan is located in the center of the rear panel of the unit. If the fan is not turning, is turning very slowly, or is making noise, you will need to replace the entire module. See Sections 4.5, 4.6, and 4.7.

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

C.3 CLEAN THE OPTICAL DRIVE MODULE AIR FILTER

This should be done AT LEAST every six months, but, depending on site conditions, may be required more frequently.

1. At the right side of the Filter Grill, find the Filter Grill Latch. Push it to the right and hold it to release the grill for access to the air filter. See Figure C.1b.

2. Grasp the right side of the grill and pull it away from the latch.

3. Pull the left side of the grill free of the Filter Grill Retainer and remove the grill from the unit.

4. Remove the filter from the grill.

5. Clean the filter in lukewarm water, using a mild detergent.

6. Rinse the filter well and let it dry thoroughly.

7. Replace the filter in the grill.

8. Replace the Filter Grill in the optical drive.

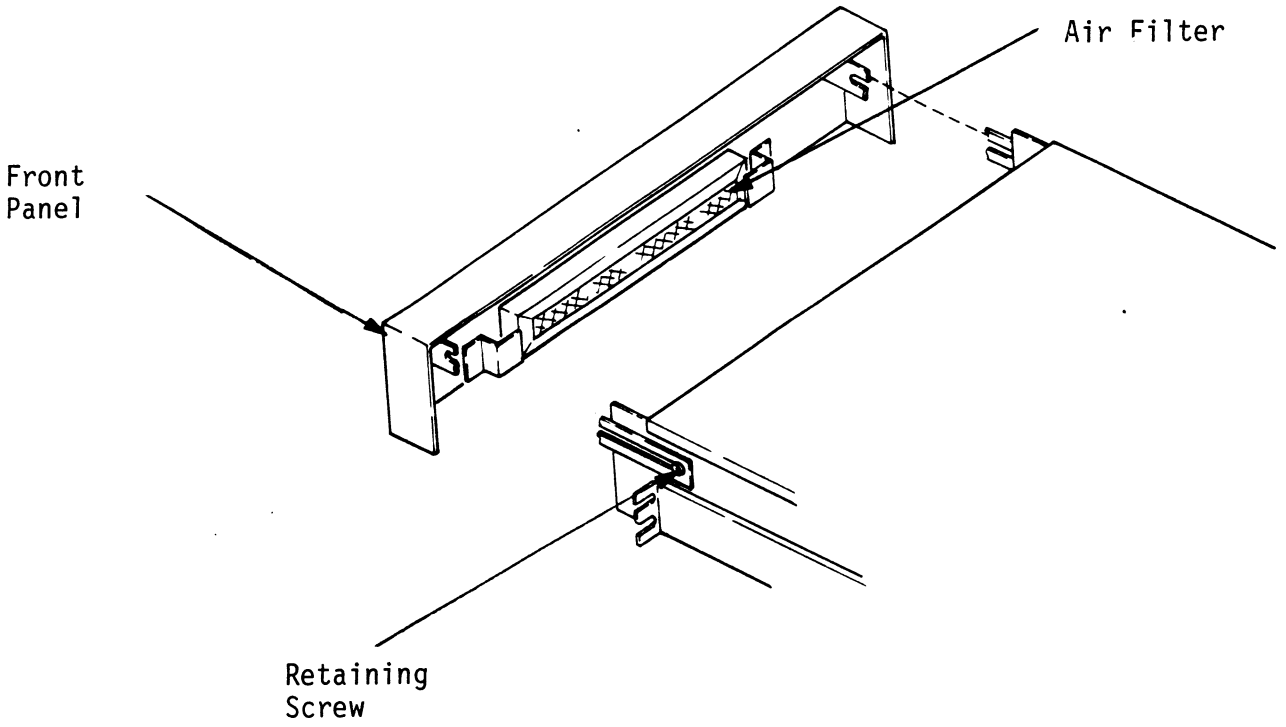
WARNING: DO NOT OPERATE THE LRS-10 WITHOUT THIS FILTER IN PLACE.

C.4 ADDITIONAL OPTICAL DRIVE MAINTENANCE CHECKS

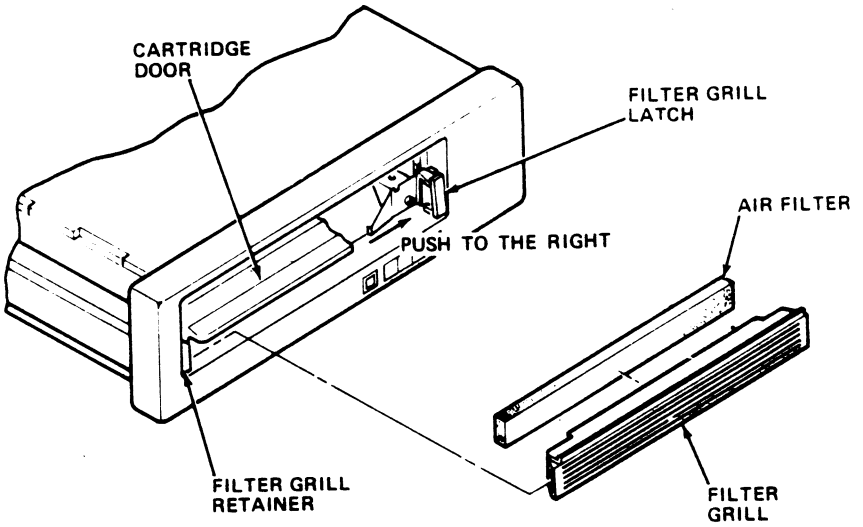
1. At least once a month, verify that the Cartridge Door Interlock is functioning properly. With power to the unit off, you should be unable to open the door. With power on (but the drive not spun up), the door should open easily.

2. Periodically inspect the entire unit visually to verify that no panels or doors are loose or distorted, as this may allow access to invisible laser radiation.

FIGURE C.1 Location of Magnetic Disk Drive Module and Optical Drive Module Air Filters



(a)



(b)

APPENDIX D

D.0 .IDEF PROGRAMMING PROCEDURE

The .IDEF system call allows the system to recognize interrupts from a device that was not originally SYSGEN'd. The procedure below must be strictly adhered to in order to successfully use it. The procedure is written based on the assumption that the reader is thoroughly familiar with DG I/O programming practice.

Note that none of the I/O instructions issued by the programmer actually invoke the secondary device. Instead, they are issued to the device code of the Optical Disk Controller. In the instructions below, "DSKP" stands for the Controller device code.

1. In the CLI, do INIT DPJx, then RELEASE DPJx. "x" is the number of your DPJ device.

2. In your working accumulator, place the following:

BIT:	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
VALUE:	Alt Dev Cd					1	0	1	0	0	0	1	1	1	1	

OCTAL: xx1217

3. Issue: DOCS ACC, DSKP

4. Issue: DIC ACC, DSKP

5. Loop on the instruction in Step 4 until the value 65656 (oct) appears in the accumulator. When it does, the BUSY flip-flop will set.

6. Issue the command you want to send, in the following sequence:

```
DOA ACC, DSKP
DOB ACC, DSKP
DOC ACC, DSKP
```

The DOC must come last, and must NOT contain a START. The command will begin executing immediately after the DOC is sent.

7. When execution is complete, the DONE flip-flop will set, BUSY will clear, and the CPU will receive an interrupt from the alternate device.

8. In your interrupt handler, when you issue a CLEAR to clear the interrupt it must be to DSKP.

You can issue as many commands as you wish to the alternate device, but FOR EACH COMMAND, YOU MUST DO THE ENTIRE SEQUENCE AGAIN, STARTING WITH STEP 2.

APPENDIX E

E.0 WRITE PROTECTION

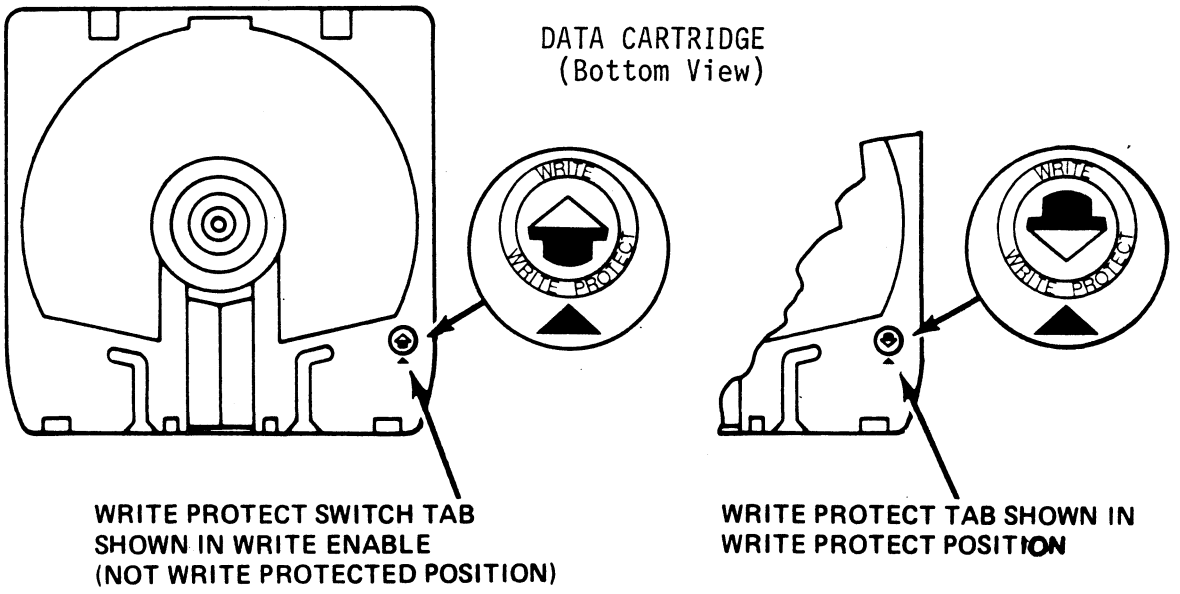
Since an optical platter is a Write-Once/Read-Many data storage medium, it is desirable to be able to prevent inadvertent writing to it. There are two ways to do this manually:

1. On the Data Cartridge there is a Write Protect Tab. When rotated to the proper position, write protection is enabled. See Figure E.1.

2. On the Optical Drive Module Operator Panel (see Figure 2.9) there is an alternate action WRITE PROTECT switch with an indicator imbedded in it. When pressed to the IN position, write protection is enabled.

You can use either method, or both at the same time. Note that the WRITE PROTECT indicator will be lit if either method is used.

FIGURE E.1 Data Cartridge Write Protect Tab



APPENDIX F

F.0 LED ERROR CODES

A complete discussion of the LEDs and their role in basic subsystem trouble-shooting is presented in Sections 4.1.4 and 4.2 of this manual. The tables below identify the specific test or error associated with each error code.

TABLE F.1 HOST Module Error Codes

CODE	TEST
1	RAM TEST
2	HI-SPEED BUFFER 1
3	HI-SPEED BUFFER 2
4	DONE
5	BURST COUNTER
6	BREAK COUNTER
7	BMC CB TEST
8	SECTOR TRANSFER SIMULATION
9	EEPROM CHECKSUM
10	DUAL PORT RAM
11	RESERVED
12	RESERVED
13	RESERVED
14	ERROR CONDITION

TABLE F.2 SCSI Module Error Codes

CODE	TEST
1	RESERVED
2	DYNAMIC RAM TEST
3	BMC DATA BUFFER
4	DUAL PORT RAM
5	5380 SCSI IC
6	DYNAMIC RAM PARITY
7	NOT USED
8	NOT USED

TABLE F.3 Operational Error Codes

CODE	ERROR
9	BMC DATA BUFFER PARITY ERROR
10	DYNAMIC RAM PARITY
11	ILLEGAL INTERRUPT FROM HOST SIDE
12	UNABLE TO ISSUE MODE SELECT TO OPTICAL DRIVE