Model ZDF-1

Disk & Tape Drive Controller

Technical Manual

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REVISION HISTORY

ECO No.	Date	Description	Pages
0346	8/16/84	Per ECO	
0382	9/25/84	Per ECO	
0393	10/2/84	Per ECO	
0523	3/4/86	New Cover	
0648	8/4/86	Add External Ground Wires to FCC cables.	3-14
0714	10/16/86	Add external ground wire (tape) to FCC cables.	3-9
0946	08/11/87	Rerolled Artwork	2-2, 3-2
1040	04/06/88	Documentation clarification.	see ECO.

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PREFACE

This manual provides complete instructions for installing Zetaco's model ZDF-1 disk/tape controller with cabling and tailoring the controller to meet your specific requirements. Instructions are also provided for using the programs and utilities contained on the software support tape. Detailed programming information and command descriptions have been included to aid in program development and fault analysis. The installation section steps through all phases from controller and cable installation to controller preparation using the Configurator program to testing and disk initialization. The information in this manual is divided into the following sections:

SECTION 1	PRODUCT DESCRIPTION - Briefly describes the controller and its features.
SECTION 2	SPECIFICATIONS - Lists functional and physical characteristics of the controller.
SECTION 3	INSTALLATION - Contains procedures for unpacking and installing the controller, tailoring it per system requirements, testing disk and tape subsystems and initializing disk media.
SECTION 4	ZDF-1 SOFTWARE SUPPORT PACKAGE - Describes the contents and use of the 1/2 inch tape included with the controller.
SECTION 5	TROUBLE-SHOOTING, CUSTOMER SERVICE - Contains information to be used in analyzing subsystem faults and instructions on returning suspect equipment for repair.
SECTIONS 6-7	DISK AND TAPE PROGRAM CONTROL - These sections describe controller programming and operation. For use in fault analysis or program development.
SECTION 8	TAPE COUPLER GUIDELINES, UTILITIES - Describes streaming operation and use of the utilities supplied on the software tape in optimizing performance of streamer tape drives.

1.0 PRODUCT DESCRIPTION

1.1 GENERAL

The Zetaco ZDF-1 is a dual function peripheral controller which combines high performance disk and tape control on a single standard interface board for use in Data General minicomputers. The controller supports most disk drives which use the industry standard SMD interface, and most industry standard 1/2 inch 9 track magnetic tape drives using the Pertec interface with embedded formatter.

The ZDF-1 emulates Data General's 60XX, 61XX and 6214 series disk subsystems and 6021 and 6125 tape subsystems with no software patches required for RDOS or AOS. It may be installed in any I/O ONLY slot of DG's Nova or Eclipse series minicomputers. Disk and Tape interface cabling is via the computer backpanel and is compatible with DG's FCC-compliant chassis.

Up to four disk drives of differing sizes and transfer rates may be attached. The disk controller has been designed to provide increased system throughput and reliability, and to achieve the most efficient use of the full capacities of standard and non-standard disks.

The tape coupler controls up to eight formatted streaming or start/stop drives. To facilitate streaming the coupler supports low/high speed, dynamic inter-record gaps, and "read look-ahead".

The controller's architecture employs dedicated microprocessors, buffers and bus acquisition control to maintain individual disk and tape performance.

The ZDF-1 uses EEPROM memory (nonvolatile, re-programmable memory) as a replacement of switches for controller configuration. The 1/2 inch tape included with the controller contains a program that must be run to set up the controller with disk type information and optional controller features.

The ZDF-1 controller is warranted against defects in material and workmanship for two full years from date of factory shipment.

1.2 ZDF-1 FEATURES

.Dedicated disk and tape microprocessors for greater throughput

.EEPROM eliminates switches and provides total software configurability

.EEPROM Configurator program provides total flexibility with a "User Friendly" format

.Software support package containing Configurator, diagnostics and utilities included on 1/2 inch tape

.User definable interrupt and data channel priority of disk vs. tape

.User definable device codes from 20 to 76 octal

.Independent selftest microdiagnostics for disk and tape with error reporting via LEDS

.Separate disk and tape LEDS indicate Busy, device status and selftest

.Internal cabling attaches to connector panel for use in FCC approved computers

.Shielded external cabling is in compliance with FCC for RF emission

1.2.1 DISK CONTROLLER FEATURES

.Emulation of Data General 6060,6061,6067,6160,6161, 6122 and 6214 Disk Subsystems

.Supports two logical Disks with one physical Disk Drive

.Simultaneous control of up to (4) SMD Interfaced Disk Drives

.Incorporates an Eleven Bit SMD Tag Bus to accomodate full capacity of the larger Drives

.Mix drives of different capacities, transfer rates, and media formats

.On-board 32 bit error checking and correcting of burst errors up to 11 bits in length

.High speed microprocessor design supports transfer rates up to 2 MB per second

.Two sector buffer

.User definable sector interleaving

.Adjustable DCH throttle control

.Supports overlap seeks

.Offset positioning for data error recovery

.Automatic data strobe early/late for data error recovery

.Two methods of power fail detection control open cable detect

.Logging of the number of Data corrections that have occurred on a per unit basis

.One second pick delay on power up controls disk drive power sequencing

.Header CRC error auto re-try

.Dual volume drives supported (two physical volumes)

.Supports dual ported drives (dual processor)

.User definable header Sync Byte

.Program Load (BOOT) waits for drive ready

.Fairchild "FAST" logic used to increase performance and reduce power consumption

1.2.2 TAPE COUPLER FEATURES

- Interfaces Data General's Minicomputers to Formatted Magnetic Tape Drives produced by popular Pertec interface Tape Drive Manufacturers

- Microprocessor based controller adds flexibility and performance enhancements

a) Dynamic inter-record gap

b) Read look ahead

} These features enhance streaming capability using standard D.G. software

- Software compatability to Data General operation software

- FIFO buffering for data channel latency

- Memory addressing capability to 64K words

- Software selectable streamer modes

- Supports transfer rates up to 1 MB per second

- Handles up to eight industry standard 1/2 inch tape drives

- Automatic high speed file search

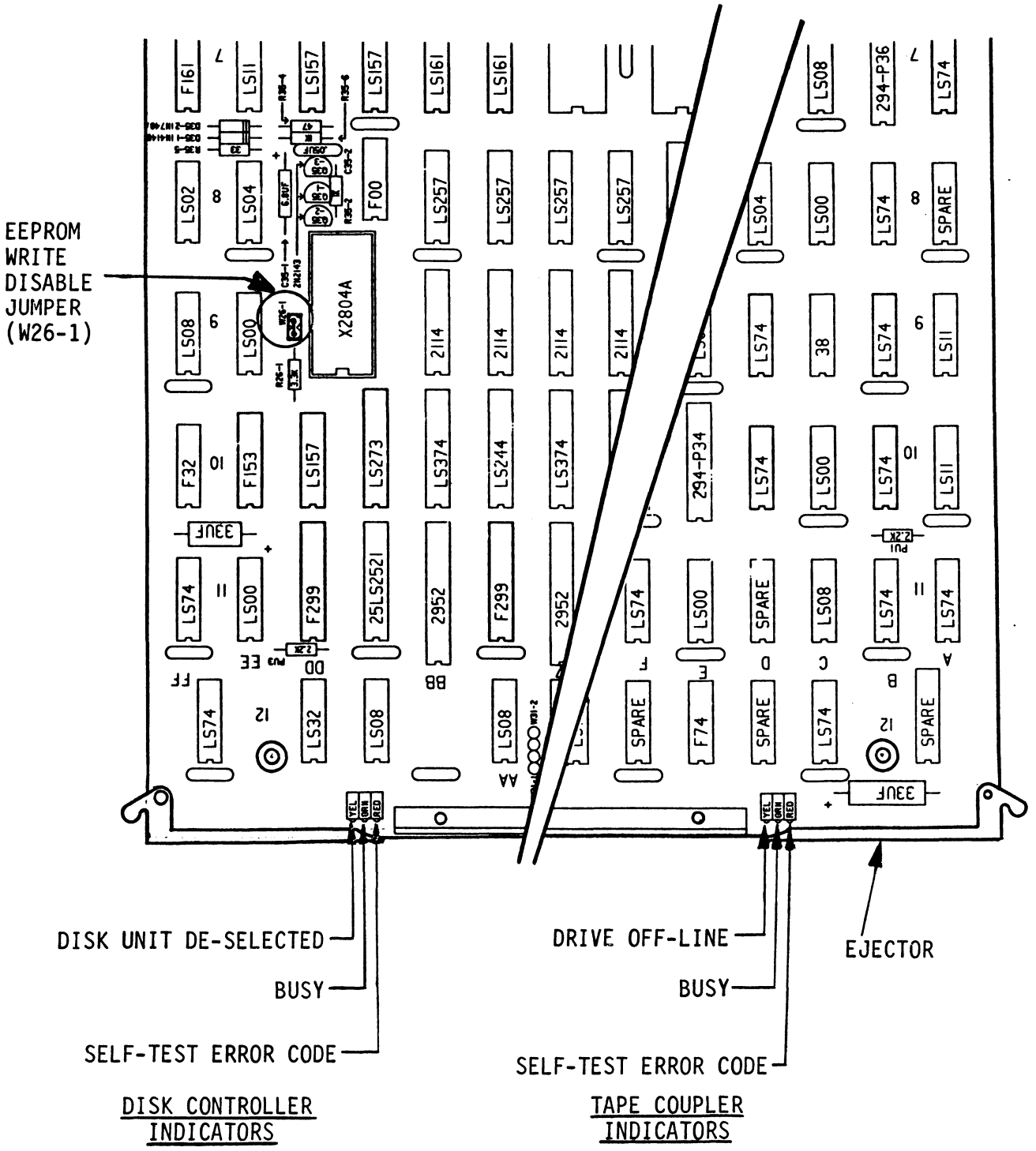
2.0 SPECIFICATIONS

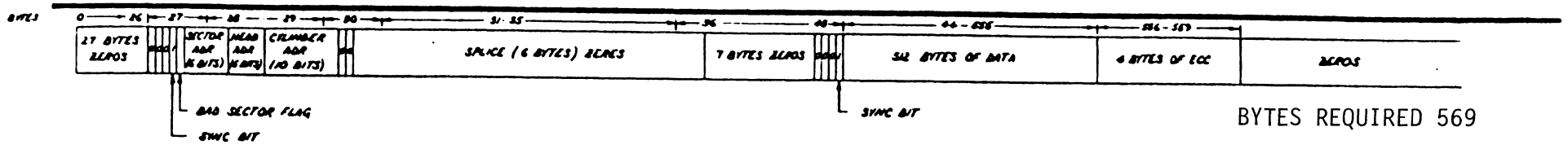
2.1 FUNCTIONAL CHARACTERISTICS

2.1.1 DISK CONTROLLER

DRIVES PER CONTROLLER:	Up to 4 single volume or up to 2 dual volume.
MEDIA FORMAT:	4 available formats selectable per port with user-defined sync byte. (See Figure 2.2 for detail).
SECTOR ORGANIZATION:	Contiguous or variable interleaved.
ERROR CORRECTION CODE:	32-bit polynomial; detects and corrects all burst errors up to 11 bits.
TRANSFER RATE:	Up to 2 Mbytes/sec (16 Mhz bit rate).
EMULATION:	Data General 6060, 6061, 6067, 6160, 6161, 6122 and 6214 Disk Subsystems.
INDICATOR LEDS: (See Figure 2.1)	YELLOW: UNIT DE-SELECTED - indicates that no disk units are currently selected. Either no DOA has yet been issued or the controller is not receiving disk status properly. GREEN: DISK CONTROLLER BUSY - indicates disk controller busy flag is set. RED: SELFTEST - indicates disk controller is executing selftest. If selftest fails, the LED is used to display the error code.

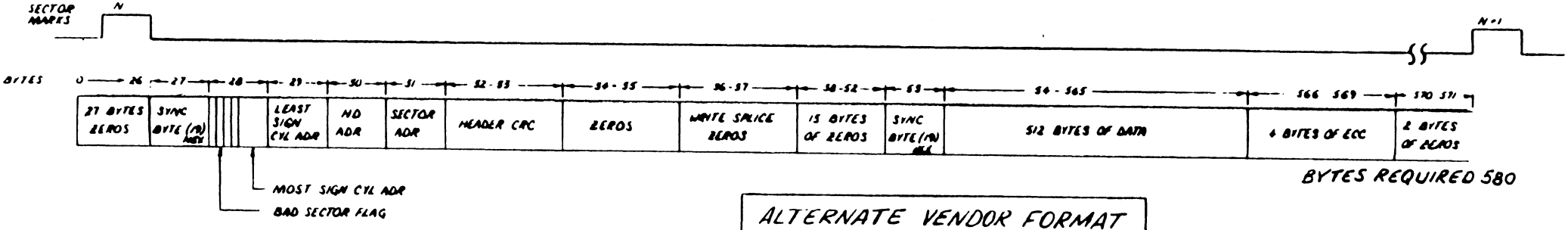
FIGURE 2.1 Indicator Layout





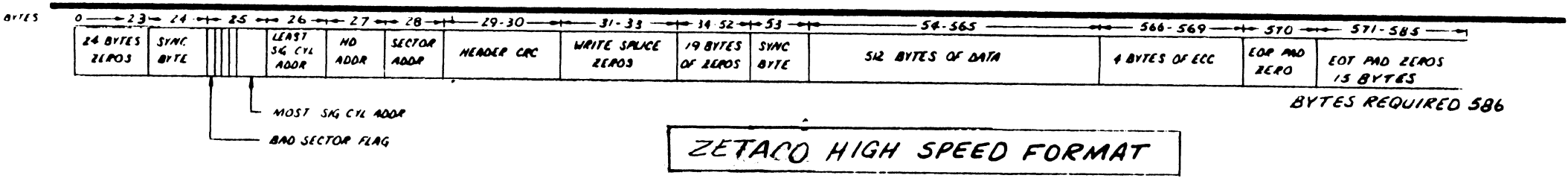
BYTES REQUIRED 569

DATA GENERAL FORMAT



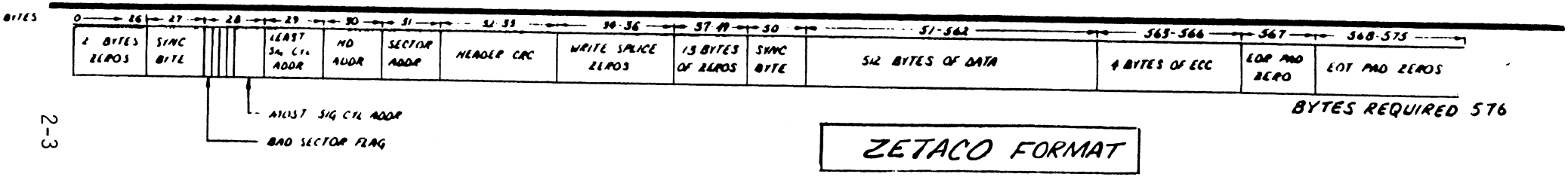
BYTES REQUIRED 580

ALTERNATE VENDOR FORMAT



BYTES REQUIRED 586

ZETACO HIGH SPEED FORMAT



BYTES REQUIRED 576

ZETACO FORMAT

DISK MEDIA FORMATS
FIGURE 2.2

2.1.2 TAPE COUPLER

DRIVES PER CONTROLLER: Up to 8 streaming, cache, GCR or start/stop (tension arm) types, with embedded formatter.

RECORDING FORMAT: Specified by drive formatter; includes PE, NRZ (see Figure 2.3).

TRANSFER RATE: Up to 1 Mbyte/sec.

PARITY: Odd (even parity for maintenance only).

EMULATION: Data General 6021 and 6125 tape Subsystems.

TAPE MEDIA CAPACITY: The following formula will aid in determining how much data storage capacity in Bytes (Byte = 8 Bits) a length of tape will offer.

$$\#\ \text{OF BYTES/LENGTH OF TAPE} = \frac{(TLEN - 25) * (RLEN) * (12)}{([(RLEN + TFD)/BPI] + GAPL)}$$

TLEN = LENGTH OF TAPE IN FEET
RLEN = RECORD LENGTH IN BYTES
TFD = TAPE FORMAT DATA (PE = 82, NRZ = 8)
BPI = RECORDING DENSITY (PE = 1600, NRZ = 800)
GAPL = GAP LENGTH IN INCHES (NOMINAL = .6")

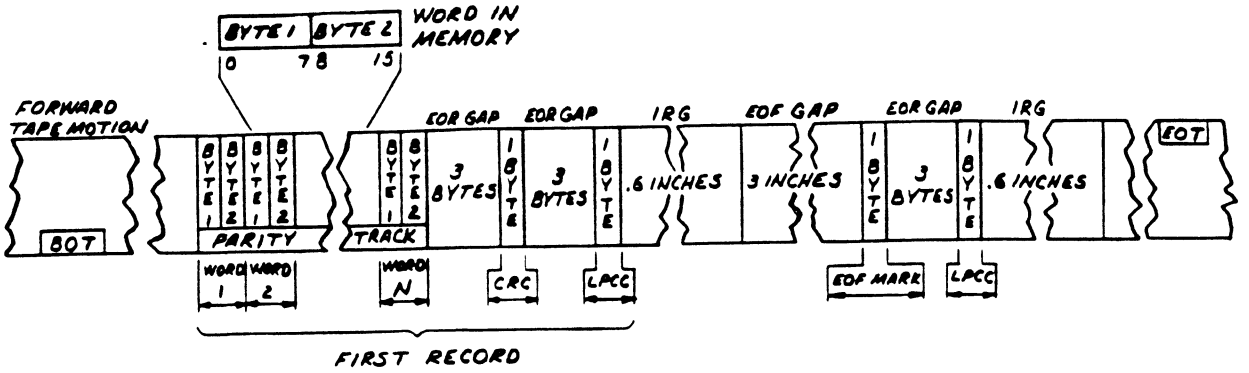
INDICATOR LEDS: (See Figure 2.1)

YELLOW: OFFLINE - indicates tape drive is off-line. Check cabling if LED remains on after tape drive is placed on-line.

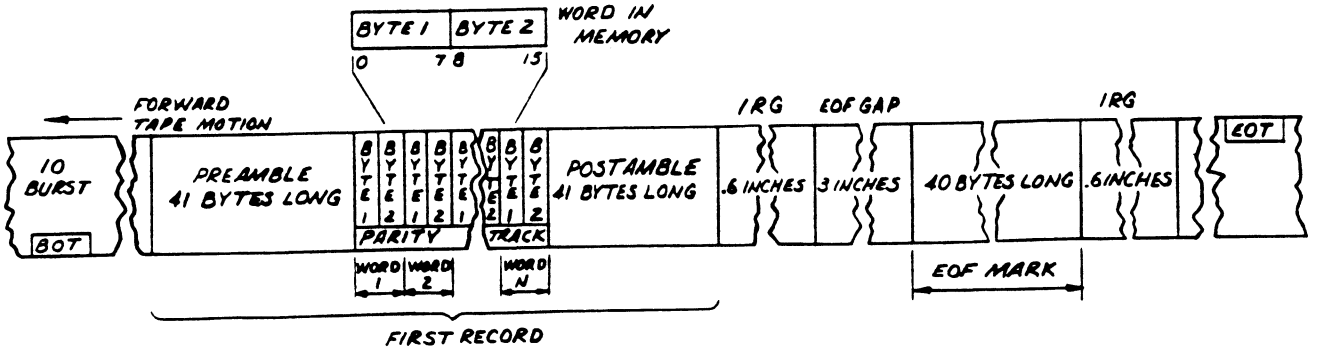
GREEN: TAPE COUPLER BUSY - indicates tape coupler busy flag is set.

RED: SELFTEST - indicates tape coupler is executing selftest. If selftest fails, the LED is used to display the error code.

NRZI



PE



EXAMPLE TAPE FORMATS
FIGURE 2.3

2.2 COMPUTER INTERFACE

The ZDF-1 uses the standard Data General I/O and data channel interface and supports standard or high speed data transfers.

The controller installs in Data General minicomputer models which have a rear-mounted backpanel and contain I/O only slots*. This includes models such as Nova 4, Eclipse S120, S140, S280, etc.

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*CAUTION: THE ZDF-1 CONTROLLER MAY ONLY BE INSERTED IN AN I/O ONLY SLOT. COMPONENT DAMAGE WILL OCCUR IF A SLOT OTHER THAN AN I/O ONLY SLOT IS USED. ZETACO'S WARRANTY IS VOID IF A NON-I/O ONLY SLOT IS USED.

The controller's internal cabling has been designed for use only in chassis with a rear-mounted backpanel. In addition, because of the number of backpanel pins required for disk and tape interfacing, only I/O only slots will accomodate the controller. (I/O only slots provide unrestricted use of the most backpanel pins; some of these pins are reserved in Memory-or-I/O slots.) A slot selection guide for various computers is provided in section 3.3.1 as an aid in choosing an I/O only slot.

The controller cannot be installed in a minicomputer which does not contain I/O only slots, or has a side mounted backpanel, such as Nova 3, Eclipse C150, etc.

2.3 DISK DRIVE INTERFACE

FUNCTIONAL:	SMD Standard
ELECTRICAL:	Balanced line differential drivers and receivers.
CONTROL "A" CABLE:	60-conductor cable, daisy-chain connected, computer to first drive, to next drive, etc. See Table 2.1 for pin assignments. Cumulative length should not exceed 100 feet.
DATA "B" CABLE:	26-conductor cable, radially connected, computer to drive(s). See Table 2.2 for pin assignments. Should not exceed 50 feet.

2.4 TAPE DRIVE INTERFACE

FUNCTIONAL:	1/2" Industry standard Pertec with formatter embedded in drive.
ELECTRICAL:	Open-collector TTL drivers and Schmidt Trigger receivers. Logic true: 0.4V max. Logic false: 2.4V min.
CABLING:	Two 50-conductor cables, daisy-chain connected, computer to first drive, to next drive, etc. See Tables 2.3 and 2.4 for pin assignments. (Overall cable length between coupler and last drive must not exceed 20 feet.)

2.5 POWER REQUIREMENTS

+5 VDC @ 8 Amps + 5%
-5 VDC @ .5 Amps + 5%

PIN #	SIGNAL NAME
1	TAG 1-
2	TAG 2-
3	TAG 3-
4	BIT 0-
5	BIT 1-
6	BIT 2-
7	BIT 3-
8	BIT 4-
9	BIT 5-
10	BIT 6-
11	BIT 7-
12	BIT 8-
13	BIT 9-
14	OPEN CABLE DETECTOR-
15	FAULT-
16	SEEK ERROR-
17	ON CYLINDER-
18	INDEX-
19	UNIT READY-
20	NOT USED
21	BUSY-
22	UNIT SELECT TAG-
23	UNIT SELECT 0-
24	UNIT SELECT 1-
25	SECTOR-
26	UNIT SELECT 2- (note 1)
27	UNIT SELECT 3- (note 1)
28	WRITE PROTECTED-
29	POWER SEQ. PICK- (note 2)
30	BIT 10-

(continued)

DISK "A" (J1) CABLE PIN ASSIGNMENTS

TABLE 2.1

DISK "A" (J1) CABLE PIN ASSIGNMENTS (continued)

PIN #	SIGNAL NAME
31	TAG 1+
32	TAG 2+
33	TAG 3+
34	BIT 0+
35	BIT 1+
36	BIT 2+
37	BIT 3+
38	BIT 4+
39	BIT 5+
40	BIT 6+
41	BIT 7+
42	BIT 8+
43	BIT 9+
44	OPEN CABLE DETECTOR+
45	FAULT+
46	SEEK ERROR+
47	ON CYLINDER+
48	INDEX+
49	UNIT READY+
50	NOT USED
51	BUSY+
52	UNIT SELECT TAG+
53	UNIT SELECT 0+
54	UNIT SELECT 1+
55	SECTOR+
56	UNIT SELECT 2+ (note 3)
57	UNIT SELECT 3+ (note 3)
58	WRITE PROTECTED+
59	POWER SEQ HOLD (note 2)
60	BIT 10+

NOTE 1: Unit select 2- and 3- are tied to +5V via 470 ohm resistor
NOTE 2: "Pick" and "Hold" are connected internally on controller
NOTE 3: Unit select 2 and 3 are tied to -5V via 470 ohm resistor

PIN #	SIGNAL NAME
1	GROUND (connected to internal cable shield)
2	SERVO CLOCK-
3	READ DATA-
4	GROUND
5	READ CLOCK-
6	WRITE CLOCK-
7	GROUND
8	WRITE DATA-
9	UNIT SELECTED+
10	SEEK END-
11	GROUND
12	NOT USED
13	NOT USED
14	SERVO CLOCK+
15	GROUND
16	READ DATA+
17	READ CLOCK+
18	GROUND
19	WRITE CLOCK+
20	WRITE DATA+
21	GROUND
22	UNIT SELECTED-
23	SEEK END+
24	NOT USED
25	GROUND
26	NOT USED

DISK "B" (J2-J5) CABLE PIN ASSIGNMENTS

TABLE 2.2

PIN #	NAME	DESCRIPTION
2	FBY	*FORMATTER BUSY
4	LWD	LAST WORD
6	W4	WRITE DATA 4
8	GO	INITIATE COMMAND
10	WO	WRITE DATA 0 (MSB)
12	WI	WRITE DATA 0
14	--	NOT USED
16	--	NOT USED
18	REV	REVERSE
20	REW	REWIND
22	WP	WRITE PARITY
24	W7	WRITE DATA 7 (LSB)
26	W3	WRITE DATA 3
28	W6	WRITE DATA 6
30	W2	WRITE DATA 2
32	W5	WRITE DATA 5
34	WRT	WRITE
36	--	NOT USED
38	EDIT	EDIT
40	ERASE	ERASE
42	WFM	WRITE FILE MARK
44	--	NOT USED
46	TADO	TRANSPORT ADDRESS 0
48	*R2	READ DATA 2
50	*R3	READ DATA 3

(all odd numbered pins are grounded on paddle board)

*Terminated on paddle board; 220 ohm to +5V, 330 ohm to ground

TAPE J6 CABLE PIN ASSIGNMENTS
(From backplane "B" side)

TABLE 2.3

PIN #	NAME	DESCRIPTION
1	RP	*READ PARITY
2	R0	*READ DATA 0 (MSB)
3	R1	*READ DATA 1
4	BOT	*BEGINNING OF TAPE
6	R4	*READ DATA 4
8	R7	*READ DATA 7 (LSB)
10	R6	*READ DATA 6
12	HER	*HARD ERROR
14	FMK	*FILE MARK DETECT
16	IDENT	*IDENTIFICATION
18	FEN	FORMATTER ENABLE
20	R5	*READ DATA 5
22	EOT	*END OF TAPE
24	----	NOT USED
26	NRZI	*NRZI MODE
28	RDY	*READY
30	RWD	*REWINDING
32	FPT	*FILE PROTECT
34	RSTR	*READ STROBE
36	WSTR	*WRITE STROBE
38	DBY	*DATA BUSY
40	----	NOT USED
42	CER	*CORRECTED ERROR
44	ONL	ONLINE
46	TAD1	TRANSPORT ADDRESS 1
48	FAD	FORMATTER ADDRESS
50	HISP	HIGH SPEED SELECT

(all odd numbered pins except 1 and 3 are gounded on paddle board)

*Terminated on paddle board; 220 ohm to +5V, 330 ohm to ground

TAPE J7 CABLE PIN ASSIGNMENTS
(From backplane "A" side)

TABLE 2.4

2.6 PHYSICAL CHARACTERISTICS

DIMENSIONS: 15 in. x 15 in. x 0.5 in.

SHIPPING WEIGHT: 8 lbs. Includes shipping carton, controller, paddleboards, 9-track magnetic tape and technical manual. Optional cabling not included.

2.7 ENVIRONMENTAL CHARACTERISTICS

OPERATING TEMPERATURE: 0 to 55 degrees C

RELATIVE HUMIDITY: 10% to 90% (non-condensing)

Exceeds all Nova/Eclipse minicomputer temperature and humidity specifications.

3.0 INSTALLATION

This section contains the procedures necessary for proper installation of the ZDF-1 disk and tape controller. Please read carefully.

Sections 3.1-3.8 involve preparation and installation of the hardware components. Installation personnel should have access to hardware documentation of the computer, disk drive and tape drive. The remaining sections cover using the Configurator program, diagnostics, disk media initialization and disk and tape sysgen examples.

The Configurator must be run to program the controller with the necessary information that reflects your particular installation. This program is included on the 1/2" magnetic tape shipped with the controller. Unless otherwise specified, the tape is 1600 BPI.

The Configurator need only be run at installation or when re-configuring the controller. The information will not be lost when the system is shut down, due to the use of programmable, nonvolatile memory within the controller. This memory serves as a replacement of switches and provides a fast, reliable method of controller preparation.

3.1 UNPACKING AND INSPECTION

The following items are shipped standard with each ZDF-1 in one container:

ITEM	P/N
a) ZDF-1 Controller Board Assembly	500-294-00
b) "A" Paddleboard Assembly	500-413-00
c) "B" Paddleboard Assembly	500-414-00
d) 1/2" Magnetic Tape containing Configurator, Diagnostics, Utilities	400-294-00
e) Technical Manual	600-294-00

The following cables are available as product options. Group I cables are for FCC-compatible (shielded) applications. Group II cables are for direct, unshielded connection from paddleboards to equipment.

GROUP I - FCC-Compatible Internal and Shielded External Cabling

a) Disk "A" Internal (Qty. 1)	18"	300-104-00
b) Disk "B" Internal (1 per drive)	18"	300-146-00
c) Tape Internal (Qty. 2)	18"	300-108-00
d) Disk "A" External		
Panel to Drive (Qty. 1)	6'	300-013-00
	16'	300-013-01
Drive to Drive (1 per each additional drive)	6'	300-147-00
	16'	300-147-01
e) Disk "B" External (1 per drive)	6'	300-011-00
	16'	300-011-01
f) Tape External		
Single-Drive (Qty. 2)	10'	300-001-00
Dual-Drive (Qty. 2)	20'	300-012-00

GROUP II - Flat Ribbon Cabling, Paddleboards to Peripherals

a) Disk "A" (1 per drive)	16'	300-147-00
b) Disk "B" (1 per drive)	16'	300-145-00
c) Tape (Qty. 2)	10'	300-037-00

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

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

Zetaco's warranty does not cover shipping damage.

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

3.2 CONTROLLER PREPARATION

All setup required to define the controller's functionality for various subsystem emulations, disk and tape drive models and other features, is done via the Configurator program supplied on the 400-294-00 tape. After all hardware installation is completed, read Section 3.10, which describes loading and using the Configurator.

3.2.1 EEPROM WRITE DISABLE JUMPER

After configuration of the controller is complete it is possible to hardware disable any further alterations to the configuration EEPROM. To write disable the EEPROM, remove the jumper across W26-1 at location DD9 on the controller (see Figure 2.1). Jumper W26-1 is factory installed.

3.3 CHASSIS PREPARATION

As mentioned in section 2.2, the ZDF-1 controller is designed for use in minicomputers with rear-mounted backpanels, and must only be installed in an I/O only slot. The controller will not function in Memory-or-I/O slots.

3.3.1 SLOT SELECTION

Below is a list of most of the Data General minicomputers that the ZDF-1 may be used in. To the right are the locations of the I/O only slots within each chassis. Do not attempt to install the controller in any other chassis unless you are certain that the chassis contains I/O only slots and which slots they are.

MODEL	I/O ONLY SLOTS
Nova 4 (5 slot)	3-5
Nova 4 (16 slot)	12-16
Eclipse S120 (5 slot)	3-5
Eclipse S120 (16 slot)	12-16
Eclipse S140	12-16
Eclipse S280	11-19
Eclipse S250	2-16 (optional, add-on slots)
Eclipse C350	2-16 (optional, add-on slots)

The controller is a high speed data channel device, and it must occupy an I/O only slot close enough in the priority chain to the CPU to receive sufficient priority. The controller must also allow sufficient priority for other high speed controllers further from the CPU. Priority within the controller between disk and tape sections is selectable and is configured along with other controller functions in Section 3.10.

Current loading rules must also be observed for groups of slots within the chassis.

Refer to your computer's configuration rules reference for more information.

3.3.2 PRIORITY JUMPERS

The controller must receive two priority signals from the Data General minicomputer backplane, data channel priority in (Pin A94) and interrupt priority in (Pin A96). If there are vacant slots between the controller and the processor, priority jumper wires must be installed to obtain priority continuity between controllers. To jumper across unused slots, see Figure 3.1. Pin A94 (data channel priority in) of the lowest empty slot must be jumpered to A93 (data channel priority out) of the highest empty slot below the ZDF-1, and A96 (interrupt priority in) of the lower slot to A95 (interrupt priority out) of the higher slot.

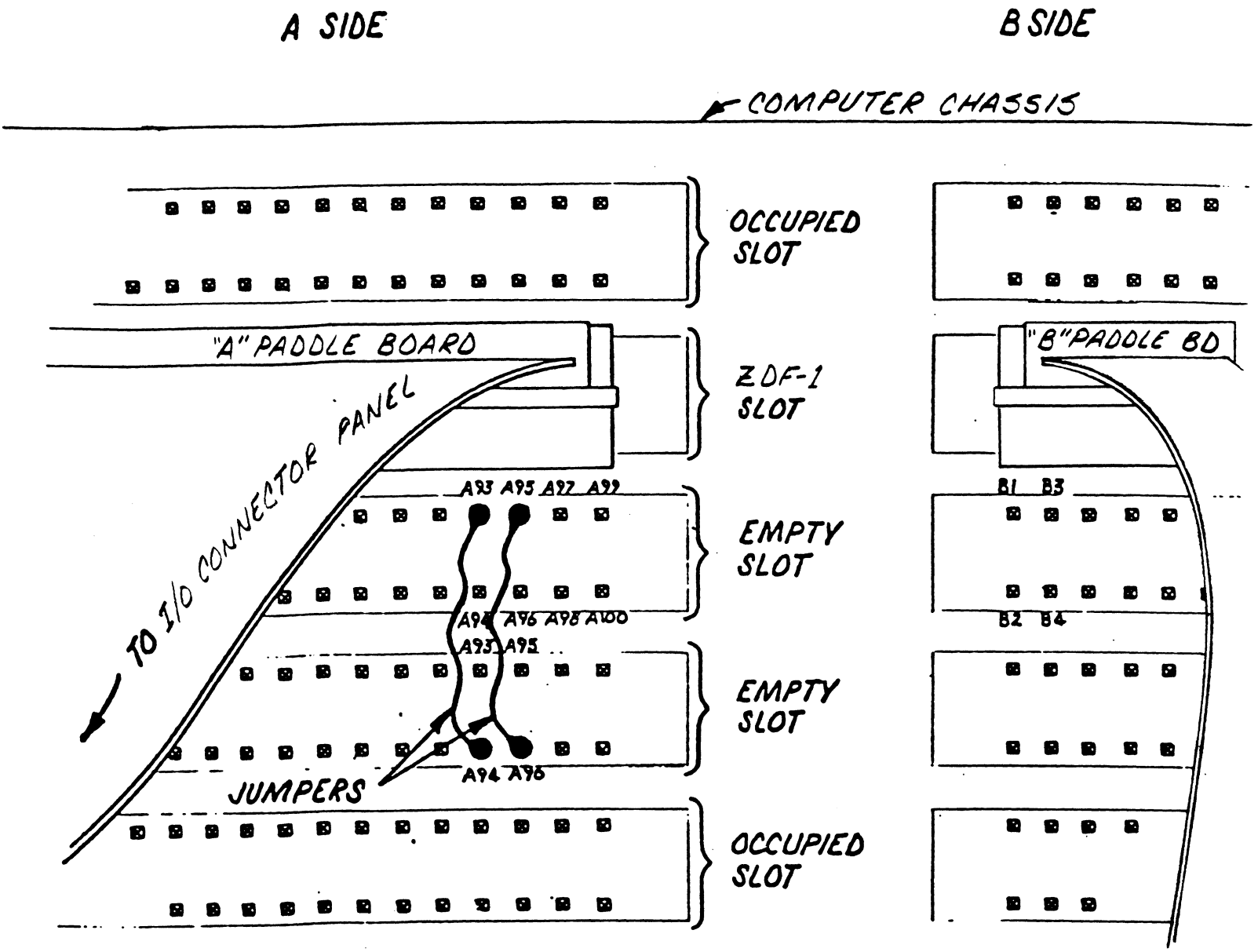
If the ZDF-1 is to be configured at or near highest priority in an S140 Computer, (Slots 12-16 I/O Only) jumper the priority first up to the ZDF-1, then back down to the additional Controller Boards in Slots 4 and up.

3.3.3 POWER FAIL PROTECTION

The ZDF-1 controller contains a double protection power fail scheme, which disables the disk drive write circuitry through the open cable detect line.

The Data General CPU outputs a signal called "Power Fail" which gives an early warning of power loss. This signal is located at the B21 pin of the backpanel. Some computers provide this signal on all slots, however, on others it may only be available on B21 of the top slot. If so, to use this signal, backpanel pin B21 of the controller's slot must be jumper connected to B21 of the top slot in the computer.

In addition, the controller contains power fail circuitry to further protect disk drive data integrity in the event the slot where the controller is installed loses power.



BACKPANEL PRIORITY JUMPERS
FIGURE 3.1

3.4 CONTROLLER INSERTION

After selecting the proper I/O only slot* as described in Section 3.3.1, insert the controller by fitting the board edges between the slot guides and allowing the board to follow the guides evenly. Pull out the ejectors on the two outside corners of the board and use them to provide leverage when the board meets the connector. Use equal pressure on both ejectors until the board seats firmly into the backpanel connectors.

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*CAUTION: THE ZDF-1 CONTROLLER MAY ONLY BE INSERTED IN AN I/O ONLY SLOT. COMPONENT DAMAGE WILL OCCUR IF A SLOT OTHER THAN AN I/O ONLY SLOT IS USED. ZETACO'S WARRANTY IS VOID IF A NON-I/O ONLY SLOT IS USED.

3.5 CABLING

The ZDF-1 paddleboards are designed to facilitate cabling either directly to the disk and tape peripherals, or to the computer I/O connector panel for use with shielded, FCC-compliant external cabling.

3.5.1 PADDLEBOARD INSTALLATION

The ZETACO provided paddleboards are "active" and require power from the computer for operation, so care must be taken in aligning them over the proper backpanel pins.

The computer backpanel, viewed from the rear, contains the "A" side pins on the left. On vertical card computers, refer to the computer reference documentation for "A" and "B" side orientation.

The ZDF-1 "A" paddleboard contains the 60-pin disk "A" cable header and one 50-pin tape cable header. The "B" paddleboard contains four 26-pin disk "B" cable headers and one 50-conductor jumper, which connects to the other tape cable.

To install the "A" paddleboard, locate the two rows of pins on the "A" side of the backpanel associated with the slot that contains the ZDF-1 controller. Check to see that none of the pins are bent, and position the paddleboard block connector over all 100 pins with components facing up. Carefully press the paddleboard onto the pins, at the same time making sure that all pins insert and do not bend, until the block connector is flush with the backpanel.

CAUTION: Component damage may occur if the paddleboard is misaligned. Make sure the block is not shifted right or left by checking for pins showing on both ends. Also, double-check that the block is installed over the correct two rows of pins and not between two slots. It may be necessary to count pairs of rows to determine correct positioning.

Repeat the procedure for installing the "B" paddleboard on the "B" side of the backpanel.

3.5.2 INTERNAL CABLES (FOR USE WITH FCC-COMPATIBLE EXTERNAL CABLES)

The internal tape, disk "A", and disk "B" cables are ribbon cables with 2-row connectors on one end, which attach to the paddleboard headers. "D" receptacle connectors on the opposite end mount to the I/O connector panel. Internal cables required are:

CABLE	P/N	QTY
DISK "A" INTERNAL	300-000-XX	1
DISK "B" INTERNAL	300-146-XX	1 per drive
TAPE INTERNAL	300-108-XX	2

3.5.3 FCC-COMPATIBLE EXTERNAL CABLES

For applications that require cabling with grounded shield to inhibit electromagnetic inductance, the following cables are needed to connect the I/O connector panel to the peripheral equipment:

CABLE	P/N	QTY
DISK "A" EXTERNAL	300-013-XX	1
DISK "B" EXTERNAL	300-011-XX	1 per drive
TAPE EXTERNAL, 1 DRIVE	300-001-XX	2
TAPE EXTERNAL, 2 DRIVES	300-012-XX	2

For two or more disk drives, each additional drive also requires one Disk "A" Daisy-chain cable, part number 300-147-XX. The external ground wire on these cables should be connected to the drive's chassis ground.

3.5.4 NON-FCC PERIPHERAL CABLING

For direct cabling from the paddleboards to the disk and tape equipment, the following cables are required:

CABLE	P/N	QTY
DISK "A" (60-PIN)	300-147-XX	1
DISK "B" (26-PIN)	300-145-XX	1 per drive
TAPE (50-PIN)	300-037-XX	2

NOTE: Additional disk "A" cables are required for connection to more than one disk drive and are connected in a daisy-chain method, described in Section 3.5.7.

3.5.5 ATTACHING CABLES TO PADDLEBOARDS

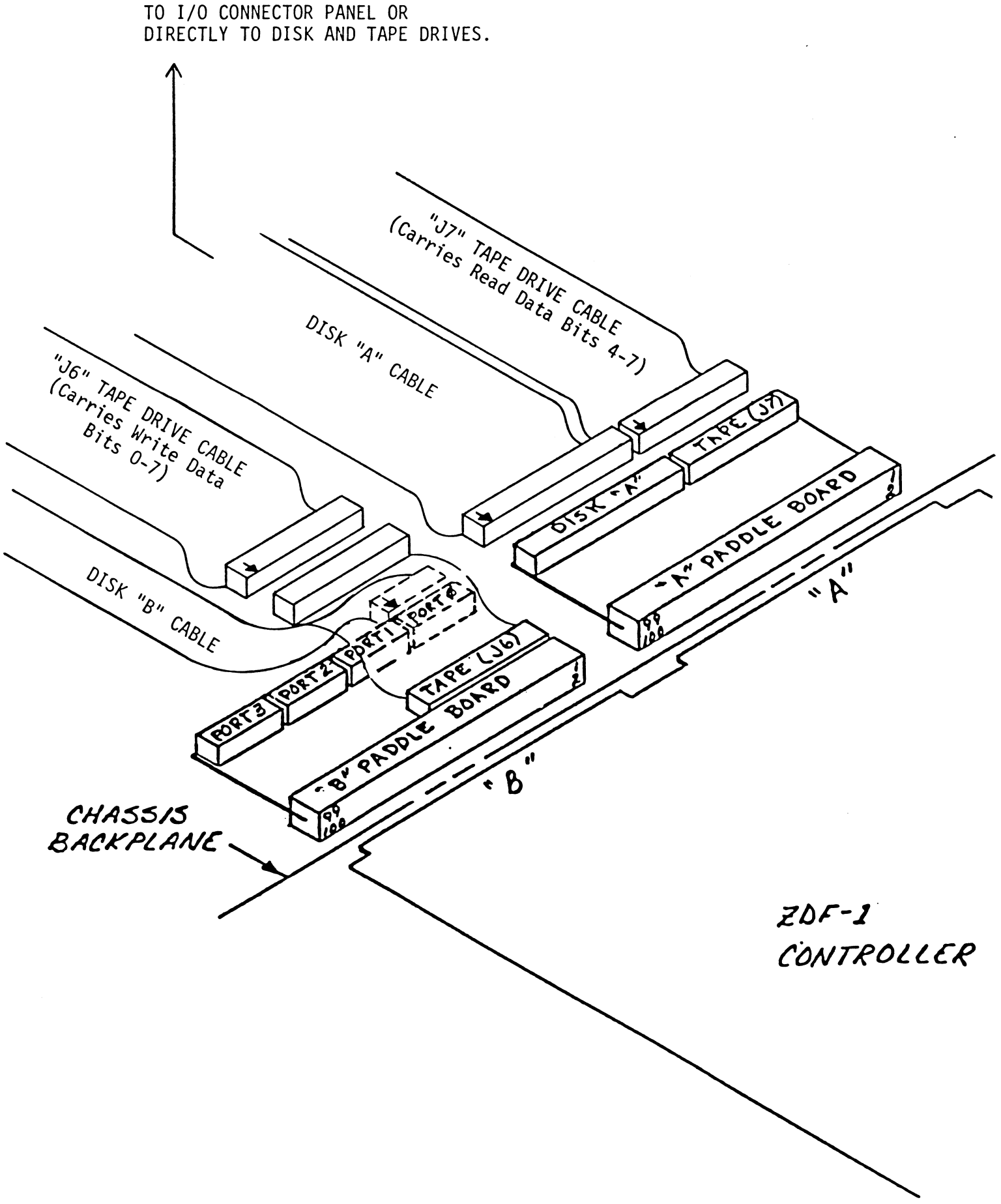
Refer to Figure 3.2 for the header layout on the "A" and "B" paddleboards. Pin 1 of the 2-row connector on each cable is indicated by an arrow. When attaching cables to the paddleboards, line the arrow up with the arrow on the top right side of the paddleboard header. Headers and connectors are also keyed to help prevent incorrect insertion.

For tape cabing, attach one tape cable to the 50-pin header marked "J7" on the outer side of the "A" paddleboard. Attach the other tape cable to the jumper cable marked "J6" on the "B" paddleboard. Because the two cables are identical, it is recommended that the other ends be marked either "J7" and "J6", or marked with the names used by the drive manufacturer to identify the formatter connectors. Section 3.5.8 contains a table that matches the cables with the connectors of popular tape drives.

For disk cabling, attach the disk "A" cable to the "DISK A" header on the "A" paddleboard. Next, attach the disk "B" cable(s) to the 26-pin headers on the "B" paddleboard. The four headers are marked, from left to right, "PORT 0" through "PORT 3". If more than one disk drive is to be connected, ZETACO recommends labeling the other ends of the "B" cables or the I/O connector panel.

It is important to note that a disk drive's unit number setting does not dictate the port header it must be attached to. The controller allows any unit to be attached to any of the four ports and assigns individual drive characteristics on a port-by-port basis.

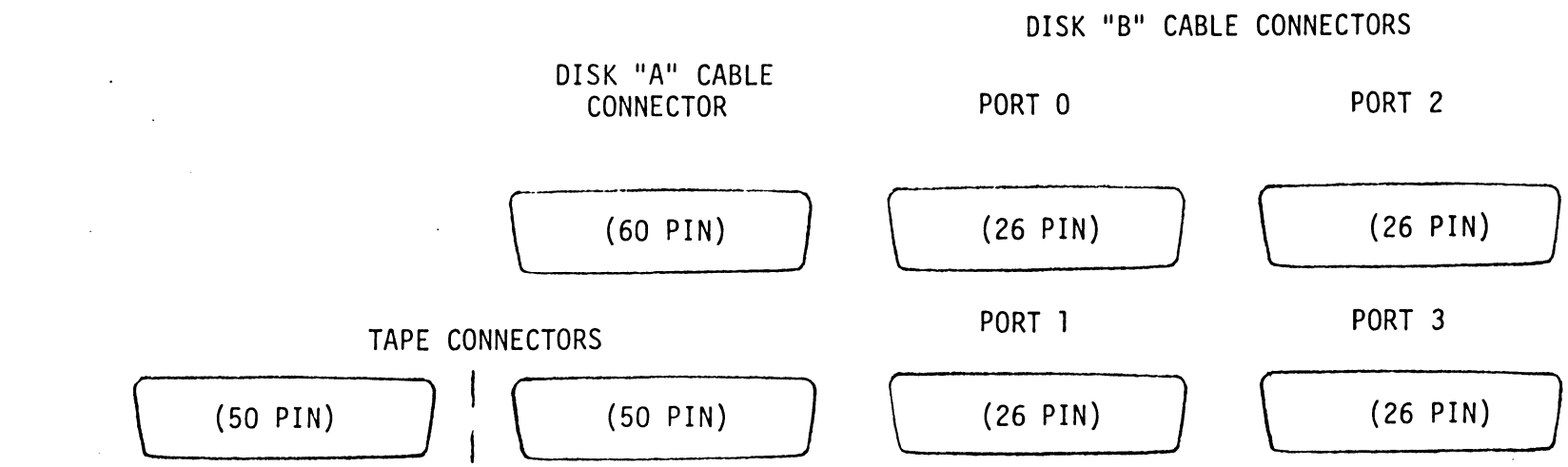
Each port is assigned characteristics via the Configurator Program supplied on the 1/2" magnetic tape. A print-out of factory-set characteristics is attached to the board cover of each ZDF-1 controller.



PADDLEBOARD CABLING
FIGURE 3.2

3.5.6 MOUNTING "D" CONNECTORS (SHIELDED EXTERNAL CABLES)

Figure 3.3 depicts an example of internal cable layout on the I/O connector panel as viewed from the rear. To mount the connectors, remove the covers from the necessary mounting holes on the panel. With the mounting hardware removed from the "D" connectors, insert the connectors into the panel and insert the hex bolts from the outside. Secure each connector to the panel with the washers and nuts.



DRIVE MODEL	DRIVE BD. EDGE CONN.	
CIPHER STREAMER	P2	P1
**CIPHER FORMATTER	P5	P4
KENNEDY STREAMER	P2	P1
KENNEDY FORMATTER	J1	J5
KENNEDY 9400 GCR	P200	P100
CDC STREAMER	J5	J4
CDC GCR	J3	J2
PERTEC	P5	P4
***STC ADAPTER	P2	P1

(additional models are listed in Section 3.6.7)

*J6 Carries write data signals, IW0-IW7

**Requires 100-pin to dual 50-pin adapter, Cipher P/N 160006-001

***Requires ZETACO 2920A Adapter Board - P/N 500-395-00.

CONNECTOR PANEL EXAMPLE LAYOUT
FIGURE 3.3

3.5.7 EXTERNAL DISK CABLING

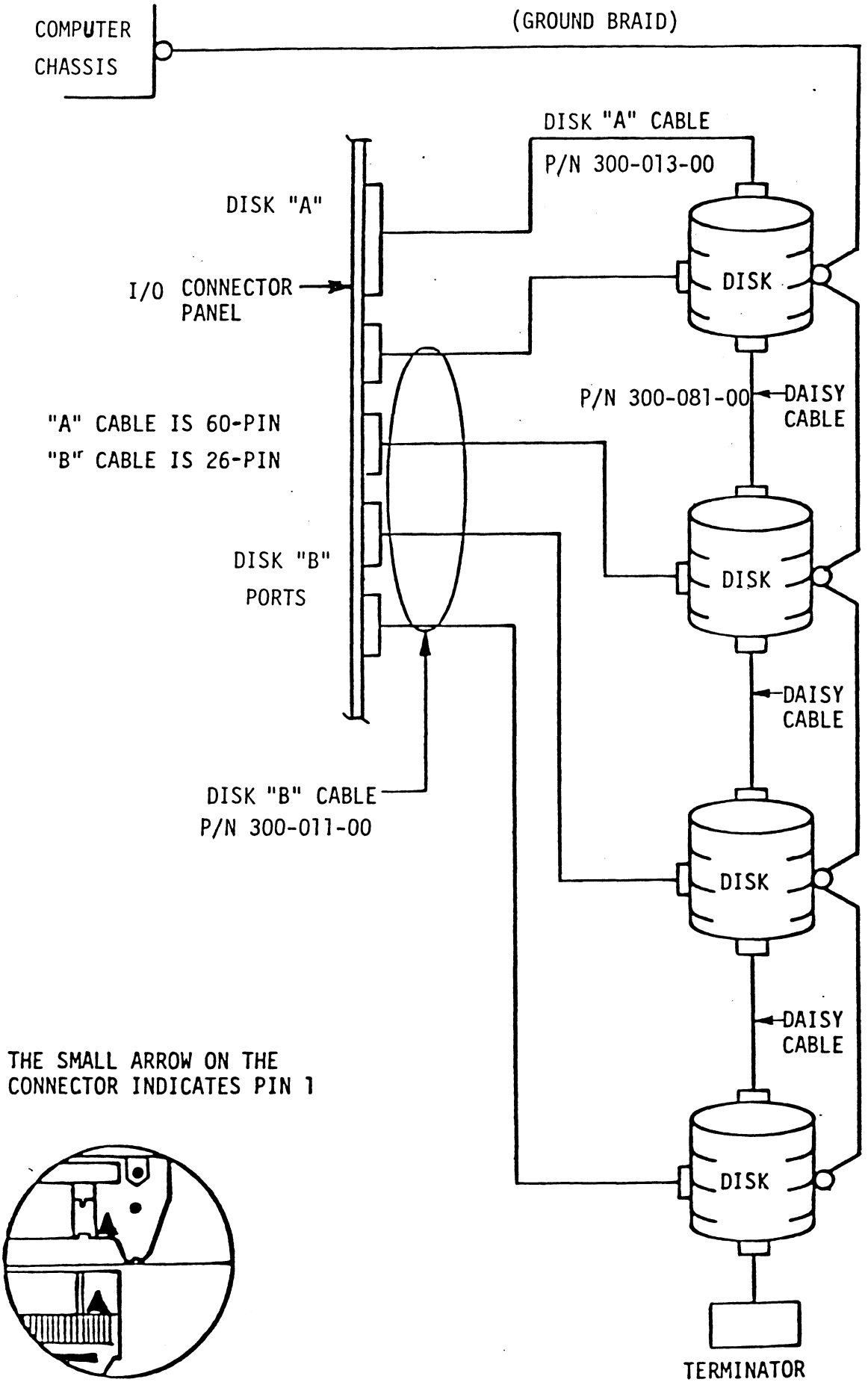
If using shielded external cables, attach the disk "A" cable and the disk "B" cable(s) to the appropriate "D" connectors on the connector panel. Because the "B" connector uses a 50-pin shell, be sure to connect it to the internal "B" cable and not one of the tape cables by mistake.

Attach the "A" cable to the 60-pin "A" header on the disk drive, ensuring that the arrows on cable and header align. Be sure that a terminator plug is installed in the unused "A" header (if any) on the drive.

For additional drives, remove the "A" cable terminator and replace it with a daisy-chain cable. Connect the other end of the cable to the next drive in a daisy-chain fashion as shown in Figure 3.4. Ensure that a terminator is installed in the last drive in the chain.

Attach the "B" cable(s) to the 26-pin "B" header on the disk drive, again observing the arrows for correct polarity.

Connect external ground wire on both A and B cables to the drive's chassis ground.



THE SMALL ARROW ON THE
CONNECTOR INDICATES PIN 1

DISK DRIVE CABLING
FIGURE 3.4

3.5.8 EXTERNAL TAPE CABLING

If using shielded external cables, attach the two tape cables to the appropriate "D" connectors on the connector panel. Because the disk "B" connector also uses a 50-pin shell, be sure not to connect a cable to the disk "B" internal cable by mistake.

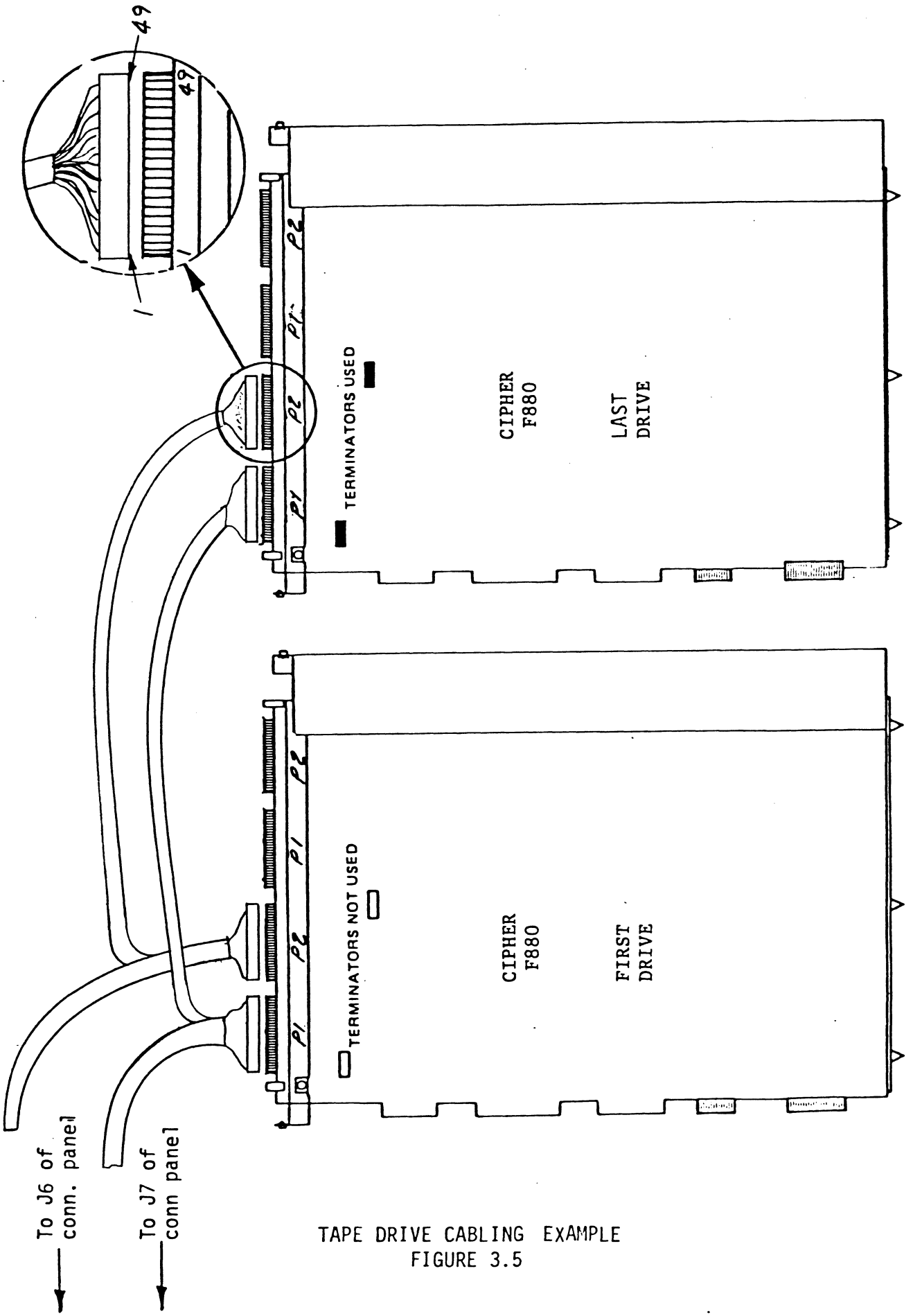
Cables are terminated with 50-pin edge connectors that fit onto the tape drive's formatter board connectors.

Generally, there is no industry-standard labeling of the drive's formatter board connectors. To assist in matching the proper cable to formatter connector, below is a list of some drive model connector designations. If your tape drive is not listed, refer to the drive documentation; the drive connector containing the Write Data Bit signals (IW0-IW7) should connect to the J6 cable.

		COMPUTER CONNECTOR PANEL	
		"B" SIDE	"A" SIDE
	TAPE DRIVE	J6*	J7
	Cipher Streamer	P1	P2
**	Cipher Formatter	P4	P5
	Kennedy Streamer	P1	P2
	Kennedy Formatter	J5	J1
	Kennedy 9400 GCR	P100	P200
	CDC Streamer	J4	J5
	CDC GCR	J2	J3
	Pertec	P4	P5
***	STC 2920	P1	P2
	STC 2921	P6	P7
	Fujitsu M2444	B	A
	Telex 9251	1/01	1/02

* J6 cable carries signals IW0 through IW7.
** Requires 100-pin to dual 50-pin adapter, Cipher P/N 160006-001.
*** Requires ZETACO 2920A Adapter Board, P/N 500-395-00.

Attach the two cables to the drive's board edge connectors. See example in Figure 3.5. Each cable's connector pads are numbered 1-50. Make sure pin 1 of each cable connector is aligned with pin 1 on the drive's formatter board. Make sure cable terminators are left on the drive if only one drive is being installed.



TAPE DRIVE CABLING EXAMPLE
FIGURE 3.5

3.5.8.1 MULTIPLE TAPE DRIVES

Figure 3.6 shows 3 multiple-drive cabling schemes. The coupler may address up to 8 tape units. These may be all drives with individual formatters, as shown in Figure A, or they may be drives which share a common formatter as in Figure B, or a combination of both as in Figure C.

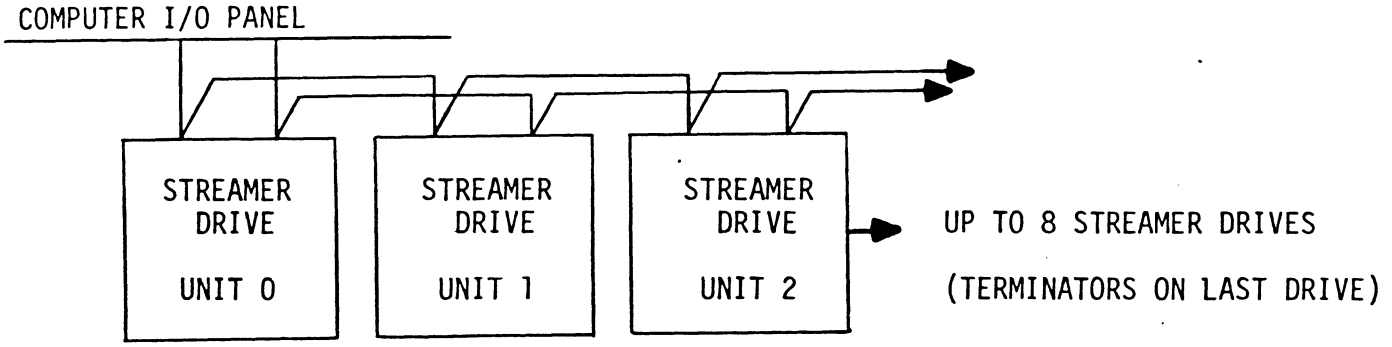
In Figure A, the drives are set to units 0-7. In B and C, each embedded formatter responds to 4 consecutive units, 0-3 or 4-7. Note that in C, the first streamer drive is set to unit 4, although the unit 0 formatter may only be controlling a single drive.

To attach two tape formatters to the controller, use the optional cables (P/N 300-012-00). Each cable has a connector spliced in for attachment to the two board edge connectors of the first formatter. The ends of each cable then attach to the second formatter. Be sure terminators are removed from the first formatter and are left on the second.

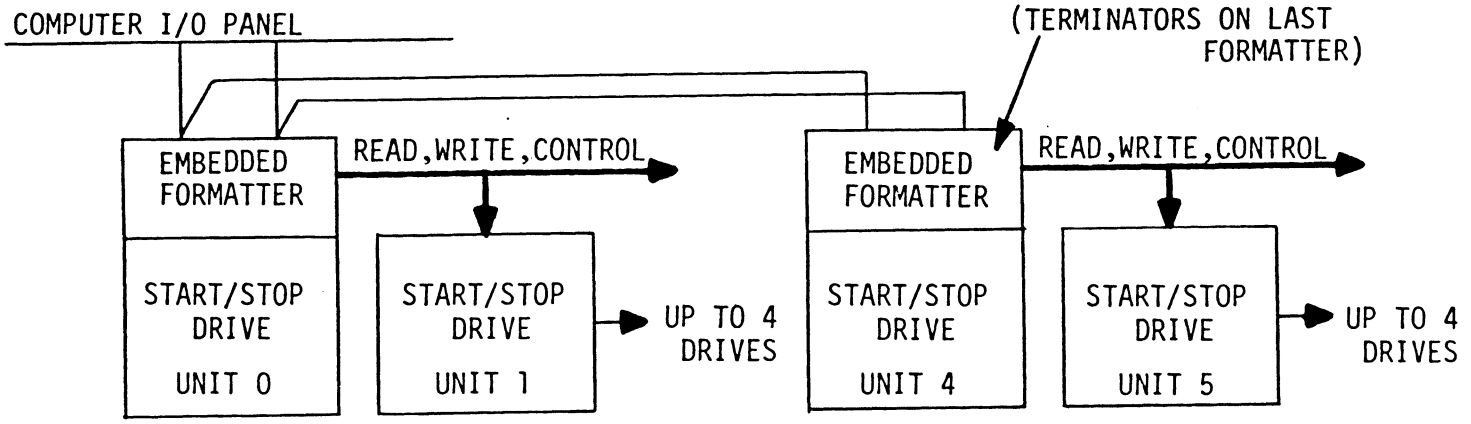
3.5.9 SYSTEM GROUNDING

Because the power system safety ground does not necessarily satisfy all system grounding requirements, additional connections are required to earth ground, referred to as system ground. The controller and its attached disk drive(s) must be connected to a single-point ground system. Tape drives receive sufficient grounding and additional grounding is usually not required. Ground connections are made via ground braids that pass from drive to drive, drive to computer chassis,, and computer chassis to earth ground.

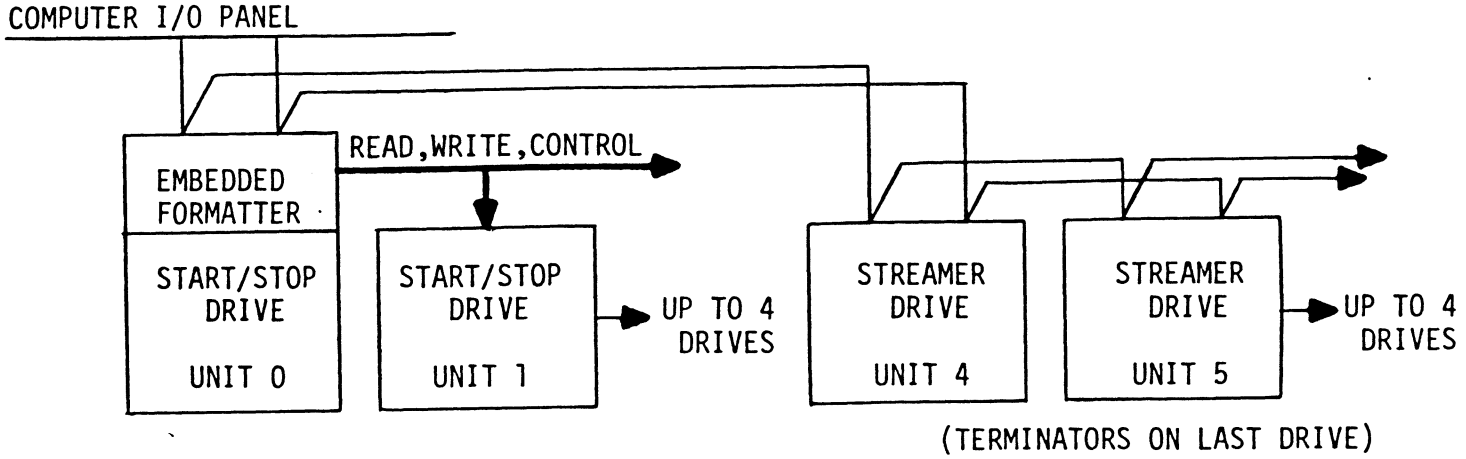
WARNING - To ensure proper ground return to earth, each disk drive in the system must be connected using a daisy-chain ground system. Both the AC and DC grounds within each drive must be joined (consult your Drive Manual). The drives must then be joined by a daisy-chain grounding braid and connected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



A. STREAMER DRIVES ONLY



B. TWO EMBEDDED FORMATTERS



C. EMBEDDED FORMATTER AND STREAMER DRIVES

MULTIPLE TAPE DRIVE CABLING
FIGURE 3.6

3.6 DISK DRIVE PREPARATION

Each disk drive will need to be set to the correct number of sectors per track, and to the desired unit number. In addition, the disk drive's installation manual should be read to see if any other setup is required.

3.6.1 SECTORS PER TRACK SELECTION

The number of sectors per track each disk drive should be set to is displayed by the Configurator Program after you have selected the drive model and sizing characteristics. To verify the sector values, run the Configurator Program and enter a List (L) Command. Sectors per track are found in the SECS column of the disk port facts.

NOTE: If "Split Sectors" appears to the right, that drive must be set for TWICE the number of sectors shown.

Refer to your disk drive manual and carefully determine the correct switch positions for the sector count and set the switches in the disk drive accordingly.

3.6.2 UNIT NUMBER, MISCELLANEOUS PREPARATION

Set the drive(s) to the desired unit numbers. This is usually done via switches in the drive or by changing lens caps on the front. For two or more drives, unit numbers assigned are usually consecutive, with unit "0" being the primary unit. For dual-volume drives such as CDC's CMD, Lark, etc., or drives which the controller treats as dual-volume (indicated in the Disk Drive "HELP" section of Configurator), the drive must be set to unit 0 or 2, with the next consecutive odd unit number used by the upper volume.

On initial power-up, the controller will delay activating pick-hold (spins up drive) for one second. This feature eases the initial current demand on the AC power source. This feature requires that the disk drive be selected for REMOTE operation.

Ensure the disk drive you are installing has the index and sector signals on the "A" cable. If these signals are on the "B" cable only, the controller will not function correctly.

3.6.3 SPECIAL CONSIDERATIONS - VARIOUS DRIVES

SPECIAL CONSIDERATIONS FOR THE FUJITSU 2351 DISK DRIVE SECTOR SELECTION

The Fujitsu 2351 should be set to 48 sectors per track by setting the number of bytes per sector to 586 and not 587 as in the Fujitsu 2351 manual. The following jumpers should be set for 586 bytes per sector:

BC7	2-3	6-7	10-11	12-13
BD7	3-4	6-7	9-10	13-14
BE7	3-4	5-6	10-11	13-14
BF7	3-4	6-7	10-11	13-14

SPECIAL CONSIDERATIONS FOR THE CDC 9457 (LARK II) AND CDC 9455 (LARK) DISK DRIVES

Ensure options "Auto Seek On Head Change" and "Two Volumes (CMD)" are installed within the disk drive. The CDC Larks must be 32 sector type.

3.7 TAPE DRIVE PREPARATION

3.7.1 DRIVE ADDRESS

Most drives have internal address selection switches for address decoding; one for formatter selection (IFAD) and two for drive selection (ITAD0, ITAD1). Start/Stop drives with embedded formatters may have an IFAD switch on the formatter board and a unit select switch on each drive. See the drive's installation manual for switch locations.

3.7.2 PARITY SELECTION

Most drives have an internal switch for parity options. One position will cause the drive to generate its own parity according to the data it receives from the controller. The other position causes the drive to accept parity from the controller and record it exactly as it was received.

It is recommended that the drive be set for "external" parity only - that generated by the controller.

3.7.3 DENSITY

Remote switching of density selection is not supported. The drive should be configured for local density selection. The 400-294-00 software tape shipped with the controller is 1600 BPI unless otherwise indicated.

3.8 INITIAL DEVICE CODES

Unless otherwise requested, the controller is normally factory set to the SECONDARY device codes for disk (67 octal) and tape (62 octal) to avoid conflict if primary disk or tape subsystems are already installed in your system. Refer to the "Configuration Facts" page attached to the ZDF-1 Board Cover for device code verification. After power-up the Configurator program may then be used to set the disk and tape device codes to any values from 20 to 76. Primary device codes are normally 27 octal for disk and 22 octal for tape.

3.9 POWER-UP

Apply system power. The RED LEDs on each side of the controller should come on and then go off, indicating successful completion of controller selftesting. If this does not occur, refer to section 5.0. The tape coupler red LED should remain on from 2 to 4 seconds.

Functions of the other LEDs are described in section 2.1. After selftest, all should be off with the exception of the yellow LEDs on each side of the controller. These indicate unit de-selected for disk and offline for tape.

3.10 CONFIGURING THE CONTROLLER

The "Configurator" program supplied on the 400-294-00 1/2" magnetic tape must be run following hardware installation to configure various parameters within the controller per your requirements. The parameters are then stored by the controller in nonvolatile EEPROM memory.

NOTE: The ZDF-1 controller has been shipped from ZETACO with most configuration facts set to standard recommended values for both disk and tape sections unless, upon order, specific configurations are requested. These parameters are listed on a print-out attached to the ZDF-1 Board Cover.
In any event, the controller MUST be tailored for the disk drive types you have installed and the tape and disk subsystem emulations necessary for your system.

Refer to Sections 4.1.1 and 4.1.2 for instructions on loading and executing the Configurator Program.

Following are descriptions of each configurable feature supported by the ZDF-1. After completion of the Configurator, the computer must be powered down and then powered up to re-initialize the controller with the new parameters.

3.10.1 DISK FIELD DESCRIPTIONS

3.10.1.1 DEVICE CODE

The disk controller can be configured to any device code between 20 octal and 76 octal. Primary is normally 27 octal and the secondary is 67 octal. Secondary device code (67 octal) has been set at the factory to avoid conflict if a primary disk controller already exists. It should normally be changed to the primary value of 27 if no other disk controllers exist. If the device code is changed, it will not take effect until the computer is powered down and back-up.

3.10.1.2 THROTTLE BURST RATE

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

The ZDF-1 allows you to select a different burst rate for each SMD port thereby giving the ability to fine tune the bus to the particular speed or activity of each disk drive.

3.10.1.3 SYNC BYTE

The ZDF-1 supports a disk media format which contains a header sync byte and data field snyc byte versus a sync bit. The sync byte provides better header address verification and data integrity. This sync byte is user definable for each SMD port. Any value between 01 hex and FF hex is acceptable, although 93 hex (223 oct) is the recommended value. When entering a sync byte use the octal (oct) number. This feature can provide a means for disk pack access security between different disk subsystems.

3.10.1.4 ERROR CORRECTION ENABLE/DISABLE

When this function is enabled, on-board error correction and data strobe early/late occur automatically on bad disk data. Also, a running count of ECC corrections and successful data strobe early or late data recoveries are logged in scratch pad memory (separate count for each unit). With this function disabled, ECC corrections must be handled by the software. This feature can be selected on any port.

If any disks are going to be formatted and initialized following configuration, it is recommended that on-board ECC be disabled, then re-enabled after disk initialization.

3.10.1.5 MEDIA FORMAT

The ZDF-1 currently offers a choice of 4 different disk media formats, to maintain compatability with other disk subsystems. Each port is independently configurable for any of the formats.

The disk media formats available are:

- ZETACO STANDARD FORMAT - 10MHz (recommended for best performance and data integrity over a wide range of drive types).
- ZETACO HIGH SPEED FORMAT (version of standard format designed for use with drives with transfer rates of 1.8 MByte/sec. (15 MHz) or greater).
- ALTERNATE VENDOR FORMAT
- DATA GENERAL FORMAT (10MHz)

See Figure 2.2 for detailed information.

3.10.1.6 INTERLEAVE FACTOR

The ZDF-1 supports any sector interleave from 1:1 to 6:1 and each SMD port can have a different interleave ratio. 1:1 interleave is recommended for optimum performance and should be sufficient in most cases. Disk drives with very high transfer rates may require a sector interleave of 2:1 to avoid missing the next logical sector.

Interleaving may be used, along with throttling, to fine tune a system's performance. This is to avoid going a full revolution on the disk when the CPU cannot respond fast enough to access the next consecutive sector.

If data channel activity is too high to access the next consecutive sector, which is indicated by extremely slow disk performance, then an interleave factor of 2:1 or greater should be selected. To maintain optimum performance, don't select an interleave greater than is required to access the next logical sector in a multiple sector transfer.

3.10.1.7 DISK DRIVE TYPES

The ZDF-1 is capable of controlling virtually any disk drive that meets the SMD interface specification. The controller may be configured to assign drives of varying capacities, transfer rates, formats, etc. to any of the four ports.

However, when running under AOS only those drives which meet the sizing characteristics of the supported emulations can be used. Under RDOS the ZDF-1 can take advantage of the full capacity of most disk drives because Zetaco's disk initializer, CSDKINIT, allows deviation from standard RDOS disk emulations.

This section of the Configurator program allows the operator to assign drive characteristics on a port-by-port basis. Note that drive characteristics are assigned per "port", or "B" cable, and not per the drive's unit number setting. (Any unit can be connected to any of the four ports). A warning will be issued when a potentially illegal configuration is attempted. "HELP" information is available throughout.

Notes regarding dual volume drives:

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

There are two forms of dual volume drives:

The first is an actual dual volume drive, designed with two physical volumes, usually one fixed and one removable cartridge. These include the Control Data Corporation Lark and 9448 (CMD), and Amcodyne's 7110.

The other form is actually a single volume drive which is "split" by the controller into two logical units to provide the sizing characteristics necessary for emulation. For example, under AOS the Fujitsu 2351 (Eagle) is split for dual 6061 emulation, and the Applied Peripheral Systems 4835 is split for dual 6161 emulation.

Both forms of dual volume drives must have each logical unit formatted separately.

3.10.2 TAPE FIELD DESCRIPTIONS

3.10.2.1 DEVICE CODE

The tape coupler can be configured for any device code between 20 and 76 (octal). Primary is normally 22 and the secondary is 62. Secondary device code (62 octal) has been factory set to avoid conflict if a primary tape subsystem already exists. It should normally be changed to the primary value of 22 if no other tape subsystems exist. If the device code is changed, it will not take effect until the computer is powered down and back up.

3.10.2.2 TAPE EMULATION

The tape coupler has been factory set to 6021 emulation, which is used by RDOS (mnemonic MTX), or AOS (MTA). 6125 emulation is also supported, which is used by AOS (MTC). RDOS does not support 6125 emulation.

3.10.2.3 READ/LOOK-AHEAD ENABLE

Read Look-Ahead is a feature that helps avoid drive re-positioning during multiple-record reads on basic streamer drives. We recommend it be ENABLED for these drives. We recommend this feature be DISABLED for GCR or cache streamer drives, and for tension arm or vacuum column start/stop drives.

3.10.2.4 FAST BOT STATUS

This feature decreases the delay between the time a rewind command is issued to the tape coupler and Beginning-Of-Tape status (DIA bit 8-Load Point) is presented to the CPU. We recommend fast BOT be enabled.

3.10.2.5 ERASE ON WRITE RETRY

If this feature is enabled, the controller will automatically erase a segment of tape before attempting the write when retrying after a write parity error. The purpose of this option is to minimize AOS hard errors (15 retries) caused by bad tape media. Hard write parity errors are most likely to occur when recording at high density (GCR).

3.10.3 PRIORITY - DISK VS. TAPE

The user may select which section of the controller receives higher interrupt and data channel priority within the controller. The section which is given higher priority is equivalent to being nearest the CPU in the chassis priority chain. The controller is factory set giving the disk controller higher priority.

3.11 TAPE COUPLER TESTING

The tape system should be tested by running the Tape Diagnostic and Reliability programs included on the 400-294-00 tape, files 3 and 4. Instructions are provided in Section 4.3.

3.12 DISK TESTING AND INITIALIZATION

The following procedure is recommended to prepare each disk drive installed.

1. Verify that the "ECC ENABLE/DISABLE" flag for each disk drive port was set to the desired state during controller configuration.

   For most situations it is recommended that on-board error correction be disabled while running disk formatter and initializer programs. This will allow the programs to flag and detect those bad blocks which are potential problems even though they might be correctable at the time of running the initializer. However, it is also possible to run with ECC correction enabled in cases where there is a need for using marginal disk media.

2. Run the Disk Formatter Program per the instructions in Section 4.5.1. Run at least three passes, preferably six.

3. For RDOS systems, run the Disk Reliability program for at least 15 minutes per the instructions in section 4.5.3 to exercise and test the disk system.

   For AOS systems, first run at least six passes of the Disk Diagnostic program (disk sizing characteristics will be displayed) per section 4.5.2, followed by Disk Reliability.

4. For RDOS systems, run ZDKINIT. (Included on the 400-294-00 tape.)

   For AOS systems, run DFMTR. (Data General's AOS Disk Initializer on your system build tape).

5. For the final step, run the Configurator again to enable ECC correction for each disk drive port.

3.13 SYSGEN CONSIDERATIONS

3.13.1 DISK SYSGEN

RDOS USERS: When SYSGEN asks "Controller #1 6160/6161 Type?", answer NO. This allows up to four drives to be attached to the controller. Answering YES allows only two drives.

3.13.2 TAPE SYSGEN

The user must correctly specify the tape coupler device mnemonic at Sysgen time. The correct mnemonic depends on the operating system and the emulation the coupler is configured for (section 3.10.2.2). The situation is as follows:

RDOS: 6021 emulation is MTX
6125 emulation is not supported

AOS: 6021 emulation is MTA
6125 emulation is MTC

AOS/VS: 6021 emulation is not supported
6125 emulation is MTC

4.0 ZDF-1 SOFTWARE SUPPORT PACKAGE

The Software Support Package is supplied on the 400-294-00 1/2" magnetic tape. Included on the tape are the Configurator program, tape and disk maintenance programs and system support programs and utilities. Sections 3.10 - 3.12 of this manual describe the sequence of programs that should be run following installation. File 2 must be used to configure the controller per your requirements. In addition, only the Disk Formatter included should be used for formatting, and only ZDKINIT for disk initialization in RDOS systems. For AOS, use Data General's DFMTR. Other corresponding Data General programs may not work on this controller.

4.1 USING THE 400-294-00 TAPE

System Requirements:

Data General Nova/Eclipse Family CPU/SPU
Minimum 32K words memory
Console Device at 10/11
Magnetic Tape Drive: 1/2" 9-Track 1600 BPI
Printer at Device 17 for hard copy (optional)

If your system has another 1/2" tape subsystem, we recommend that it be used until the controller's tape interface is tested to be working properly.

The 400-294-00 tape is structured so that the programs on Files 2-10 can be loaded and executed directly from the tape. Files 0 and 1 contain the software which enables you to boot from the tape and select the particular program you want loaded into the system. Each of the programs on Files 2-10 is a stand-alone program. This means that they do not need, and cannot have, an operating system running when they are executed.

Programs cannot be loaded onto your disk directly from Files 0-10. File 11 for RDOS and File 12 for AOS contain the programs in the standard system dump format and you can load them from these files to your disk.

4.1.1 BOOTSTRAP PROCEDURES

1. Mount the tape on the drive and put it on-line. Be sure that the BPI setting matches that specified on the tape label (normally 1600 BPI).

2. Program Load - The ZDF-1 is normally factory configured to SECONDARY tape (device 62). The method of program load varies for the different processors.

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

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

For the S120 virtual console, enter 22H (or 62H for the secondary tape drive).

For MV class CPU's you must enter the full virtual console and respond to the prompt:

SCP-CLI>
with BOOT 22 (or 62 for secondary tape)

3. 400-294-00 menu will be displayed on console:

```
FILE #   PROGRAM                          FILENAME

  2      ZDF-1 CONFIGURATOR               CFZDF1.SV
  3      TAPE DIAG                        MTAFD.SV
  4      UNIVERSAL MAG TAPE RELI          UMTR.SV
  5      TAPEMODE (STAND-ALONE)           TAPEMODE.SV
  6      DISK FORMATTER                   DISKF.SV
  7      DISK DIAGNOSTIC                  DISKD.SV
  8      DISK RELIABILITY                 DISKR.SV
  9      ZDKINIT -DISK INITIALIZER        ZDKINIT.SV
           (RDOS SYSTEMS ONLY)
 10      ZDSKED -DISK EDITOR              ZDSKED.SV
           (RDOS SYSTEMS ONLY)
 11      ".SV & .LS" Files and any Utilities in
           RDOS dump format.
 12      ".SV & .LS" Files and any Utilities in
           AOS dump format.

 FILE NUMBER?
```

4. Enter the file number (2-10) you wish to execute, followed by CR. The tape should then space forward and load the program into memory. Refer to the sections which follow for instructions.

4.1.2 COPYING THE 400-294-00 TAPE TO DISK

Files 11-12 are RDOS and AOS "dump" versions of the programs on the previous files plus system executable utilities. Utilities are described in Sections 4.8 and 8.2.

If possible, the tape's contents should also be copied onto a media other than the ZDF-1 disk, such as an alternate disk subsystem, to avoid loading diagnostics from a suspect controller or peripheral at some later time.

To load files 11-12 onto disk, use the standard CLI commands for loading from tape:

FOR RDOS:

```
DIR %MDIR%
INIT MT0
LOAD/A/R/V MT0:11
RELEASE MT0
```

FOR AOS:

```
SUPERUSER ON
DIR :
LOAD/V/R @MTA0:12
REWIND @MTA0
SUPERUSER OFF
```

The files can now be booted from disk. For RDOS enter the filename (see menu in section 4.1.1) in response to FILENAME? For AOS enter the full pathname (including .SV) in response to PATHNAME?.

4.2 ZDF-1 CONFIGURATOR

The purpose of the Configurator is to set up the controller with information unique to your particular installation. The facts are then saved within the controller in non-volatile memory. Configuration need only be done at installation time, or at any later time to adjust performance, attach new disk drives, etc.

NOTE: We strongly recommend you save a hard copy of dialogue between operator and Configurator for future reference. The program has printer output control at device code 17 (LPT). If a printer is not available, the operator should record all configuration facts displayed by using the "L" command after configuration.

Boot the 400-294-00 tape and load the Configurator (File 2) per the instructions in section 4.1.1.

The program will display an introduction. Please read carefully before proceeding.

4.2.1 DEVICE CODE

Communication between program and controller is via the ZDF-1 disk device code. When the program requests the device code, respond accordingly:

- The controller is normally factory set to the secondary value of 67 octal to avoid conflict if another disk subsystem exists. The factory set device code is also listed on the "Configuration Facts" page attached to the ZDF-1 Board Cover.

4.2.2 CONFIGURATOR OPERATION

The ZDF-1 Configurator includes two "HELP" commands; one for OPERATIONAL questions and one that suggests WHAT you might want to do. Both are accessed from the main command menu. In addition, you can get an explanation for any item by responding with an "H" to the question. Please use these functions whenever you are uncertain as to what to do.

It is recommended that the "J" command be used for initial installation to allow setup of all parameters. When configuration is complete, enable the printer output and list the configuration. Use the "U" command to update the controller and the "Q" command to end the session.

Refer to Section 3.10 of the installation section for additional information and configurator field descriptions.

4.3 TAPE COUPLER MAINTENANCE SOFTWARE

4.3.1 TAPE DIAGNOSTIC

The Tape Coupler Diagnostic program is provided to find failures that are related to the basic operations of tape control. The diagnostic assumes the magnetic tape media is not the cause of errors. You should use a good scratch tape for the testing. In the interest of saving time during the EOT portion of diagnostics, it is a good idea to use a small tape reel.

A. Boot the diagnostics program (File 3) from tape 400-294-00 or disk. You should see the following:

```
-            MTAFD Release N.NN
-   Formatted Tape Coupler Diagnostics
-            Product of Zetaco

-   Please mount a write-enabled error free scratch tape.
-   Only the drive you are testing can be on-line.
-   Press any key to continue.
```

B. Load a scratch tape on the drive being tested, put the drive on-line and then press RETURN. Program displays:

```
-   Enter drive unit number:
```

C. After you have entered the unit number, the program will display:

```
-   Specify the Zetaco emulation type of the unit being
    tested.
-   (6021 = 0 or 6125 = 1):
```

Enter the value (0 or 1) which corresponds to the emulation selected during configuration.

D. Next you should select the recording mode to be tested:

- If the drive is set for NRZ (800 BPI), enter 0; otherwise enter 1.

E. Enter the tape coupler device code selected during configuration:

   - Enter device code [22]:

F. The last request before the tests are executed is:

   - Set switch register to the desired value, then press RETURN to continue.

G. If you wish to set any switches, refer to the program text file in the back of the manual. To proceed with the test, you must enter RETURN (NEW LINE will not do it).

H. When diagnostics have successfully run, the word CYCLE, followed by PASS #, will display. Run at least 6 passes. When errors are encountered, an explanation will be displayed and the program will loop on the error. To continue beyond the error, turn on Switch 1.

4.3.2 TAPE COUPLER RELIABILITY

The Reliability Program is provided to find intermittent and pattern sensitive problems.

A. Load the program (File 4) from 400-294-00 tape or disk.

   Program displays:

   - UMTR - Release N.NN
   - Universal Mag Tape Reliability
   - Product of Zetaco

   - Starting Addresses:

   - 500-Reliability Test
   - 501-Interchange Test (WRITE/READ)
   - 502-Interchange Test (READ ONLY)
   - 503-Command String Interpreter
   - 504-Error Log Printout

   - Set Switch register to desired value, then press RETURN to continue.

B. Load scratch tape on all drives to be tested. Press RETURN (not NEW LINE). You will be asked to specify the Model Number of your Tape Coupler:

   - Specify the Zetaco Model Number of the unit(s) being tested.
   - (110=1, 120=2, 133/ZDF-1 (6021)=3, 133A/ZDF-1 (6125)=4):3

C. You should enter 3 if the Coupler is configured for 6021 emulation, or 4 if it is configured for 6125 emulation. All the drives being tested must be at the same device code.

   - Enter device code [22]:

D. Enter the device code. Program then asks:

   - Enter 0 to test CRC (NRZI only), otherwise enter 1.

E. Specify the recording mode. Program then asks:

   - Enter 1 if the controller will be run in an AOS system, otherwise enter 0.

F. The last message reminds you to mount your scratch tapes:

   - Mount scratch tape(s). Press RETURN to continue.

G. Press RETURN (not NEW LINE). The Reliability tests will begin. While the program is running, you should press the SPACE BAR to display the current statistics of READS, WRITES and ERRORS.

H. Run Reliability for at least 15 minutes, check status.

4.4 TAPE STREAMING MODE UTILITIES

ZDF-1 Tape Coupler utilities included on the 400-294-00 tape all concern streamer-type drives. They include TAPEMODE- a stand-alone program, and system executable utilities for RDOS and AOS. If you have a streamer drive, you should read section 8 for information on optimizing the performance of the drive.

4.5 DISK MAINTENANCE SOFTWARE

4.5.1 DISK FORMATTER

The Disk Formatter Program is a utility designed program to format and check Disk Packs to be used on the Disk Systems. It is recommended that on-board error correction for each drive be disabled throughout both formatter and initializer programs. It should then be enabled by running the Configurator again after disk initialization. See section 3.12.

Boot the Disk Formatter program from tape 400-294-00 or disk.

The following is a sample dialogue:

```
ZETACO SMD DISK CONTROLLER FORMATTER REV. XX

STARTING ADDRESSES:

        500-FORMATTER/CHECK PROGRAM
        501-CHECK PROGRAM ONLY
        502-ERROR LOG RECOVERY
        503-COMMAND STRING INTERPRETER
ENTER DEVICE CODE [27]:
SET SWPAK AS PER SECT 8.0 OR HIT (CR) TO CONTINUE
START TIME? - MON,DAY,YR HR,MIN
# PASSES TO FORMAT COMPLETION? - 6
UNIT   TYPE    HDS     CYLS    SEC/TRK
 0      0       5       823      32
 2      1       5       815      24
ENTER UNIT NUMBERS (0,1,2,3) TO RUN:  0,2
UNIT: 0
ENTER TYPE OF DISK: 0
UNIT:2
ENTER TYPE OF DISK: 1
FORMATTING UNIT 0,2
```

See Formatter Text at end of Manual for further details.

4.5.2 DISK DIAGNOSTIC

This diagnostic program is provided to find failures that are related to the basic operations of the Disk Controller.

Boot the Disk Diagnostic from tape 400-294-00 or disk.

The following is a sample dialogue for 6160 (AOS):

```
ZETACO SMD DISK CONTROLLER DIAGNOSTIC REV. XX
STARTING ADDRESSES:
        200-DIAGNOSTIC (INITIALIZE)
        201-DIRECT ODT ENTRY
        202-RANDOM SEEK EXERCISERS
            SEEK EXER 1 IS A SINGLE DRIVE EXERCISER
            SEEK EXER 2 IS A TWO DRIVE EXERCISER WITH SEEK
              OVERLAP
        500-DIAGNOSTIC (RESTART)
ENTER DEVICE CODE [27]: 67
ANY DUAL VOLUME UNITS?  ENTER 1
ENTER UNIT NUMBES (0,1,2,3) TO RUN:  0,1
SET SWPAK AS PER 8.0, LISTING OR ENTER RETURN (CR) TO CONT.
TESTING UNIT 0
.
.
.
.
UNIT    HDS     CYLS    SEC/TRK
  0      5       823     35
These are the units and characteristics found, do you
want to loop on reading them?  Enter 1, otherwise enter
Return (CR).
.
.
.
.
```

See Diagnostic Text at the end of the Manual for further details.

```
ADDRESSABLE SECTORS/TRACK WITH THIS CONTROLLER IS 64.
DRIVE UNIT #0 WILL BE IDENTIFIED AS A 6160 (73 MBYTE)
BY AOS OR AOS/VS.
DRIVE UNIT #1 WILL BE IDENTIFIED AS A 6160 (73 MBYTE)
BY AOS OR AOS/VS.
TEST(S) COMPLETE.
SEEK EXERCISER TESTS.
PASS
```

4.5.3 DISK RELIABILITY

The Disk Reliability program is a maintenance program designed to exercise and test the Disk System. The program will test from one to four drives. Boot the Disk Reliability program from tape 400-294-00 or disk.

The following is a sample dialogue:

```
ZETACO...DISK RELIABILITY REV. XX
STARTING ADDRESSES:
        500-RELIABILITY TEST
        501-RELIABILITY TEST WITH OPTIONS
        502-DISK ADDRESS TEST
        503-COMMAND STRING INTERPRETER
        504-FORMAT ONLY
        505-RUN ALL TESTS
        506-SEEK EXERCISER
        507-RANDOM SEEK EXERCISER
        510-ERROR COUNT/LOG RECOVERY
ENTER DEVICE CODE [27]:
STARTING ADDRESS = 505
SET SWPAK AS PER 8.0, OR HIT (CR) to CONT.
ARE MAPS TO BE EXERCISED (YES/NO)?  YES
START TIME? - MON,DAY,YR  HR,MIN
ANY DUAL VOLUME UNITS (YES/NO)?  NO
UNIT    TYPE    HDS     CYLS    SEC/TRK
 0       0       5       823      32
 2       1       5       815      24
ENTER UNIT NUMBERS (0,1,2,3) TO RUN:  0,1
UNIT: 0
ENTER TYPE OF DISK: 0
UNIT: 1
ENTER TYPE OF DISK: 1
TESTING UNIT 0,1
```

See Reliability Text at the end of Manual for further details.

4.6 DISK INITIALIZATION

If on-board ECC was disabled during formatting, it should also remain disabled until the initializer is finished, then enabled using the Configurator.

For RDOS systems, use ZETACO's ZDKINIT, per the instructions in section 4.6.1.

For AOS systems, use the DFMTR program from your system build tape.

4.6.1 ZDKINIT - RDOS DISK INITIALIZER

Before you load any RDOS system onto a Model ZDF-1 disk, YOU MUST INITIALIZE THE DISK BY RUNNING ZDKINIT. This is a stand-alone program which performs all the functions of Data General's DKINIT. Please refer to Data General manual on loading an RDOS system for full details on the functionality of disk initialization.

Remember that only ZDKINIT will work correctly for Model ZDF-1 disks. If you are building your system from an RDOS release tape, do NOT run file 4 on the D.G. tape after running ZDKINIT. Data General's DKINIT cannot be run on a Model ZDF-1 disk. ZDKINIT can, however, be used to initialize any DG supported disk.

STEP 1 - LOADING

Boot the ZDKINIT program from tape 400-294-00 or disk.

STEP 2 - DISK TYPE

```
PROGRAM DISPLAYS:
        DISK INITIALIZER - REV.NN.NN/with ZETACO Disk
                Support-REV.1
        DISK DRIVE MODEL NUMBER?
YOU RESPOND:
        6XXX
NOTE:  Enter the X's as shown above.
A)  If the disk type is not valid-
PROGRAM DISPLAYS:
        ILLEGAL DISK TYPE
Step 2 will be repeated until your response is acceptable.
B)  If the disk type is valid-
PROGRAM DISPLAYS:
        6XXX (ZETACO Emulation) Drive Type
```

STEP 3 - DISK UNIT
PROGRAM DISPLAYS:
        DISK UNIT?
YOU RESPOND:
        DZx, where x indicates drive number: 0,1,...,7
A) If the disk unit is not valid-
PROGRAM DISPLAYS:
        ILLEGAL DISK UNIT DECLARATION
Step 3 will be repeated until your response is acceptable.
B) If the disk unit is valid-
PROGRAM DISPLAYS:

#HEADS	#SEC/TRK	#CYLINDERS	MGB/BLK
H	S	C	Megabytes if disk >4000 blks. Blocks if disk <4000 blks.

H = the number of heads, S = the number of sectors, and C = the number of cylinders the logical disk unit is configured as.

STEP 4-COMMANDS AND SUBSEQUENT OUTPUT
The commands which can be selected are identical to those of DKINIT.
From this point on ZDKINIT will perform exactly as DKINIT.

4.7 ZDSKED - RDOS STANDALONE DISK EDITOR

ZDSKED provides the same functions for the ZDF-1 disk as Data General's DSKED does for standard DG disks. It can also be used for any DG supported disk. Please refer to the Data General Stand-alone Disk Editor Manual for a complete description of the commands.

We will describe the steps necessary to run ZDSKED.

STEP 1 - LOADING
Boot the ZDSKED program from tape 400-294-00 or disk.

STEP 2 - DISK TYPE
PROGRAM DISPLAYS:
        DISK EDIT - REV NN.NN WITH ZETACO DISK SUPPORT -
                REV. 1
        DISK DRIVE MODEL NUMBER?
YOU RESPOND:
        6XXX
NOTE: Enter the X's as shown above.
A) If the disk type is not valid -
PROGRAM DISPLAYS:
        ILLEGAL DISK TYPE
Step 2 will be repeated until your response is acceptable.
B) If the disk type is valid -
PROGRAM DISPLAYS:
        6XXX (ZETACO Emulation) Drive Type

STEP 3 - DISK UNIT
PROGRAM DISPLAYS:

DISK UNIT?

YOU RESPOND:

DZx, where x indicates drive number: 0,1,...,7

A) If the disk unit is not valid -
PROGRAM DISPLAYS:

ILLEGAL DISK UNIT DECLARATION

Step 3 will be repeated until your response is acceptable.

B) If the disk unit is valid -
PROGRAM DISPLAYS:

# HEADS H	# SEC/TRK S	# CYLINDERS C	MBG/BLK
			Megabytes if disk >4000 blks. Blocks if disk <4000 blks.

H = the number of heads, S = the number of sectors, and C = the number of cylinders the logical disk unit is configured for.

STEP 4 - COMMANDS AND SUBSEQUENT OUTPUT
The commands which can be selected are identical to those of DSKED. From this point on ZDSKED will perform exactly as DSKED.

4.8 DISK ECC COUNTER UTILITIES

The Model ZDF-1 controller maintains a counter of ECC corrections for each disk drive connected to the board(s). These are the corrections performed by the firmware and are therefore invisible to the system except through these counters. The counters are automatically cleared by the reset switch on the front panel or if the controller is powered down.

The utilities must be loaded onto disk from the 400-294-00 tape (RDOSECC.SV for RDOS and AOSECC.PR for AOS). The utilities allow you to monitor the media by displaying or modifying the counters. Some installations may decide to reset the counters to zero on some regular basis: daily, weekly, monthly, etc.

STEP 1 - EXECUTING THE PROGRAM UNDER CLI

A) RDOS Version

ENTER: RDOSECC

B) AOS Version

ENTER: X AOSECC

STEP 2 - MAIN MENU
ZETACO - ECC FUNCTIONS
1 - DISPLAY CONTROLLER ECC CORRECTIONS
2 - RESET CONTROLLER ECC CORRECTIONS
3 - STOP
NOTE - SELECT ONLY THOSE DRIVES WITH ZETACO CONTROLLER BOARDS.
RESULTS ARE UNPREDICTABLE ON OTHER BOARDS!
ENTER SELECTION
YOU RESPOND:
1) To display the ECC corrections counter(s)
2) To modify the ECC corrections counter(s)
3) To terminate the program and return to the CLI

STEP 3 - ENTERING THE UNIT
If you selected 1 or 2,
PROGRAM DISPLAYS:
ENTER UNIT:
YOU RESPOND:

DZn	(n=0, 1, ..., 7)	for RDOS
DPFn	(n=0, 1, 2, 3, 10, 11, 12, 13)	for AOS
Carriage return or new line to return to Main Menu.		

The program will display the (decimal) value of the corrections counter for the drive selected. This step will be repeated until the response to ENTER UNIT is carriage return or new line.

STEP 4 - MODIFYING THE COUNTER
If your response to the Main Menu was 2 - there will be another message after Step 3:
ENTER NEW VALUE:
You respond with the (decimal) value to which you want the counter set. The number must be between 0 and 65,535. This step will be repeated until you enter a carriage return or new line which will return you to Step 3.

5.0 TROUBLE-SHOOTING, CUSTOMER SERVICE

5.1 SELFTEST

The ZDF-1 controller runs on-board microdiagnostics each time the board is powered up. Disk and tape microprocessors perform independent, extensive testing of all internal controller functions. The RED LEDS indicate selftest; the left LED is on during disk selftest (300 ms.), and the right LED is on during tape selftest (will be less than 4 seconds).

If selftest passes, both LEDS will go off. If either disk or tape sections detect an error, the corresponding LED will blink an error code used in locating the malfunctioning circuit within the controller.

Depressing the computer's reset switch while the error code is being displayed causes that section to loop on the error.

Any command issued to the tape coupler will cause it to abort selftest and if not aborted, the coupler will appear Not Ready to the system until tape selftest successfully completes.

Reference Table 5.1 for disk selftest error codes and Table 5.2 for tape selftest error codes.

CODE	TEST	POSSIBLE FAILURE
1	EEPROM TEST	The data in the EEPROM did not compare with expected data (55 hex). EEPROM may not have been previously burned.
2	RAM TEST	Data read from RAM did not compare with data written. 2114, PBUS or RAM data bus may be bad.
3	2940 ADDRESS GENERATOR TEST	Data read from 2940's did not compare with data written. 2940 may be bad.
4	SEQUENCE ERROR TEST	A forced sequence error did not occur within a specified amount of time. Format sequencer may be bad. (No Clock)
5	SYNC DETECT TEST	A sync detect was not made in a specified amount of time or the terminate FF may not have set. The sync register or compare logic may be bad or the terminate FF may be bad.
6	ECC TEST	The generated ECC pattern did not compare with the expected pattern. The shift registers, ECC logic, or multiplexers may be bad.

The disk selftest error code is displayed via the red LED on the left side of the controller front edge. If the LED does not blink or go out, then the 2925 clock circuitry, the 2910 or the power fail circuit may be bad.

DISK SELFTEST ERROR CODES

TABLE 5.1

CODE	TEST	POSSIBLE FAILURE
1	MICRO PROCESSOR RAM TEST	Read data did not compare with what was written 6810 (238 x 8 Ram)
2	DONE/BUSY TEST	Done did not set or busy done were not cleared on power up
3	DATA LATE TEST	Data late flip-flop was set on power on or it did not set after one more reference with a full buffer.
4	WORD COUNT OVERFLOW TEST	Word count overflow flip-flop did not set when expected (should set after 65536 counts)
5	ILLEGAL FLAG TEST	Illegal status bit did not set or it was not detected as being set (ISTAT)
6	FIFO BUFFER TEST	The READ data did not compare with what was written. 2114's (1024 x 8 Ram)
7	ADDRESS TURNOVER TEST	Address turnover flip-flop did not set when expected. (Should set after 1024 RD/WT buffer references)
8	EPROM CHECK SUM	Check sum calculation did not agree with the data in the check sum location (replace EPROM)

The tape selftest error code is displayed via the red LED on the right side of the controller front edge.

TAPE SELFTEST ERROR CODES

TABLE 5.2

CUSTOMER SERVICE

Our warranty attests the quality of materials and workmanship in our products. If malfunction does occur, our service personnel will assist in any way possible. If the difficulty cannot be eliminated by use of the following service instructions and technical advise is required, please phone Zetaco giving the serial number, board name, model number and problem description. You will be placed in contact with the appropriate technical assistance.

PRODUCT RETURN

Pre-return Checkout.

If controller malfunction is suspected, the use of test software is needed to determine if the controller is the problem and what in particular is wrong with the controller. The tests applicable to this board are listed on the next page of the manual. Please run the test sequence BEFORE considering product return.

Returned Material Authorization.

Before returning a product to Zetaco for repair, please ask for a "Returned Material Authorization" number. Each product returned requires a separate RMA number. Use of this number in correspondence and on a tag attached to the product will ensure proper handling and avoid unnecessary delays.

Returned Material Information.

Information concerning the problem description, system configuration, diagnostic program name, revision level and results, i.e., error program counter number should be included with the returning material. A form is provided for this information on the next page of the manual.

Packaging.

To safeguard your materials 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.

(include with returning material)

MATERIAL RETURN INFORMATION

All possible effort to test a suspected malfunctioning controller should be made before returning the controller to Zetaco for repair. This will: 1) Determine if in fact the board is defective (many boards returned for repair are not defective, causing the user unnecessary system down-time, paper work, and handling while proper testing would indicate the board is working properly). 2) Increase the speed and accuracy of a product's repair which is often dependent upon a complete understanding of the user checkout test results, problem characteristics, and the user system configuration. Checkout results for the ZDF-1 Controller should be obtained by performing the following tests. (include error program counter numbers and accumulator contents if applicable; use back of sheet if more space is needed).

FUNCTION	TEST	RESULT
Power-Up	Disk Selftest	_____
	Tape Selftest	_____
Tape Coupler	Tape COUPLER DIAG	_____
	UNIV. MAG TAPE RELI	_____
DISK CONTROLLER	DISK DIAGNOSTIC	_____
	DISK RELIABILITY	_____

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

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

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

2. What operating system are you running under? (AOS, RDOS)

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

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

To be filled out by CUSTOMER:

Model #: _____
Serial #: _____
RMA #: _____

Returned by: _____
(company name)

6.0 DISK PROGRAM CONTROL

6.1 INSTRUCTION FORMAT

Symbolic form for I/O instructions:

DXXF AC, DSKP

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

F = Function:

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

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

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

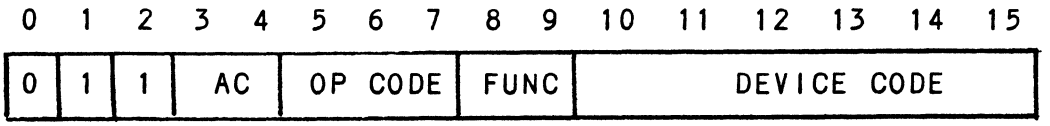
AC = Accumulator: 0, 1, 2 or 3.

DSKP = Device Code: Primary - 27 Octal

Secondary - 67 Octal

(Other available)

BINARY REPRESENTATION OF AN I/O INSTRUCTION



INTERRUPT MASK BIT 7

MSKO AC

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

IORESET INSTRUCTION

IORST

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

IOSKIP INSTRUCTION

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

SKPBZ DSKP - SKIP IF BUSY FLIP-FLOP IS CLEAR.

SKPBN DSKP - SKIP IF BUSY FLIP-FLOP IS SET.

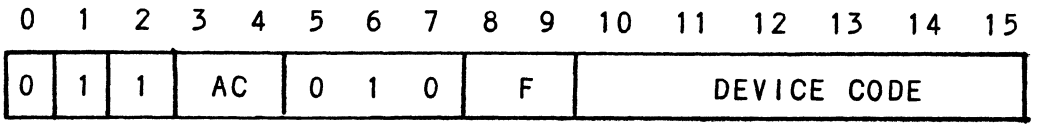
SKPDZ DSKP - SKIP IF DONE FLIP-FLOP IS CLEAR.

SKPDN DSKP - SKIP IF DONE FLIP-FLOP IS SET.

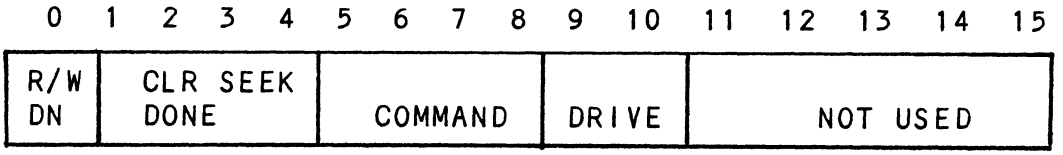
6.2 ACCUMULATOR FORMATS

6.2.1 DOA - SPECIFY COMMAND AND DRIVE

DOAF AC, DSKP



Accumulator



BIT POSITION

0 - Clear Read/Write Done if it is a one

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

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

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

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

5 - 8 Specify Command

		FUNCTION REQUIRED TO INITIATE
0000	READ	START
0001	RECALIBRATE	PULSE
0010	SEEK	PULSE
0011	STOP DISK	PULSE
0100	OFFSET FORWARD	PULSE
0101	OFFSET REVERSE	PULSE
0110	WRITE DISABLE	PULSE
0111	RELEASE DRIVE	PULSE
1000	TRESPASS	PULSE
1001	SET ALT MODE 1	NONE
1010	SET ALT MODE 2	NONE
1011	EXAMINE RAM	PULSE
1100	DATA VERIFY	START
1101	READ BUFFERS	START
1110	WRITE	START
1111	FORMAT	START

NOTE: See Section 6.3 for detailed command description

9 - 10 Drive Selection

00 - Drive Unit 0

01 - Drive Unit 1

10 - Drive Unit 2

11 - Drive Unit 3

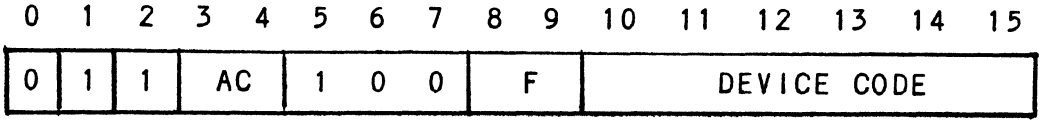
DOA will reserve a previously unreserved drive.

Bit Position 9 is not used if 616X.

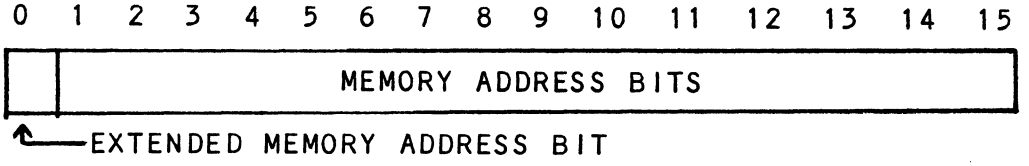
11-15 Reserved for future consideration

6.2.2 DOB - LOAD STARTING MEMORY ADDRESS

DOBF AC, DSKP



Accumulator

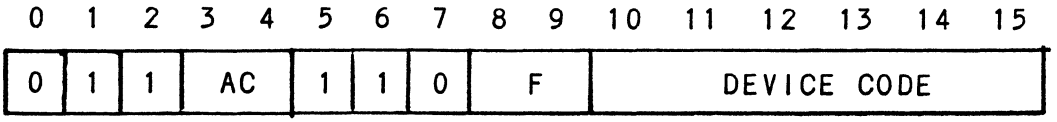


Execution of this instruction will load the controllers address counter with the contents of the specified accumulator and will be used as the starting memory address for a command that requires a data channel transfer operation.

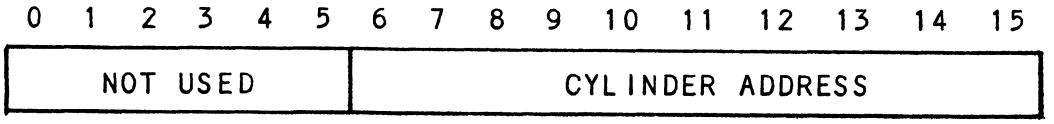
6.2.3 DOC - LOAD DRIVE ADDRESS

6.2.3.1 DOC - SPECIFY CYLINDER

DOCF AC, DSKP

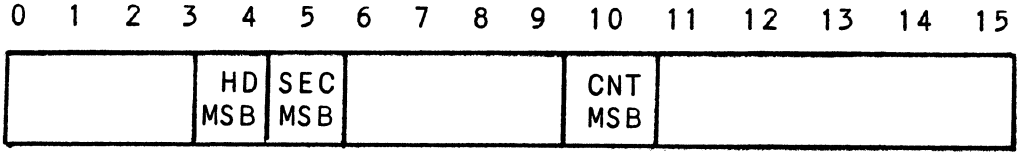


Accumulator (if previous DOA specified a Seek)

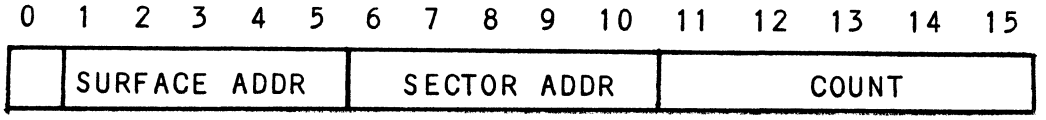


6.2.3.2 DOC - FIRST DOC SPECIFIES EXTENDED SURFACE, SECTOR AND COUNT (DOUBLE DOC MODE ONLY)

Accumulator (if previous DOA specified a Read, Write, Format or Data Verify)



6.2.3.3 DOC - SECOND DOC SPECIFIES LOWER FIVE BITS OF SURFACE, SECTOR AND COUNT (FIRST AND ONLY DOC IF SINGLE DOC MODE)



0 - Not Used

1 - 5 Starting Surface Address

6 - 10 Starting Sector Address

11-15 Two's complement of number of sectors to be transferred

6.2.4 READ STATUS - NON ALTERNATE MODE

6.2.4.1 DIA - READ DATA TRANSFER STATUS

DIAF, AC, DSKP

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

Accumulator

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

0 - Control Full

1 - R/W Done

2 - Unit 0 Atten Done

3 - Unit 1 Atten Done

*4 - Unit 2 Atten Done

*5 - Unit 3 Atten Done

6 - Bus Error

7 - Illegal Sector Adr

8 - ECC Error

9 - Bad Sector Flag

10 - Cyl Addr Error

11 - Surf/Sect Addr Error

12 - Verify Error

13 - R/W Timeout

14 - Data Late

15 - Read/Write Fault

*Bit Positions 4 and 5 are not defined if 616X Emulation

DATA TRANSFER STATUS BIT DESCRIPTIONS

BIT POSITION	NAME	DESCRIPTION
0	CONTROL FULL	Will be a one when the controller receives a pulse function. Will be a zero once the controller completes the function to the drive that was specified by the command (Recal, Seek, Stop Disk, Offset, WRT DIS, Release, Trespass and Exam Ram).
1	R/W DONE	A one indicates that the done flag was set following a data transfer command.
2-5	UNIT ATTEN DONE (UNITS 0-3)	A one indicates that the respective drive completed a successful seek or recalibrate operation. If the drive was unsuccessful in its attempt to seek, a positioner fault status will be indicated. A recalibrate operation will clear the fault.
6	BUS ERROR	An incorrect number of memory transfers resulted on the data channel when set to a one.
7	ILLEGAL SECTOR ADDR	The starting sector address (DOC) exceeded the capacity of the drive if set to a one. Done sets immediately.
8	ECC ERROR	A sector of data read from the disk did not correlate with the appended polynomial. This means that the data read does not agree with the data that was originally written.
9	BAD SECTOR FLAG	The controller detected the bad sector flag set to a one within the sectors address header. (Done will set immediately). This implies that the format program originally determined that the surface within this sector could not support errorless data.

10	CYLINDER ADDRESS ERROR	The Cylinder Address contained within the Sectors Header did not match the requested cylinder given by the previous seek command. Bit 11 will set, instead, if there is no match due to a media flaw. The Read/Write Operation will be terminated immediately.
11	SURFACE/ SECTOR ADDRESS ERROR	This status bit may be set by one of the following cases: 1) The Surface or the Sector Address contained within the Sectors Header did not match the current contents of the controller's Surface/Sector Register (initiated by a DOC). 2) The CRC polynomial did not correlate with the Header Address. 3) The Data Sync on a Read Command could not be detected. The Read/Write operation will be terminated immediately.
12	VERIFY ERROR	Data in memory did not agree with the data on the disk. (See Verify Command).
13	READ/WRITE TIMEOUT	A Read or Write type of operation did not complete within one second.
14	DATA LATE	Not implemented.
15	*READ/WRITE FAULT FLAG	A one indicates that at least one bit is set in bit positions 6 through 14 or a drive fault occurred during a Read/Write transfer operation.

*Refer to Table 6.1 for a detailed description of bits 6-14.

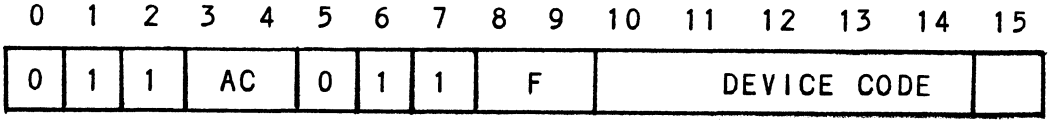
	STATUS BIT POSITION	CONTROLLLER ACTION	ERROR RECOVERY
BUS ERROR	6	Sets done immediately	New command. Re-try Read/Write Transfer. May correct the problem.
ILLEGAL SECTOR ADDRESS	7	Sets done immediately	New command if error re-occurs. Make sure the controller is configured to match the drive type.
ECC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

READ/WRITE FAULTS (DIA)

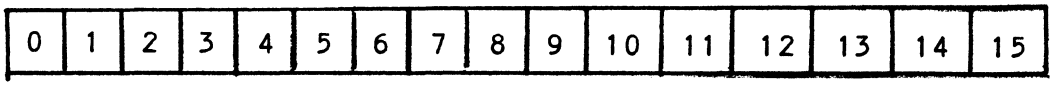
TABLE 6.1

6.2.4.2 DIB - READ DRIVE STATUS

DIB AC, DSKP



Accumulator



*0 - Invalid Status

*1 - Drive Reserved

*2 - Trespassed

3 - Ready

4 - Busy

*5 - Positioner Offset

6 - Write Disabled

*7 - ID

*8 - III Sur/Cyl Addr

*9 - Illegal Command

*10 - DC Voltage Fault

*11 - Pack Unsafe

12 - Positioner Fault

*13 - Servo Clock Fault

*14 - Write Fault

15 - Drive Fault

*These Bits are undefined if 616X.

0	INVALID STATUS	A one indicates that Status Bits 1 through 15 should be ignored because the drive is not selected or it is in the process of being selected.
1	DRIVE RESERVED	In a dual port configuration the selected drive is currently in use by another processor.
2	TRESPASSED	Not implemented.
3	READY	Drive unit specified by a previous DOA command is selected, spindle is up to speed and positioner is on cylinder.
4	BUSY	The positioner within the currently selected drive is not on cylinder.
5	POSITIONER OFFSET	The selected Read/Write head was moved from on cylinder dead center as was specified by an offset forward or reverse command.
6	WRITE DISABLED	Status from the drive indicates that a write type of command cannot be executed.
7	ID	This Bit is a one if 6122 is selected, a zero for all other emulations.
8	ILLEGAL SURFACE OR CYLINDER ADDRESS	The requested surface or cylinder address exceeds the capacity of the drive. Read/Write operaation will terminate immediately.
9	ILLEGAL COMMAND	The controller was requested to perform a write type of command while servo is offset or write disabled is active.

10	DC VOLTAGE FAULT	Not implemented.
11	PACK UNSAFE	Conditions exists within the drive which may impair the safety of the media. This bit will be a one if a fault status is received directly from the drive interface.
12	POSITIONER FAULT	This indicates that the drive was unable to complete a seek within 500 ms, or that the positioner has moved to a position outside the recording field. The system should send a recal command to recover from this error.
13	SERVO CLOCK FAULT	A clock synchronization failure occurred between the serial data being read and the reference clock coming from the disk drive. In most cases this means that the header or data sync was not encountered within a specified amount of time. This flag would set if the format on the disk did not agree with what the controller expected. Check the configuration to make sure the proper format was selected.
14	WRITE FAULT	An abnormal condition was detected by the drive during a write type of operation.
15	*DRIVE FAULT	One or more bits are set in positions 8 through 14 or the drive detected an abnormal condition.

*Refer to Table 6.2 for a detailed description of bits 8-13.

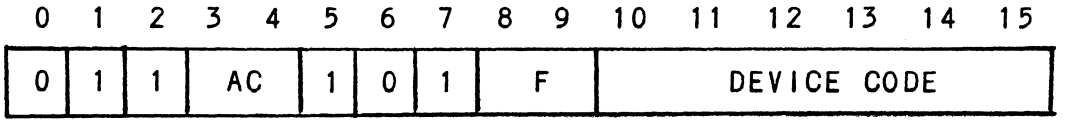
	STATUS BIT POSITION	CONTROLLER ACTION	ERROR RECOVERY	DRIVE ACTION
ILLEGAL SURFACE	8	Command is rejected and Done is set immediately,	New Command	None
ILLEGAL CYLINDER	8	Seek Command is rejected,	New Seek or Recal Command	None
ILLEGAL COMMAND	9	Command is rejected and Done is set immediately.	New Command	None
PACK UNSAFE	11	Command is terminated.	A Recal Command, if the controller caused the Fault (i.e. exceeding the Surface or Cylinder Address or Write Command while Write is disabled).	Fault status is issued to controller. Refer to Drive Manufacturer's Specifications for Faults that cannot be cleared by Fault Clear (Recal) from the controller.
POSITIONER FAULT	12	If it is detected at the start of a Read or Write Command, Pack Unsafe will also Set and the Command will terminate immediately.	Recal Command	Fault Status is issued to the controller along with Seek Error.
SERVO CLOCK	13	Read/Write Command is terminated immediately.	Reformat the surface or select the proper format on the controller. The format on the surface did not agree with the format selected on the controller.	None

DRIVE FAULT TABLE (DIB)

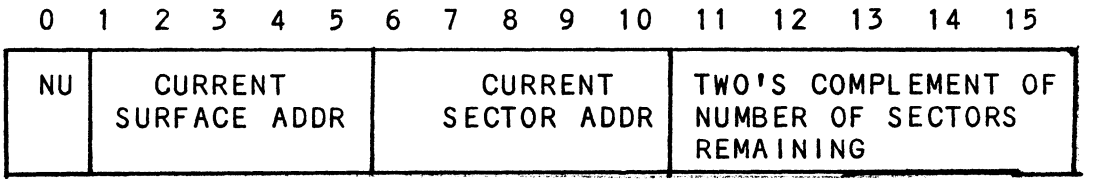
TABLE 6.2

6.2.4.3 DIC - READ SURFACE, SECTOR AND COUNT

DICF AC, DSKP



Accumulator



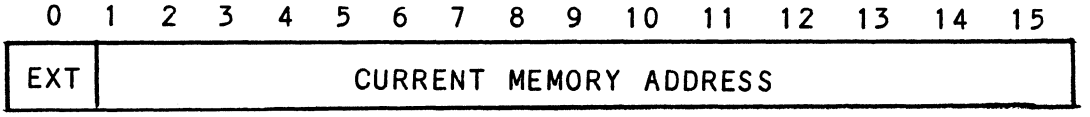
6.2.5 READ STATUS - ALTERNATE MODE ONE

See detailed description of Alternate Mode One Command. Previous DOA specified ALT Mode One for Sections 6.2.5.1 through 6.2.5.3.

6.2.5.1 DIA - READ CURRENT MEMORY ADDRESS

DIAF AC, DSKP

Accumulator

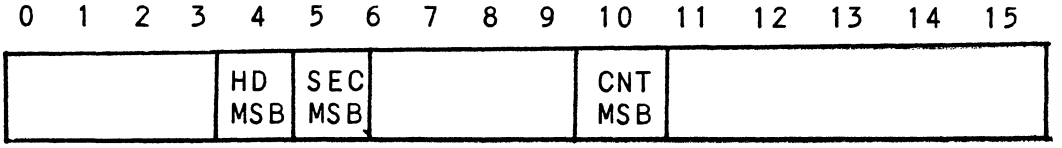


After the execution of this instruction the value of the accumulator will contain the memory address to where the next data word transfer will take place. The memory address counter is incremented by one after each data channel transfer.

6.2.5.2 DIB - READ EXTENDED DISK ADDRESS

DIBF AC, DSKP

Accumulator



The AC will contain the current most Significant Bits for the Surface (Bit 4), Sector Address (Bit 5) and Two's Complement Count (Bit 10). These Bits will allow the System to reference up to 64 heads or sectors.

6.2.5.3 DIC - NOT CURRENTLY IMPLEMENTED

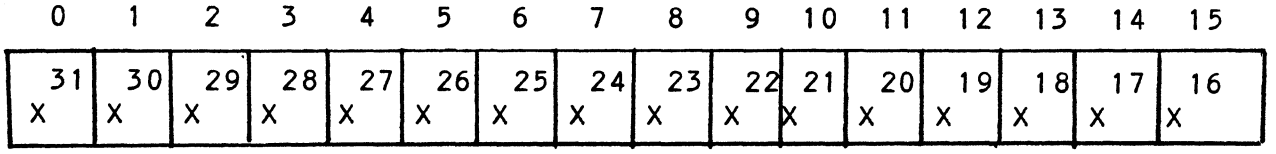
6.2.6 READ STATUS - ALTERNATE MODE TWO

See detailed description of Alternate Mode Two Command. Previous DOA specified ALT Mode Two for Sections 6.2.6.1 through 6.2.6.3.

6.2.6.1 DIA - READ ECC REMAINDER UPPER

DIAF AC, DSKP

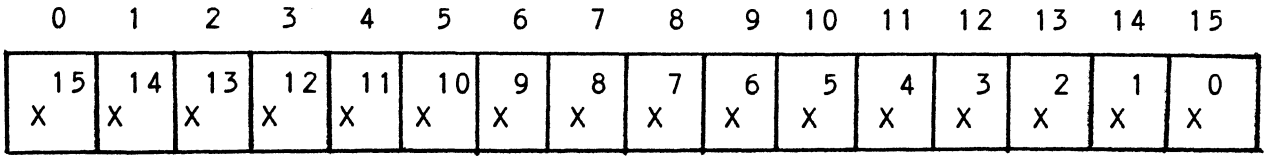
Accumulator



6.2.6.2 DIB - READ ECC REMAINDER LOWER

DIBF AC, DSKP

Accumulator



6.2.6.3 DIC - NOT CURRENTLY IMPLEMENTED

6.3 DETAILED COMMAND DESCRIPTIONS

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

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

The Command is stored in the controller via a DOA instruction. Before any Command is initiated, the selected Unit must have valid status and be ready.

6.3.1 DATA TRANSFER COMMANDS

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

Read/Write Initialization Steps:

1. Control full and Drive status must be tested for proper state before commencing with a Read/Write Command.
2. Send the Starting Surface and Sector Address along with the two's complement of the number of sectors transferred. (See DOC)
3. Send the Starting Memory Address of where the data should be stored or retrieved. (See DOB)
4. Send the Command type and the desired Drive Unit Number. (See DOA)
5. Issue a Start Pulse.

Read/Write Termination Possibilities (Done Set):

1. All the sectors implied by the two's complement sector count were transferred.
2. A Drive or Read/Write Error was encountered. DIC command should be issued to determine which sector the error occurred at.
3. Busy was cleared by an IORESET instruction or a clear pulse was issued to the controller during the Read/Write transfer. Done will not set in this case.

6.3.1.1 READ DATA COMMAND

When busy sets, the controller will wait for on cylinder if the previous seek command has not been completed yet. It will then search for the starting sector address specified by the previous DOC instruction.

The header is read and compared with the starting sector address, starting surface address and stored cylinder address to insure that the proper sector has been physically located. Before the data can be accepted the header must match the specified address, the header CRC must be good and no bad sector flags encountered. If the header is in error or the bad sector flag is a one, the appropriate status bit and done flag is set immediately.

When the drive's RD/WRT head reaches the data field the serial data is sent to the SMD interface formed into parallel words by the controller and transferred to the buffer. When all 256 words are contained within the buffer, the ECC Code appended in the data is checked to insure proper data by reading the results of the remainder. A data error occurred if the remainder is not equal to zero. In the case of an error the controller will transfer the data into memory and then set ECC Error Flag and Done.

If the ECC Enable feature is selected (refer to Configuration section), the controller will attempt to correct the data within its own buffer prior to transferring it to memory.

If it determines that it is not correctable, the controller will re-try on its own with a Data Strobe Early and if unsuccessful, again with a Data Strobe Late. If the data is still not correctable, then it will set ECC Error Flag and Done. If more sectors are to be transferred, the controller will begin searching for the next sector while the data from the previous sector is transferred to memory.

6.3.1.2 WRITE DATA COMMAND

When busy sets, the controller will wait for the positioner to be on cylinder if the selected drive is still in the process of seeking. Upon the completion of the previous seek operation, the controller will transfer 256 words of data from memory to a sector buffer. The starting address of memory was specified by the previous DOB instruction.

The controller searches for the desired sector and performs a head verification (same as the read command) before data is written on to the surface of the disk. Once the correct sector is found, the controller will select the sector buffer previously written by the data channel control. The contents of this buffer is then written on to the disk surface preceeded by a gap and data sync. The controller incorporates two sector buffers. Therefore, the data channel logic can write into one buffer while data is transferred to the disk from the other.

6.3.1.3 VERIFY

When busy sets, the controller initially starts out as if it were a read command (i.e. wait for on cylinder, verify header etc). Once a full sector is transferred from the disk to a controller buffer a comparison is made against system memory. This is accomplished by reading a word from memory starting from the previous DOB and comparing each word of sector. If a word does not compare, data transfer status (DIA) Bit 12 and Done will set.

6.3.1.4 FORMAT

The objective of the format command is to write the header information (surface, sector and cylinder address) on a sector. Up to 64 contiguous sectors may be formatted per command. Data that was contained within the sector will be lost (replaced by all zeros). Refer to Figure 2.2 for format details. Format is also used to set the bad sector flag.

6.3.1.5 READ BUFFERS

Reads the contents of the currently used buffer and transfers all 256 words to memory specified by the starting address. Primarily used for diagnostic purposes.

6.3.2 DRIVE COMMANDS

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

6.3.2.1 RECALIBRATE

Moves the heads to cylinder 0, selects Head 0, and issues a fault clear to the drive.

An IORESET switch will automatically cause a recalibrate command to be issued to Unit 0.

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

6.3.2.2 SEEK

Moves the heads to the cylinder specified by the DOC.

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

See the SMD specification for the Seek Timing.

6.3.2.3 OFFSET FORWARD

Offsets the heads forward off the track center-line. This operation is cleared by the next command. (The drive does not allow write operations when the positioner is offset).

6.3.2.4 OFFSET REVERSE

Offsets the heads reverse off the track center-line. This operation is cleared by the next command. (The drive does not allow write operations when the positioner is offset.) Offset forward or reverse may be used as an attempt to recover data that cannot be corrected by the error correction algorithm.

6.3.2.5 WRITE DISABLE

Not implemented.

6.3.2.6 RELEASE DRIVE

Clears the reserved condition of the specified drive which this processor had previously reserved.

6.3.2.7 TRESPASS

The controller issues a priority select to the specified drive. The drive will immediately be reserved until a release command is issued or the drive timeout feature times out.

6.3.2.8 STOP DISK

All drives connected that are selected for remote operation will unload the heads and spin down via the pick-hold line. A console reset, IORESET instruction, or another command will spin the disk back up.

6.3.2.9 EXAMINE RAM COMMAND

This command gives the system the capability of reading from or writing to the ZDF-1 controller's memory. This command must be preceeded by a DOC containing the address of the desired RAM location. See table 6.3/6.3.1 for memory map.

In order to write to RAM, Bit 0 (MSB) must be a one in the DOC address, and the data to be written is sent via the DOB. If a read RAM is implied (DOC Bit 0 = 0), the contents of the DIC will contain the RAM data after control full clears.

This feature is used for obtaining the following information:

a. Drive characteristics for the formatter and reliability programs.

b. Number of ECC corrections by the controller (each unit has a separate count).

c. Maintenance testing.

d. Configuring the EEPROM

e. Features that may be considered in the future.

ADDRESS (HEX)	NAME
000 - 0FF	SECTOR BUFFER 0
100 - 1FF	SECTOR BUFFER 1
200 - 2FF	SECTOR BUFFER 2 (NOT USED)
306	CYL 0
307	CYL 1
308	CYL 2
309	CYL 3
30A	CURRENT SURFACE,SECTOR,SECTOR COUNT
30B	ZADJ. SURFACE ADDR
30D	SURF - SECT
310	BAD SECTOR FLAG
311	UNIT SELECT
312	SOFT ECC DISABLE (NOT USED)
320	UNIT 0 PORT SEEK END MAP
321	UNIT 1 PORT SEEK END MAP
322	UNIT 2 PORT SEEK END MAP
323	UNIT 3 PORT SEEK END MAP
330	ZADJ. MAX SECTOR (see detail)
331	ZADJ. MAX SURFACE (see detail)
332	ZADJ. MAX CYLINDER (see detail)
333	SYNC BYTE
334	VOLUME ADDR (CMD)
335	BANK SEL,
340	UNIT 0 CORRECTION COUNT (see detail)
341	UNIT 1 CORRECTION COUNT (see detail)
342	UNIT 2 CORRECTION COUNT (see detail)
343	UNIT 3 CORRECTION COUNT (see detail)
348	SECTOR VERIFICATION ENABLE
349	SECTOR COUNT
34A	LENGTH OF LAST SECTOR (COUNT * 600 NANOSEC.)
3FF	PROM ID/REVISION LEVEL

ZDF-1 DISK RAM MEMORY MAP

TABLE 6.3

ADDRESS (OCTAL)	NAME
4800	START OF PORT 0 CHARACTERISTICS
4880	START OF PORT 1 CHARACTERISTICS
4900	START OF PORT 2 CHARACTERISTICS
4980	START OF PORT 3 CHARACTERISTICS

DISK PORT CHARACTERISTICS

XX00	RCHAR SWITCHES
XX01	RPARA SWITCHES
XX02	DISK DEVICE SELECT CODE
XX03	INTERLEAVE FACTOR
XX04	THROTTLE BURST RATE
XX05	NOT USED
XX06	NOT USED
XX07	TAPE DEVICE SELECT CODE
XX08	TAPE CONFIGURATION CHARACTERISTICS
XX20	MAX SECTOR
XX21	MAX CYL-UPPER
XX22	MAX CYL-LOWER
XX23	MAX HEAD
XX24	MAX HEAD-ODD UNIT
XX25	HEAD MASK
XX26	BANK,PRIORITY
XX27	SYNC BYTE
XX30 - XX7F	INTERLEAVE MAP

ZDF-1 EEPROM MEMORY MAP

TABLE 6.3.1

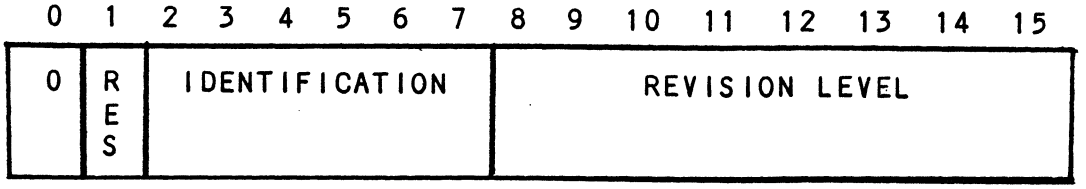
DETAILED RAM DESCRIPTIONS

ADDRESS (OCTAL)	NAME	DESCRIPTION
1460-1462 (330-332 hex)	SELECTED DRIVE CHARACTERISTICS	These locations will be updated whnever a new drive is selected. 1460 - Maximum sector address 1461 - Maximum surface address 1462 - Maximum cylinder address Allow invalid status to go away before a reference is made. Avoid writing to these locations.
1500-1503 (340-343 hex)	UNIT CORRECTION COUNTS	These locations will be incremented each time the controller does a correction either by the ECC algorithm or an Early/Late re-try. The maximum count per unit is 65535 (the count will stay at maximum if there are any more corrections to that unit). The counts are initialized to zero on either a power on or an IORESET switch. A separate count is maintained for each unit. 1500 - Unit 0 1501 - Unit 1 1502 - Unit 2 1503 - Unit 3

EXAMINE RAM COMMAND

1777-8 PROM ID/REV

DIC ACCUMULATOR



EXAMPLE: Identification 80 (Hex) Revision Level 6

Location 1777-8 = 100006

NOTE: Avoid referencing any locations that are not defined here.

EXAM RAM EXAMPLE

READ Contents of Loc 1500 Octal (Unit 0 corrections)

Accumulator Set up:

```
A0 = 002600 (NOP Command Unit 0)
A1 = 001500 (RAM Address for DOC)

DOC 1, DSKP              ; Send RAM Address
DOAP 0, DSKP             ; Send NOP Command and IOPULSE
DIA 0, DSKP              ; Wait for Control Full
MOVZL# 0,0,SZC           ; To be zero
JMP .-2

DIC 2, DSKP              ; Put contents of RAM Location
                           1500 into Accumulator 2
```

WRITE To Location 1500 Octal (Clear Unit 0 Corrections)

Accumulator set up:

```
A0 = 002600 (NOP Command Unit 0)
A1 = 101500 (RAM Address for DOC)
A2 = 000000 (RAM Data)

DOC 1, DSKP              ; Send RAM Address
DOB 2, DSKP              ; Send RAM Data
DOAP 0, DSKP             ; Send NOP Command and IOPULSE
```

6.3.3 ALTERNATE MODES

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

6.3.3.1 ALTERNATE MODE ONE

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

6.3.3.2 ALTERNATE MODE TWO

It changes the context of the DIA and DIB command. This is used to extract the syndrome (ECC remainder not equal to zero after a read command) from the controller in order to determine whether the data error within the sector read is correctable or not.

6.4 ERROR CORRECTION CODE (ECC)

When a write command is specified the ECC hardware divides the data field within the sector by a fixed *generator polynomial and appends the resulting checkword to the data field.

*Generator Polynomial

$$X\text{-}32 + X\text{-}23 + X\text{-}21 + X\text{-}11 + X\text{-}2 + 1$$

When a read command is specified the ECC hardware divides the data field and the appended checkword within the sector by a *factored version of the same generator polynomial. If a data error occurs, the resulting remainder is non-zero, and the data transfer status (DIA) bit position 8 is set (bit 8 will not set if the controller was enabled to correct and the error is correctable). Be aware that there exists a small class of errors which are undetectable due to the cyclic properties of the generator polynomial.

*Factored Version

(X-11 + X-2 + 1) (X-21 + 1)

The ECC feature detects all error bursts contained within 21 or less contiguous bits in a sector and allows correction of all error bursts up to 11 contiguous bits.

6.5 FORMAT SEQUENCER

The ZDF-1 Disk Controller features a format sequencer which controls the disk side of the controller. The firmware which controls this sequencer is contained in PROMS allowing disk format changes to take place in the PROMS instead of the microprocessor firmware.

The format sequencer firmware is arranged in eight banks of 64 words each and is selectable for the format bank desired. Each bank consists of READ/WRITE/ FORMAT CODE. The last bank is reserved for selftest.

6.5.1 READ/WRITE FORMATS

Each disk port of the ZDF-1 may be independently configured to use one of four currently available sector formats. These formats are described in section 3.10.1.5. See Figure 2.1 for detailed format information.

7.0 TAPE PROGRAM CONTROL

7.1 INSTRUCTION FORMAT

Symbolic Form for I/O Instructions

DXXF AC,MTA

DXX = DOA, DOB, DOC, DIA, DIB

F = FUNCTION: C (CLEAR) - Clear all error flags (except EOT/BOT) and done and busy flip-flops. If for some chance that the system issues a clear pulse during the command operation, the Coupler will abort the command and done will not set.

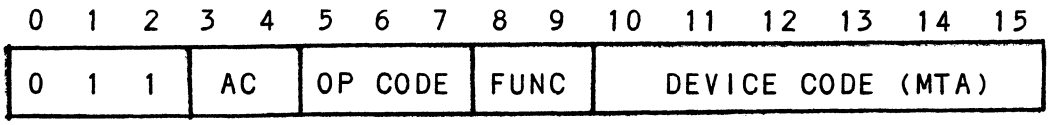
S (START) - Clears all errors except illegal, set busy and clear done. Command that was issued by a DOA will be executed.

P (PULSE) - Not used.

AC = ACCUMULATOR: 0, 1, 2 OR 3

MTA = DEVICE CODE: PRIMARY - 22 OCTAL
SECONDARY - 62 OCTAL

BINARY REPRESENTATION



INTERRUPT MASK BIT = 10

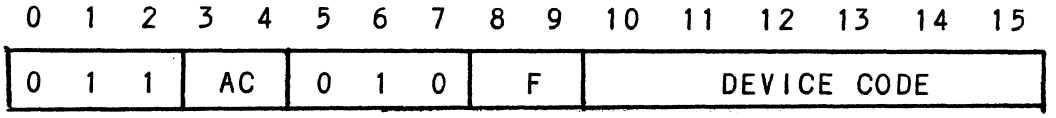
7.1.1 SKIP INSTRUCTIONS

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

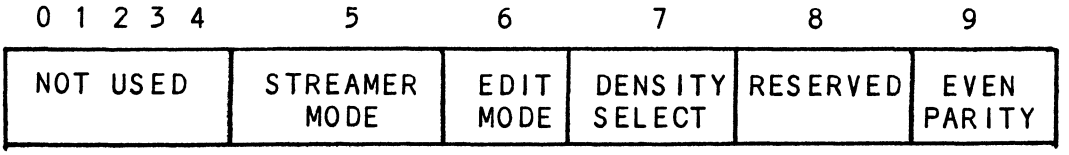
SKPBZ MTA - SKIP IF BUSY FLIP-FLOP IS CLEAR.
SKPBN MTA - SKIP IF BUSY FLIP-FLOP IS SET.
SKPDZ MTA - SKIP IF DONE FLIP-FLOP IS CLEAR.
SKPDN MTA - SKIP IF DONE FLIP-FLOP IS SET.

7.2 DOA - SEND COMMAND

DOAF AC,MTA



AC



10 11 12 13 14 15

COMMAND (0-7)

UNIT SELECT (0-7)

UNIT SELECT: USED TO SELECT ONE OF A POSSIBLE EIGHT TAPE DRIVES

0 - READ
1 - REWIND
2 - NOT USED
3 - SPACE FORWARD
4 - SPACE REVERSE
5 - WRITE
6 - WRITE END OF FILE
7 - ERASE

The command and unit select will default to read and unit zero after a clear pulse or IORESET.

The Coupler may address up to eight tape drives but only one command can be done at a time with the exception of rewind.

STREAMER MODE SELECT BIT 5 = 0

5	6	7	8	9
0	EDIT	DEN	RES	EVEN

EDIT MODE (BIT 6) - Use to re-write records within blocks. This bit is an option. It is generally not necessary unless the tape unit is a primary storage device or key to tape applications.

DENSITY SEL (BIT 7) - Used when controller is connected to a dual formatter board. Selects PE if one, NRZI if zero. The formatted drive must accommodate this feature as well.

(BIT 8) - Reserved

EVEN PARITY (BIT 9) - Maintenance Use Only

STREAMER MODE SELECT BIT 5 = 1

5	6	7	8	9
1	LIMIT 1	LIMIT 0	HIGH SPEED	DYNAMIC GAP

Applicable to streamers only. NOTE: It is not necessary to re-issue streamer mode select if the same configuration is desired for successive commands. A start pulse is not required to select the streamer mode.

HIGH SPEED (BIT 8) - If set to a one, select high speed tape motion (100 IPS). If this bit is zero, low speed will be selected.

DYNAMIC GAP (BIT 9) - If set to a one, write dynamic inter-record written. This increases the re-instruct period. It should be noted that a loss of usable data media may result with this command. If this bit is zero, nominal inter-record gap is selected.

NOTE: If the Cipher F880 Microstreamer is selected, the gap will dynamically be lengthened depending upon the next command is issued. The Kennedy 6809 Streamer will lengthen the gap by an additional .6 inch, thereby increasing the re-instruct period by 6 millisec.

If a Cipher Streamer is used, gap length limits (Bits 6 and 7) can be established by the controller. This may be useful if there is long time intervals occasionally before the next write command is issued (between 1 and 4 seconds). The time limits could prevent outrageously long record gaps. If the selected limit is not met, the unit will simply reposition back to a nominal gap length. The following table indicates the re-instruct limits.

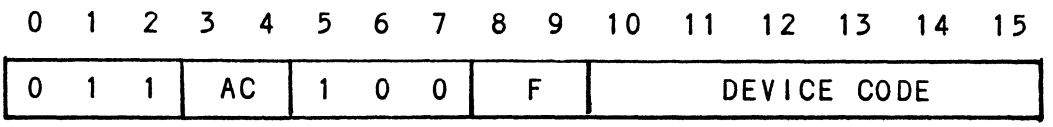
BIT 6	BIT 7	
LIMIT 1	LIMIT 0	LIMIT (MS = MILLISEC.)
0	0	75 MS
0	1	150 MS
1	0	300 MS
1	1	RESERVED

LIMIT TABLE

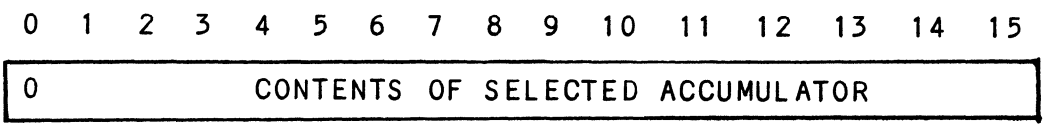
These modes, high speed and dynamic gap, will remain as selected until another DOA with streamer mode select (BIT 5) = 1 is issued again. The default condition is normal gap and low speed. Default is established on power on or IORESET switch depressed.

7.3 DOB - LOAD STARTING MEMORY ADDRESS

DOBF AC,MTA



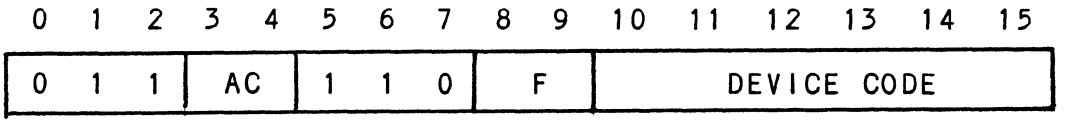
AC



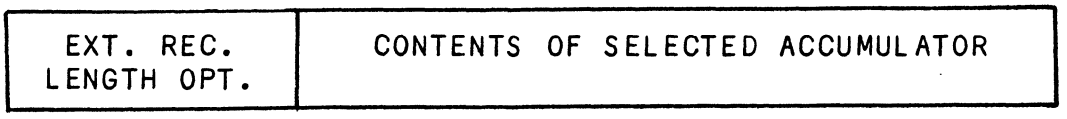
The contents of Selected Accumulator will be loaded into the controllers address counter. This will become the starting address for the next command that requires the data channel (READ or WRITE).

7.4 DOC - LOAD WORD COUNT

DOCF AC,MTA



AC

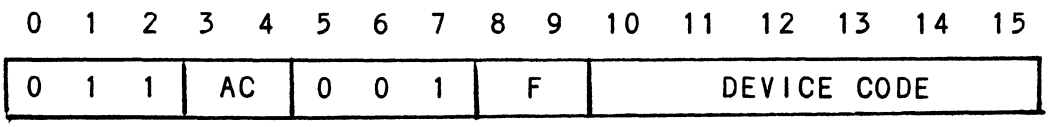


Program must place two's complement of desired word count into selected accumulator before this instruction is executed.

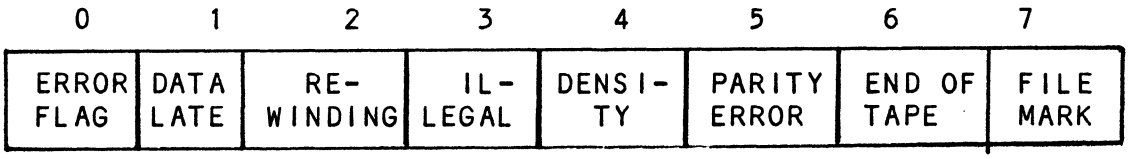
Spacing Forward/Reverse - Place two's complement of the maximum number of records to be spaced.

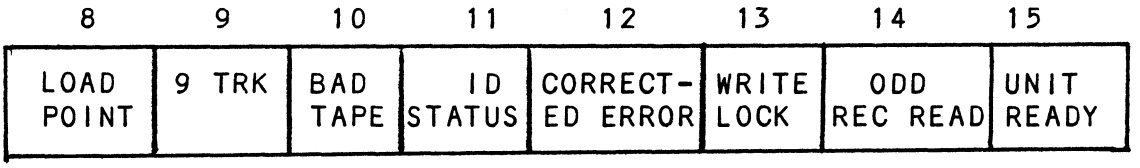
7.5 DIA - READ STATUS

DIAF AC,MTA



AC





Bits 11 and 12 are for phase encoded only.

STATUS BITS:

0 ERROR FLAG - A condition was detected by the controller board that may require attention. If Bit 1, 3, 5, 6, 7, 8, 10 or 14 are a one, the error flag will be set to a one.

1 DATA LATE - Data Channel requests were not honored in time to keep up with device, resulting in one or more lost data words. This condition will not occur until the FIFO buffer overflows.

2 REWINDING - Selected unit is rewinding.

3 ILLEGAL - A start function is asserted under one of the following cases:

1) Write protect is on (no write ring installed and the command that was issued prior to the start was a write, erase or write file mark.

2) Space reverse command was issued and unit is at load point.

3) Unit is not ready.

NOTE: No tape motion will take place and done will set. Only clear function or IORESET will clear illegal.

4 DENSITY - Always a one in a standard configuration. May be optionally used to differentiate between PE mode (one) or NRZI mode (zero) if controller is connected to a dual embedded formatter.

5 PARITY ERROR - One of two conditions possibly occurred. Even vertical parity was detected by the controller or a corrected error occurred during a write command.

6 END OF TAPE - The selected unit is at or beyond the EOT mark. A space reverse or rewind command will clear this bit.

7 FILE MARK - Will be set to a one when the unit detects the presence of a file mark during a write file mark command (READ AFTER WRITE) or when a read or spacing command passes over a previously written file mark.

8 LOAD POINT - Selected unit senses a load point marker (BOT).

9 9 TRACK - Always a one.

10 BAD TAPE - Set to a one by the occurrence of one of the following cases:

1) PE only, did not detect an ID burst when reading from load point.

2) PE only, tape was in a runaway condition (reading an erased tape).

3) PE only, multi-track dropout.

4) PE only, uncorrectable parity error.

5) PE only, non-zero character in postamble.

6) Excessive skew.

7) PE only, loss of data envelope prior to postamble detection.

8) Vertical parity on cable in error.

9) NRZ only, vertical parity error on data character.

10) NRZ only, longitudinal parity error.

11) NRZ only, CRCC parity error.

12) NRZ only, improper record format.

13) NRZ only, CRC error.

RETRIES MAY CORRECT THE ABOVE PROBLEMS

11 ID BURST - PE only, set to one if the unit detects an identification burst on a forward motion command from load point.

If detected during a READ command, the tape media was written by a phase-encoded transport.

A write command (write or write file mark) issued at load point will cause the unit to automatically write an ID Burst.

12 CORRECTED PAR ERRROR - PE only, if this bit is a one after a write command, the parity error flag will also be set to a one and the software should backspace and re-write the record.

If it occurs after a READ command, it is not necessary to re-read the record, the error is probably caused by the media itself (such as dust, slightly damaged tape or it was poorly written), and the data has been corrected.

13 WRITE PROTECT - A write ring was not installed on the tape reel.

14 ODD RECORD READ - An odd number of characters were read within the record.

15 READY - The selected tape unit is ready. The following conditions must be satisfied before this bit is a one:

1) Unit is online.

2) Not rewinding.

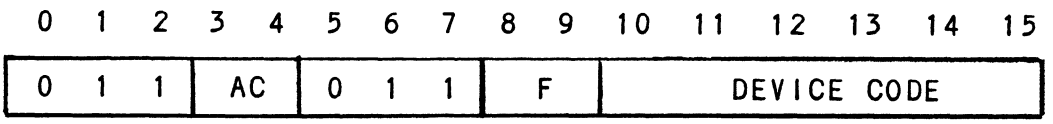
3) Controller is not busy.

4) Ready line from unit must be received.

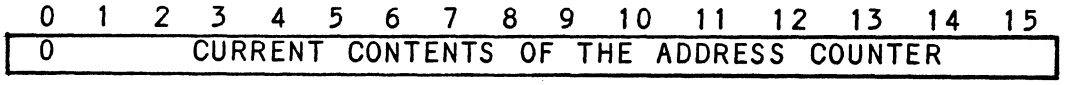
5) Selftest is done.

7.6 DIB - READ CURRENT MEMORY ADDRESS

DIBF AC,MTA



AC



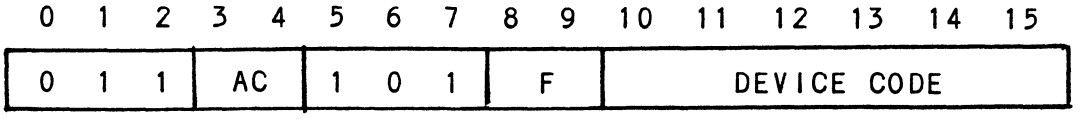
The seleted accumulator will contain the current contents of the address counter after the execution of this instruction.

READ WRITE RECORD - Contains the memory address to where the next data word transfer will take place. The memory address counter is incremented by one after each data channel transfer.

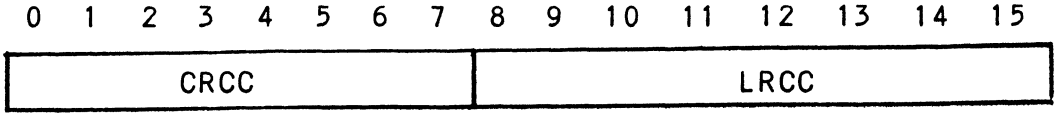
SPACING FORWARD/REVERSE - The address counter becomes a record counter on a space forward or reverse command. The difference between the contents of the counter before and after the space command will indicate the number of records spaced over.

7.7 DIC - READ CHECK CHARACTERS (MAINTENANCE USE ONLY)

DICF AC,MTA



AC



This command is useful for testing to make sure that a NRZ drive is generating the proper check characters. The check characters will be available (NRZ Only) after every read record command. This command will only be necessary for diagnostic purposes. Since a phase encoded drive does use check characters, a DIC will simply transfer the last two characters read from a record into the selected accumulator.

7.8 COMMAND DESCRIPTIONS

7.8.1 READ

DOA Command is read and a start pulse was issued.

Start sets busy, coupler then sends a read forward command to the tape unit. Tape unit will ramp up to speed and transfer data to the coupler when it reaches the data field. Every two bytes sent by the unit will be transferred to the mini's memory as one complete word. After the transfer the address and word counter will increase by one. Tape motion will continue until a record GAP is reached (unless "ON THE FLY" is achieved). Word transfer to the mini continues until the word count limit is met or the last word of the record is sent via the data channel.

If the record is a file mark, tape motion will cease and no data transfers on the data channel will take place.

Done will set when the command is finished or an error has occurred.

Possible Errors:

1) Selected unit is not ready (rewinding, off line coupler busy or drive not in system.

2) Hard or corrected error.

3) Data Late.

8.0 TAPE COUPLER GUIDELINES, UTILITIES (STREAMER DRIVES ONLY)

8.1 RE-INSTRUCT PERIOD

The most important issue when referring to streaming, is the term "RE-INSTRUCT PERIOD". This is the amount of time the specific mag tape drive gives the controller to assert the next command before tape motion stops. If the next command issued (provided it is of the same type and direction) is met, tape motion will continue at the same rate for the next record. This is normally referred to as "ON THE FLY" operations. If "ON THE FLY" is not established, then it is referred to as start/stop action (tape motion ceases within record gaps). With vacuum column or tension arm mag tape drives, start/stop times are rather fast in the order of about 8 millisec.

However, with streamer drives, the high cost mechanisms necessary for fast start/stop ramp times are eliminated. Hence, start/stop times may take more than one second. If the next command is not issued during the re-instruct period with a streamer drive, it will then enter what is called a repositioning cycle. This cycle is necessary because the streamer cannot stop within the nominal inter-record gap length (approximately .6 inches). Therefore, after it decelerates forward it must accelerate in reverse, and finally decelerate in reverse. The repositioning cycle is longer the faster the tape speed, therefore, most streamers offer a low speed (25 IPS or 12.5 IPS) along with the high speed (100 IPS).

If the program that is controlling the data transfers to the mag tape does not issue commands during the normal re-instruct period, repositioning takes place. Options are available to remedy this situation to extend the re-instruct period. One option would be to use a lower speed. Another would be to lengthen the record gap after a write command, but this would sacrifice media (which may prove to be useful providing the gaps are not too long).

8.1.1 RE-INSTRUCT TABLE

CIPHER RE-INSTRUCT TIMES:

SPEED	GAP LENGTH	RE-INSTRUCT TIME
25 IPS	NORMAL (.6")	16 MS
100 IPS	NORMAL (.6")	4 MS
25 IPS	VAR. LENGTH	UP TO 4 SEC.
100 IPS	VAR. LENGTH	UP TO 4 SEC.

KENNEDY RE-INSTRUCT TIMES:

SPEED	GAP LENGTH	RE-INSTRUCT TIME
12.5 IPS	NORMAL (.6")	START/STOP ONLY
100 IPS	NORMAL (.6")	4.5 MS
100 IPS	LONG GAP (1.2")	10.5 MS

8.2 STREAMING MODE UTILITIES

Zetaco provides utility programs which can help optimize the performance of streaming tape drives. These utilities are supplied on the 400-294-00 tape from Zetaco. Please refer to Section 4.1.2 for information on loading these programs onto your disk. For Cache or Start/Stop drives, these utilities are not useful and you should skip the rest of this section unless you have a streaming tape drive.

To decide how and when you want the streaming mode set, you should refer to the Performance Chart at the end of this section, 8.2.4. For a particular System Tape Routine and your drive speed, the Chart shows the most efficient set of parameters to select. The programs described in the remainder of this section will set the tape speed and inter-record gap to pre-defined values. The default settings are low speed and nominal gap. Be aware that resetting the CPU will cause any tape settings to be lost. Thus any time the CPU is reset it is initially set for low speed and nominal gap.

8.2.1 RDOS EXECUTABLE UTILITIES

There are five RDOS utility programs for streamer drives. The programs will set the tape drive as follows:

```
LNG     = Low Speed, Nominal Gap
LDG75   = Low Speed, Dynamic Gap 75 MS, Min Gap Nominal
HNG     = High Speed, Nominal Gap
HDG75   = High Speed, Dynamic Gap 75 MS, Min Gap Nominal
HMG90   = High Speed, Dynamic Gap 300 MS, Min Gap 90 MS
```

There are three files associated with each of these programs: Executable Program File (-.SV), a Text File (-.TX) which describes the most recent configuration, and a Command Line File (-.MC) which runs the program and displays the configuration.

You must first load these programs from the 400-294-00 tape onto your disk. After determining which program you want to run, just enter the program name.

8.2.2 AOS EXECUTABLE UTILITIES

There is one general purpose AOS utility for streaming mag tapes: STREAMER. The purpose of this program is to improve the performance of the tape drive. You can set the drive(s) for high/low speed and for dynamic gap(s) using this program. Switches and arguments to this program follow the AOS style. The general format for executing STREAMER is:

```
STREAMER[/global switches] device-code[/switches] device-
        code[/switches]  .....
```

For more information on operating STREAMER, you should load the files on 400-294-00 tape from file 12. This load will include STREAMER.PR and STREAMER.CLI. Operational HELP will display if you enter: STREAMER/H.

The CRT will display:

```
STREAMER:  ZETACO utility to configure a streamer mag tape
           for high/low speed and dynamic/nominal gaps.  For
           use on ZETACO controllers only.
FORMAT:    Streamer[/Global switches][Dev[/switches]][Dev[/
           switches]]... (Dev is octal device-code between
           20 and 76.)
GLOBAL SWITCHES:  /H display help on operating streamer.
                        Overrides other switches.
                  /V verify after configuring.
SWITCHES:
           /H set for high speed.  If this switch is not
           present, it will be set for low speed.
```

/D set for dynamic gaps. If this switch is not present, it will be set for nominal gaps.
/U set upper limit for gaps to 75 ms. /D must be true.
/U=N where N=75, 150, 300 or 4. Set upper limit for gaps to N ms. (or 4 secs). /D must be true. If both /U= and /L= are present, /L is ignored.
/L set lower limit for gaps to 30 ms. /D must be true.
/L=N where N=30, 60, 90 or 120. Set lower limit for gaps to N ms. /D must be true. If both /U= and /L= are present, /L is ignored.

Possible gaps are:

Upper Limit	Lower Limit	
75 ms.	Nominal	This is the default
150 ms.	Nominal	
300 ms.	Nominal	
4 secs.	Nominal	
75 ms.	30 ms.	
150 ms.	60 ms.	
300 ms.	90 ms.	
4 secs.	120 ms.	

Please refer to Section 8.2.4 for suggested values for various tasks. STREAMER can be called from a CLI file with arguments passed to the program. A backup macro might include:

```
STREAMER 22/D/U 62/D/U - sets both drives to dynamic upper
                         limit gaps of 75 ms.
BACKUP using DUMP (to 22 and 62)
STREAMER 22 62         - resets both drives to nominal
```

8.2.3 STAND-ALONE UTILITY

TAPEMODE is a stand-alone utility which will configure the Coupler without having to use an Operating System. This is useful prior to running DG stand-alones, such as PCOPY. TAPEMODE will configure the ZDF-1 Tape Coupler to any desired configuration.

To use TAPEMODE, load the program from 400-294-00 tape or disk (see Section 4.1.2). First you must answer the questions to configure the Coupler as desired. After the tape has been configured, TAPEMODE asks for the device code for re-booting. The auto-boot function is provided to prevent the operator from inadvertently cancelling the configuration (RESET switch).

8.2.4 PERFORMANCE CHART

		25/100 TAPE	12.5/100 TAPE
RDOS			
	MDABS MDSAVE ETC.	Low Speed Nominal Gap	Low Speed Nominal Gap
RDOS			
	XFER	Low Speed Dynamic Gap 75 MS	Low Speed Nominal Gap
RDOS			
	DUMP LOAD	Low Speed Dynamic Gap 75 MS	Low Speed Nominal Gap
RDOS			
	FDUMP FLOAD	Low Speed Nominal Gap	Low Speed Nominal Gap
RDOS BURST	DUMP LOAD	High Speed Dynamic Gap 75 MS	High Speed Dynamic Gap 75 MS
AOS			
	COPY	Low Speed Nominal Gap	Low Speed Nominal Gap
AOS			
	DUMP LOAD	Low Speed Dynamic Gap 75 MS	Low Speed Nominal Gap
AOS PCOPY		High Speed Nominal Gap	High Speed Nominal Gap

8.3 USER-WRITTEN STREAMING CONTROL

If the streaming control utilities included on the M294 tape cannot be used due to software incompatability, it may be necessary to write utilities or modify the driver or software to achieve proper streaming control. If so, section 7.2, DOA-Send Command, should be referenced for details on configuring/re-configuring the tape coupler's streaming mode. Also, review sections 7.8.1 and 7.8.2 for Read and Write Command descriptions and section 8.1, Re-Instruct period. Read look-ahead should normally be enabled at controller configuration (Section 3.10.2.3) for streaming drives.

If the drive cannot be kept streaming (drive repositions occur) then the following adjustments could be made:

For streaming on writing - increase gap dynamically

For streaming on read - increase minimum gap length when writing

If in high speed - switch to low speed

NOTE: Increasing the gap length will use additional tape.

INDEX

(T)

```
 0001  LDG75    AOS ASSEMBLER REV 04.20        10:04:33 03/28/84
01              ;
02              ;
03              ;
04              ;*************************************************************************
05              ;
06              ; DESCRIPTION:  STREAMER MAG TAPE CONFIGURATOR (PRE-DEFINED)
07              ;
08              ;
09              ; PRODUCT OF ZETACO, 1984
10              ;*************************************************************************;
11              ;1.     PROGRAM NAME: LDG75.SR
12              ;
13              ;2.     REVISION HISTORY:
14              ;
15              ;       REV.       DATE
16              ;        00     11/13/81
17              .REV     01.0  ;03/27/84        ZETACO
18              ;3.     REQUIREMENTS:
19              ;       SYSTEM EXECUTATABLE
20              ;4.     SUMMARY:
21              ;       THIS PROGRAM IS PROVIDED TO CONFIGURE A STREAMER MAG TAPE, FOR
22              ;       HIGH SPEED AND DYNAMIC GAP.
23              ;
24              ;       CONFIGURATION BITS OF DOA WITH BIT 5 = 1:
25              ;                10    MINIMUM GAP*
26              ;                9     DYNAMIC GAP
27              ;                8     HIGH SPEED
28              ;               6-7    LIMITS
29              ;                5     STREAMER MODE SELECT
30              ;                -
31              ;       LIMITS:
32              ;       6   7   10      MAX             MIN
33              ;       0   0   0        75MS           NOMINAL
34              ;       0   1   0       150MS           NOMINAL
35              ;       1   0   0       300MS           NOMINAL
36              ;       1   1   0         4SEC          NOMINAL
37              ;       0   0   0        75MS           30MS
38              ;       0   1   1       150MS           60MS
39              ;       1   0   1       300MS           90MS
40              ;       1   1   1         4SEC         120MS
41              ;
42              ;       *NOTE: MIMIMUM GAP IS ONLY TRUE IF DRIVE IS STREAMING, IF
43              ;              REPOSITIONING OCCURS GAP IS OF NOMINAL LENGTH(NOMINAL IS .6 IN)
                .TITL   LDG75
45              .NREL
46 00000'020426 LOAD:   LDA     0,C22                  ;PRIMARY TAPE
47                      ?DEBL                          ;ENABLE         ;.SYSTM (RDOS)
48 00003'000401         JMP     .+1                    ;NO ERROR       ;.DEBL
49 00004'020424         LDA     0,CWORD                ;CONFIGURATION WORD
50 00005'061022         DOA     0,22                   ;CONFIGURE PRIMARY MT
51 00006'020420         LDA     0,C22
52                      ?DDIS                                          ;.SYSTM (RDOS)
53 00011'000401         JMP     .+1                                    ;.DDIS
54 00012'020415         LDA     0,C62
55                      ?DEBL                                          ;.SYSTM (RDOS)
56 00015'000401         JMP     .+1                                    ;.DEBL
57 00016'020412         LDA     0,CWORD
58 00017'061062         DOA     0,62                   ;CONFIGURE SECONDARY
59 00020'020407         LDA     0,C62
60                      ?DDIS                                          ;.SYSTM (RDOS)
```

```
 0002  LDG75
01 00023'000401          JMP     .+1                                    ;.DDIS
02                       ?RETURN                                        ;.SYSTM (RDOS)
03 00026'000022 C22:     22                                             ;.RTN
04 00027'000062 C62:     62
05 00030'002100 CWORD:   2100                  ;75MS MAX GAP, MIN NOMINAL GAP, LOW SPEED,
06                                              ;AND STREAMER SELECT MODE.
07                       .END    LOAD
**00000 TOTAL ERRORS, 00000 FIRST PASS ERRORS
```

```
 0001  HDG75    AOS ASSEMBLER REV 04.20        10:05:00 03/28/84
01              ;
02              ;
03              ;
04              ;*********************************************************************
05              ;
06              ; DESCRIPTION:  STREAMER MAG TAPE CONFIGURATOR (PRE-DEFINED)
07              ;
08              ;
09              ; PRODUCT OF ZETACO, 1984
10              ;*********************************************************************;
11              ;1.     PROGRAM NAME: HDG75.SR
12              ;
13              ;2.     REVISION HISTORY:
14              ;
15              ;       REV.       DATE
16              ;        00     11/13/81
17              .REV     01.0  ;03/27/84        ZETACO
18              ;3.     REQUIREMENTS:
19              ;       SYSTEM EXECUTATABLE
20              ;4.     SUMMARY:
21              ;       THIS PROGRAM IS PROVIDED TO CONFIGURE A STREAMER MAG TAPE, FOR
22              ;       HIGH SPEED AND DYNAMIC GAP.
23              ;
24              ;       CONFIGURATION BITS OF DOA WITH BIT 5 = 1:
25              ;                10    MINIMUM GAP*
26              ;                9     DYNAMIC GAP
27              ;                8     HIGH SPEED
28              ;               6-7    LIMITS
29              ;                5     STREAMER MODE SELECT
30              ;                -
31              ;       LIMITS:
32              ;       6   7   10      MAX             MIN
33              ;       0   0   0        75MS           NOMINAL
34              ;       0   1   0       150MS           NOMINAL
35              ;       1   0   0       300MS           NOMINAL
36              ;       1   1   0         4SEC          NOMINAL
37              ;       0   0   0        75MS           30MS
38              ;       0   1   1       150MS           60MS
39              ;       1   0   1       300MS           90MS
40              ;       1   1   1         4SEC         120MS
41              ;
42              ;       *NOTE: MIMIMUM GAP IS ONLY TRUE IF DRIVE IS STREAMING, IF
43              ;              REPOSITIONING OCCURS GAP IS OF NOMINAL LENGTH(NOMINAL IS .6 IN)
                        .TITL   HDG75
45                      .NREL
46 00000'020426 LORD:   LDA     0,C22                  ;PRIMARY TAPE
47                      ?DEBL                          ;ENABLE         ;.SYSTEM (RDOS)
48 00003'000401         JMP     .+1                    ;NO ERROR       ;.DEBL
49 00004'020424         LDA     0,CWORD                ;CONFIGURATION WORD
50 00005'061022         DOA     0,22                   ;CONFIGURE PRIMARY MT
51 00006'020420         LDA     0,C22
52                      ?DDIS                                          ;.SYSTM (RDOS)
53 00011'000401         JMP     .+1                                    ;.DDIS
54 00012'020415         LDA     0,C62
55                      ?DEBL                                          ;.SYSTM (RDOS)
56 00015'000401         JMP     .+1                                    ;.DEBL
57 00016'020412         LDA     0,CWORD
58 00017'061062         DOA     0,62                   ;CONFIGURE SECONDARY
59 00020'020407         LDA     0,C62
60                      ?DDIS                                          ;.SYSTM (RDOS)
```

```
 0002  HDG75
01 00023'000401          JMP     .+1                                    ;.DDIS
02                       ?RETURN                                        ;.SYSTM (RDOS)
03 00026'000022 C22:     22                                             ;.RTN
04 00027'000062 C62:     62
05 00030'002300 CWORD:   2300                  ;75MS MAX GAP, MIN NOMINAL GAP, HIGH SPEED,
06                                              ;AND STREAMER SELECT MODE.
07                       .END    LOAD
**00000 TOTAL ERRORS, 00000 FIRST PASS ERRORS
```

```
 0001  MNG     MOS ASSEMBLER REV 04.20        10:05:31 03/28/84
01              ;
02              ;
03              ;
04              ;*****************************************************************
05              ;
06              ; DESCRIPTION:  STREAMER MAG TAPE CONFIGURATOR (PRE-DEFINED)
07              ;
08              ;
09              ; PRODUCT OF ZETACO, 1984
10              ;*****************************************************************;
11              ;1.     PROGRAM NAME: MNG.SR
12              ;
13              ;2.     REVISION HISTORY:
14              ;
15              ;       REV.       DATE
16              ;        00     11/13/81
17              .REV     01.0  ;03/27/84        ZETACO
18              ;3.     REQUIREMENTS:
19              ;       SYSTEM EXECUTATABLE
20              ;4.     SUMMARY:
21              ;       THIS PROGRAM IS PROVIDED TO CONFIGURE A STREAMER MAG TAPE, FOR
22              ;       HIGH SPEED AND DYNAMIC GAP.
23              ;
24              ;       CONFIGURATION BITS OF DOA WITH BIT 5 = 1:
25              ;                10    MINIMUM GAP*
26              ;                9     DYNAMIC GAP
27              ;                8     HIGH SPEED
28              ;               6-7    LIMITS
29              ;                5     STREAMER MODE SELECT
30              ;                -
31              ;       LIMITS:
32              ;       6   7   10      MAX             MIN
33              ;       0   0   0        75MS           NOMINAL
34              ;       0   1   0       150MS           NOMINAL
35              ;       1   0   0       300MS           NOMINAL
36              ;       1   1   0         4SEC          NOMINAL
37              ;       0   0   0        75MS           30MS
38              ;       0   1   1       150MS           60MS
39              ;       1   0   1       300MS           90MS
40              ;       1   1   1         4SEC         120MS
41              ;
42              ;       *NOTE: MIMIMUM GAP IS ONLY TRUE IF DRIVE IS STREAMING, IF
43              ;              REPOSITIONING OCCURS GAP IS OF NOMINAL LENGTH(NOMINAL IS .6 IN)
                        .TITL   MNG
45                      .NREL
46 00000'020426 LOAD:   LDA     0,C22                  ;PRIMARY TAPE
47                      ?DEBL                          ;ENABLE         ;.SYSTM (RDOS)
48 00003'000401         JMP     .+1                    ;NO ERROR       ;.DEBL
49 00004'020424         LDA     0,CWORD                ;CONFIGURATION WORD
50 00005'061022         DOA     0,22                   ;CONFIGURE PRIMARY MT
51 00006'020420         LDA     0,C22
52                      ?DDIS                                          ;.SYSTM (RDOS)
53 00011'000401         JMP     .+1                                    ;.DDIS
54 00012'020415         LDA     0,C62
55                      ?DEBL                                          ;.SYSTM (RDOS)
56 00015'000401         JMP     .+1                                    ;.DEBL
57 00016'020412         LDA     0,CWORD
58 00017'061062         DOA     0,62                   ;CONFIGURE SECONDARY
59 00020'020407         LDA     0,C62
60                      ?DDIS                                          ;.SYSTM (RDOS)
```

```
 0002  HNG
01 00023'000401          JMP     .+1                                    ;.DDIS
02                       ?RETURN                                        ;.SYSTM (RDOS)
03 00026'000022 C22:     22                                             ;.RTN
04 00027'000062 C62:     62
05 00030'002200 CWORD:   2200                  ;NOMINAL GAP, HIGH SPEED, AND STREAMER SELECT MODE
06                       .END    LOAD
**00000 TOTAL ERRORS, 00000 FIRST PASS ERRORS
```

```
;
;
;*****************************************************************
;-----------------------------------------------------------------
;
; DESCRIPTION: ZETACO DISK CONTROLLER DIAGNOSTIC
;
;
; Product of ZETACO, 1986
;*****************************************************************
 -------:TITL   DISKD-----------------------------------------------
        .DUSR   X=1
        .NOMAC  X
; 1.0 PROGRAM NAME:      DISKD.SR

; 2.0 REVISION HISTORY:
;
;       REV.        DATE
;        00      02/17/83        ;
;        01      09/07/83        ;ANOTHER RDY UNIT WARNING,1 HD
;                                ;ERR C22, AOS BOOTSTRAP(400'S),
;                                ;NO OFFSET TESTS FOR CMD'S
;        02      03/28/84        ;2^5C,296 AND BMX TESTS
;                                ;DEVICE CODE CHANGE ROUTINE
;        03      06/12/84        ;ZDF1 CHANGES, A5 TESTS 17-76
;
;        04      08/21/85        ;DISABLE VIRTUAL, WEL-RECAL,
;                                ;DISK SIM PARMS
;        05      11/20/86        ;297, 6214, HELP, DMA PTR, IORST

; 3.0 MACHINE REQUIREMENTS:
;       NOVA/ECLIPSE/MV FAMILY CENTRAL PROCESSOR
;       MINIMUM of 16K READ/WRITE MEMORY
;       ZETACO DISK CONTROLLER (ZEBRA TYPE)
;       0-3 DISK DRIVES
;       TELETYPE or CRT and CONTROL

; 4.0 TEST REQUIREMENTS:         N/A

; 5.0 SUMMARY:
;       The ZETACO DISK CONTROLLER DIAGNOSTIC PROGRAM
;       is a HARDWARE DIAGNOSTIC for the ZETACO DISK
;       CONTROLLERS and DRIVES. The Device Code may be 20-76
;       OCTAL with the Default being 27.


; 6.0 RESTRICTIONS:
;       This Program has no Restrictions as to Single or
;       Dual Processor Hardware Configuration. However, the
;       Diagnostic may be run on ONLY ONE CPU at a time and
;       must be the only Program being run within the Disk
;       System.
```

```
; 7.0 PROGRAM DESCRIPTION/THEORY OF OPERATION:

;       7.1 "A" TESTS CHECK:

;       - BUSY, DONE, I/O BUS SELECT LOGIC
;       - DISK SELECT LOGIC, CONTROLLER RAM

;       7.2 "B" TESTS CHECK:

;       - START, BUSY, CLEAR LOGIC
;       - RECALIBRATE, ATTN, INTERRUPT LOGIC
;       - INTERRUPT DISABLE, INTA LOGIC
;       - That SEEKS to CYL'S 0,1/2 CYL MAX,and CYL MAX
;         can at least be EXECUTED and SET DRIVE BUSY.
;       - READY/SELECT LOGIC

;       7.3 "C" TESTS CHECK:

;       - That the CA REGISTER INCREMENTS properly
;         VIA DCH  or BMC REQUESTS
;       - That a WRITE can be EXECUTED
;       - SELD, CLEAR LOGIC
;       - That SEEK/WRITE Operations can be EXECUTED
;       - WRITES to Different HDS,SECTORS
;       - MULTI-SECTOR WRITES
;       - The INCREMENT HEAD LOGIC
;       - ILLEGAL SECTOR, SURFACE, CYLINDER Conditions

;       7.4  "E" TESTS CHECK:

;       - That a READ may be EXECUTED
;       - 8 SECTOR WRITE/READ OPERATIONS (9 Different
;         Data Patterns) at CYL'S 0;1/2 CYL MAX and CYL MAX
;         with Full Core Compare
;       - Data VERIFY Function (Normal and with Forced Errors)
;       - OFFSET MODES
;       - ILLEGAL COMMAND TRAPS
;       - WRITE CYL# to HEAD 0,SECTOR 0 of All Cylinders
;       - WRITE HEAD # to SECTOR 0 of All Heads on CYL 0
;       - WRITE SECTOR # to All Sectors of Head 0,CYL 0
;       - Each of the above Operations is followed by
;         a Corresponding READ/CHECK Operation to Verify
;         Disk Addressing Logic.

;       7.5  "F" TESTS CHECK:

;         The Format Logic on CYL 0,HEAD 0,SECTOR 0,
;         A SET BAD SECTOR FLAG given and TESTED.
;         The FORMAT is set to Normal after Completion
;         of these Tests.

;       7.6 "S" TESTS ARE SEEK EXERCISERS

;       - Performs RANDOM SEEKING. Each SEEK is Followed
;         by a Read to Head 0,Sector 0

;       - Performs RANDOM OVERLAPPED SEEKING to TWO DRIVES.
;         Each SEEK is Followed by a Read to Head 0,Sector 0.
;          1 is the the Primary Unit under Test and U2
;         is the next Drive found in a 1,2,3,0 ETC. Search.
;         If only 1 Drive, Test is Bypassed. Test is only run
;         after a Pass is Achieved on All Drives.
```

; 8.0 OPERATING MODES/SWITCH SETTINGS:

;8.1 SWITCH SETTINGS
;
; Location "SWREG" is used to select the program options. This
; Location will be set according to the answers supplied by
; the Operator. The Options can be changed or verified by
; using one of the commands given in Sec. 8.3.
;
;8.2 SWITCH OPTIONS
; Different bits and their interpretation at location
; "SWREG" is as follows:
;

BIT	OCTAL VALUE	BINARY VALUE	INTERPRETATION
1	40000	0	LOOP on ERROR
	000000	1	SKIP LOOPING on ERROR
2	20000	0	PRINT to CONSOLE
	000000	1	ABORT PRINT OUT to CONSOLE
3	10000	0	DO NOT PRINT % FAILURE
	000000	1	PRINT % FAILURE
5	02000	0	DO NOT PRINT on the LINE PRINTER
	000000	1	PRINT on the BYTE I/O LINE PRINTER(DC17)
6	01000	0	DO NOT HALT on ERROR
	000000	1	HALT on ERROR
7	00400	0	N/A
	000000	1	DISABLE FORMATTING HD 0, CYL 0, SEC 0
8	00200	0	N/A
	000000	1	RECALIBRATE during SCOPE LOOP
9	00100	0	N/A
	000000	1	1 SECOND DELAY during SCOPE LOOP
10(A)	00040	0	N/A
	000000	1	PRINT TEST #'S and FIRMWARE REVISIONS
11(B)	00020	0	N/A
	000000	1	PROGRAM will EXIT to ODT when not in TESTS F1-F3 SWT is Set to 0 upon EXIT
12(C)	00010	0	SKIP LONG RAM TEST
	000000	1	LONG CONTROLLER RAM TEST
16(G)	00000	0	DO NOT PRINT on the DMA LINE PRINTER
	100000	1	PRINT on the DMA LINE PRINTER(DC 17)

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

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

; 9.0 OPERATING PROCEEDURE/OPERATOR INPUT:

;       9.1 Load the Program

;       9.2 STARTING ADDRESSES
;               200-To IDENTIFY DISK TYPE (INITIALIZE)
;                   PROGRAM then PROCEEDS to 500.
;               201-ODT DIRECT ENTRY ONLY
;               202-RANDOM SEEK EXERCISERS. (1 PASS of DIAG FIRST)
;                SEEK EXER 1 is a SINGLE DRIVE EXERCISER
;                SEEK EXER 2 is TWO DRIVE EXERCISER with SEEK OVERLAP
;               500-DIAGNOSTIC (RESTART)

;       9.3 The Program Prints"PASS" following each
;          Complete Pass through the Tests. Random
;          Seek Exerciser performs 1000 Seeks
;          per "PASS" Message.

;       9.4 Device Code of Controller is Requested (27 is Default)

;       9.5 Unit Numbers to be Tested are Requested to which the
;           Operator Enters the Unit Numbers to be Tested, Separating
;           the Individual #'s by a <,> or <Space>.

;       9.6 Operator is Requested to Enter 1, if Unit Characteristics
;           Displayed are INCORRECT, and Wants to LOOP on Reading them.
```

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

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

;       A. STANDALONE CONTROLLER TEST FAILURES-

;       B. STATUS ERRORS

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

;       C. MEMORY/DISK ADDRESS ERROR

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

;       C. INTERRUPT TIMEOUT

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

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


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

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

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

```
; 11. DEBUG HELP:
;
;OCTAL DEBUGGER  (ODT)
;
;       This Diagnostic is equipped with a built in ODT which can be
;       accessed by hitting CONTROL O at any time during the execution
;       of the Program (after Setting the Parameters). On entering ODT
;       the Address of the Location having the next instruction to be
;       executed will be typed-out.
;
;       The following Conventions are used by the ODT:
;       ?       Pressing any Illegal key causes the ODT to respond
;               with a "?".
;       @       ODT is ready and at your service.
;
;       An ODT Command has the following Format:
;               [ARGUMENT][COMMAND]
;       An Argument may be one of the following:
;       "EXP"   An OCTAL Expression consisting of OCTAL Numbers
;               separated by Plus (+) or Minus (-) signs. Leading
;               Zeros need not be typed.
;       "ADR"   An Address is the same as an Expression except
;               that Bit 0 is neglected.
;       A Command is a single teletype character
;
;       The Locations that can be EXAMINED and MODIFIED by the user
;       are called CELLS. These CELLS are of two Types: Internal CPU
;       Cells and Memory Locations. The Command to OPEN one of the
;       Internal Registers is of the form "nA" where n is any OCTAL
;       Expression between 0 and 7.
;
;       0-3     For ACCUMULATORS 0-3
;       4       For PC of the next Instruction to be Executed in the
;               event of a "P" Command.
;       5       CPU and TTO Status
;               BIT     INTERPRETATION
;               15      Status of TTO DONE FLAG
;               14      Status of INTERRUPTS (ION FLAG)
;               13      Status of CARRY BIT
;       6       Address of the Location having the BREAK POINT (If any)
;       7       Instruction at the BREAK POINT Location
;
;       Other Commands to OPEN Cells are:
;
;       "ADR"/  Open the Cell and Print its contents
;       ./      Open the Cell currently pointed to by the Pointer and
;               Print its contents.
;       .+"ADR"/ Add "ADR" to the Pointer, Open the Cell and Print its
;               contents.
;       .-"ADR"/ Subtract "ADR" from the Pointer, Open the Cell and
;               Print its contents.
;       "CR"    The Return Key is used to Close the Open Cell with or
;               without Modification.
;       "LF"    Line Feed is used to Close the Open Cell with or without
;               Modification and to Open the succeeding Cell.
;       CTRL    Close the Open Cell with or without Modification and
;               Open the preceeding Cell.
;       /       Close the Open Cell without Modification, and Open the
;               Cell pointed to by its contents.
;       +"ADR"/ Close the Open Cell without Modification, and Open the
;               Cell pointed to by its contents + "ADDR".
;       -"ADR"/ Close the Open Cell without Modification, and Open the
;               Cell pointed to by its contents - "ADR".
```

```
;       Modification of a Cell:
;
;       Once a Cell has been opened its contents can be Modified by
;       typing the New Value the Cell is to contain in the form of
;       an OCTAL Expression followed by "CR" or "LF". If a + or - is
;       typed as the first character of the Expression then the Value
;       of the Expression is Added to or Subtracted from the Old
;       contents of the Cell. The Address itself or an Expression
;       relative to the Address can be Deposited by typing a "." or
;       :,+/-OCTAL Expression". A Rubout Command given right after
;       opening a Cell allows the Modification of its contents as if
;       they were typed in just before the Command was issued.
;
;       Other ODT Commands:
;
;       RUBOUT  This Key is used to Delete ERRONEOUSLY typed digits.
;               Each time the Key is pressed the right most digit is
;               Deleted and Echoed on the Terminal. If the Rubout
;               Key is pressed right after opening a Cell then it
;               Deletes the right most digit of the Cells contents.
;               This allows the Modification of the Cell as if its
;               contents were typed in just before the Key was pressed.
;       "ADR"B  Insert a BREAK POINT at Location "ADR".
;               Only one Break Point can be inserted and any entry to
;               ODT after Executing a Break Point will cause it to be
;               Deleted.
;       D       Delete the Break Point if any.
;       P       Restart the Execution of the program at CURRENT Location
;       "ADR"R  Start Executing the program at "ADR" after an IORST.
;       K       Kill the String typed so far. The ODT responds with a
;               "?" and the Open Cell is closed without Modification.
;       =       Print the OCTAL Value of the INPUT only.
;               This will Close any Open Cells without  Modification and
;               will not Open a Cell
;
;       NOTE:   In Programs which RELOCATE THEMSELVES the
;               user should place Break Points ONLY in the
;               ORIGINAL PROGRAM AREA. If a Break Point is
;               placed outside this area the results will
;               be unpredictable.
```

```
;
; 12. SPECIAL NOTES/SPECIAL FEATURES:

;       12.1 If the Disk Pack has BAD SECTOR FLAGS Set on Cylinder
;       0, or on the First 8 Sectors of Head 0 of any Cylinder,
;       Error Printouts will result when the Flags are Encountered.

;       12.2  Tests F1-F3 alter the Format on CYL 0,HD 0,SEC 0 for
;       purpases of Checking the FORMAT Logic and BAD SECTOR Logic.
;       SWPAK7 should be Set to 1 in order to stop Program from
;       executing the Format.

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

;       12.4  DISK PACKS
;       Only use Disk Packs Formatted by the DISKF Pack Formatter
;       Program. The Diagnostic Program will Write over most of
;       the Disk Surface.

; 13. RUN TIME:
;       The Run Time for a PASS is approximately: 3 MIN.
```

```
;
;
;*****************************************************************
;-----------------------------------------------------------------
;
; DESCRIPTION: ZETACO DISK CONTROLLER RELIABILITY PROGRAM
;
;
; Product of ZETACO, 1986
;*****************************************************************
 -------;TITL   DISKR-----------------------------------------------
        .DUSR   X=1
        .NOMAC  X
;1.0    PROGRAM NAME:   DISKR.SR

;2.0    REVISION HISTORY:
;
;       REV.      DATE
;        00      02/09/83                ;
;        01      09/07/83                ;S120 # SKP TOGETHER, STACK AND
;                                        ;AOS BOOTSTRAP AT 400, NO VERIFY
;                                        ;W/RANDOM DATA TEST 502 SWT 10
;        02      03/28/84                ;ADD RELEASE COMMAND TO RC
;                                        ;FOR DUAL PORT, DAISY CHAIN
;                                        ;DISK SECTOR PULSE COUNTER
;                                        ;DEVICE CODE CHANGE ROUTINE
;                                        ;502 PAT 24 SECTOR
;        03      05/30/84                ;ZDF1,
;
;        04      08/21/85                ;DISABLE VIRTUAL, UP TO 2048.
;                                        ;CYLS, 40 HDS
;
;        05      11/20/86                ;MULTI DC 500 & 505, DMA PTR
;                                        ;MAJOR

;3.0    MACHINE REQUIREMENTS:

;       NOVA/ECLIPSE/MV FAMILY CENTRAL PROCESSOR
;       16K READ/WRITE MEMORY
;       ZETACO DISK CONTROLLER (ZEBRA TYPE)
;       0-3 DISK DRIVES
;       TELETYPE or CRT and CONTROL

;4.0    TEST REQUIREMENTS:      N/A

;5.0    SUMMARY:

;       The ZETACO DISK CONTROLLER RELIABILITY PROGRAM is a
;       MAINTENANCE PROGRAM designed to EXERCISE and TEST the
;       ZETACO SMD DISK SUB-SYSTEMS and 1-4 DISK DRIVES. The
;       DISK DRIVES may be shared between TWO Computers.

;       The Device Code may be 20-76 OCTAL with the Default
;       being 27.
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```
;       1. The DISK DRIVES may be shared between TWO Computers in
;       which case the following Programs may be running in each
;       Computer:

;       STARTING ADRESSES'S (SA) 500,501 RANDOM RELIABILITY
;       SA 503 COMMAND STRING (If a RELEASE Command is included
;       in the Command String)

;       If no Drives are to be Shared, there are no other
;       Restrictions as to the running of these Programs on a
;       Dual Processor System.

;       2. Any Combination of Drives may be Tested by this Program
;       at a single time.


;7.0    PROGRAM DESCRIPTION/THEORY OF OPERATION:

;       A. RELIABILITY TEST (SA 500)

;       A Random Number Generator is used to select a Disk Drive,
;       Cylinder,Head,Beginning Sector, and Number of consecutive
;       Sectors. Random Data is then Generated, Written, and Read.
;       The Sequence is repeated indefinately. If running Multiple
;       Units, Over Lapped SEEKS are employed, if the next Random
;       Unit is different from the current Unit under I/O Execution.

;       B. RELIABILITY TEST (SA 501) with OPTIONS

;       Same as A, Except that Operator is given Options on Data
;       Patterns and may choose a Constant Cylinder,Head,Sector
;       or # or Sectors. Any Letter response to CYL,HEAD ETC.
;       gets Random function for that Variable. A Carriage Return
;       only gets the Random function for all Variables.

;       The Operator is also asked to respond to JITTER OPTION
;       (YES/NO). If YES, a Random Delay(0-40,50MS) is inserted
;       into the Background Loop to create a more asynchronous
;       Disk I/O Loop.

;       C. INCREMENTAL DISK ADDRESS TEST (SA 502)

;       Operator is given Option on Data; Requested Data is first
;       Written (SEE SWPAK10) over the entire Pack. Then the Data
;       is Read from all Sectors . This insures that all Disk
;       Blocks are useable and are Formatted properly. The Test
;       is then repeated for all Ready Disks, and PASS is Printed.
;       The sequence is repeated indefinitely.

;       #NOTE
;       SWPAK8=1, puts Program into Read ONLY Mode ## SA'S 501,502 ONLY.
;       If SA 501-Data must !NOT! be Random.

;       All Numbers entered above must be in Octal. Any Non-Octal
;       input is treated as a letter. Any letter input for CYL,Head,
;       Sector, or # of Sectors gets Random function in the Reliability
;       Test with Options.
```

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

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

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

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

;       III.    COMMAND STRING:

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

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

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

;       The following example would cause UNIT
```

```
;       WRITE SECTORS 2 and 3 of HEAD 5, then
;       READ it back and CHECK.  Data is specified
;       as ALTERNATE WORDS of ZEROS then ONES.

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

;       The following example would WRITE 0 to
;       CONTROLLER MEMORY location 1500 (OCTAL)

;       UNIT:    1
;       DATA:    N/A
;       COMMAND STRING: MEMORY 101500,0
;       NOTE: Upper memory bit = 1 defines a WRITE
;
;       E. QUICKIE FORMATTER (SA 504)
;       Formats Pack and HALTS. There is NO Verify, NO Flags are
;       Set, and NO Error Checking.

;       F. RUNALL (SA 505)
;       Program alternates between the Programs described in 7.B
;       (4 Data Patterns -PAT,RAN,FLZ,FLO) and 7.C(6 Da  Patterns
;       -PAT,RAN,RAN-2,ZEROES,ONES,ALT) and 7.H, and in that order.

;       G. SEEK EXERCISER (SA 506)
;       Program provides a SEEK scan sequence converging from the
;       extreme Outermost Tracks into the adjacent track in the
;       center, then diverging again to the extremes.

;       H. RANDOM SEEK EXERCISER (SA 507)
;       Program provides a Random SEEK sequence

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

;       I.  ERROR COUNT/LOG RECOVERY (SA 510)
;       In the event a Program was stopped during a run, the Error
;       Logs may be recovered at this Starting Address.
;       ***MUST be done before any Program RESTART as Program
;       Initialization Zeroes all Logs.
;


;
;
;8.0  OPERATING MODES/SWITCH SETTINGS:

;8.1    SWITCH SETTINGS
;
;       Location "SWREG" is used to select the program options.
;       This Location will be set according to the answers
;       supplied by the Operator. The Options can be changed
;       or verified by using one of the commands given in Sec.
;       8.3
;
;
;8.2    SWITCH OPTIONS
;       Different bits and their interpretation at location
;       "SWREG" is as follows:
;
;       BIT     OCTAL   BINARY  INTERPRETATION
;               VALUE   VALUE
```

```
;       1         40000   0       LOOP on ERROR
;                 000000  1       SKIP LOOPING on ERROR
;
;       2         20000   0       PRINT to CONSOLE
;                 000000  1       ABORT PRINT OUT to CONSOLE
;
;       4         04000   0       PRINT PASS
;                 000000  1       DO NOT PRINT PASS
;
;       5         02000   0       DO NOT PRINT on the LINE PRINTER
;                 000000  1       PRINT on the BYTE I/O LINE PRINTER(DC17)
;
;       6         01000   0       DO NOT EXIT to ODT on ERROR
;                 000000  1       EXIT to ODT on ERROR
;
;       7         00400   0       NOT USED
;                 000000  1
;
;       8         00200   0       N/A
;                 000000  1       For READ ONLY MODE (SA 501,502)
;
;       9         00100   0       N/A
;                 000000  1       BYPASS DATA CHECK
;
;       10(A)     00040   0       N/A
;                 000000  1       DO VERIFY After WRITE (SA 502 ONLY and
;                                 NOT RANDOM DATA)
;
;       11(B)     00020   0       N/A
;                 000000  1       ENABLE BAD SECTOR PRINTOUTS
;
;       12(C)     00010   0       N/A
;                 000000  1       HALT on DRIVE ERROR prior to
;                                 Recovery RECALIBRATE Operation
;
;       13(D)     00004   0       NO TRACE
;                 000000  1       TRACE PRINTOUT on ERROR
;
;       16(G)     00000   0       Do NOT PRINT on the DMA LINE PRINTER
;                 100000  1       PRINT on the DMA LINE PRINTER(DC17)
;

;
;8.3    SWITCH COMMANDS
;       Once the Program starts executing the state of any of
;       the Bits can be changed by Hitting KEYS 1-9, A-Z. The
;       Program will Continue Running after Updating the Options.
;       Each Key will Complement the state of the Bit affiliat-
;       ed with it, thus Bit 4 can be Altered by Hitting Key 4.
;       Setting of any Bit of Location "SWREG" will Set Bit 0.
;       (Default Mode is defined as all Bits of SWREG Set to 0)
;
;
;8.4    OTHER COMMANDS  (° = CONTROL KEY)
;
;       "CR"    A "RETURN" can be typed to Continue the Program
;               after its locked in a Switch Modification Mode
;
;       °D      This Command given at any time will reset "SWREG"
;               to Default Mode and Restart the Program.
;
;       °R      This Command given at any time will Restart the
;               Program. Switches are left with the values they
;               had before the Command was issued.
```

```
;         ^O        This Command given at any time will cause the
;                   Program Control to go to ODT.
;
;         M         This Command given at any time will print the
;                   Current Operating Modes.
;
;         0         This Command given at any time will lock the
;                   Program into Switch Modification Mode where
;                   more than 1 Bit can be changed.
;
;9.0      OPERATING PROCEEDURE/OPERATOR INPUT:

;         A. Verify drive (s) are ready on-line
;         B. Load Program
;         C. To RUN other than TEST 505, Enter CONTROL "0"
;            at 9.2, Enter STARTING ADDRESS followed by an "R"

;         STARTING ADDRESS
;         200       Read Unit Characteristics and then RUN ALL TEST (505)
;         500       RELIABILITY TEST, ALL CYLINDERS
;         501       RELIABILITY TEST, (OPTIONS)
;         502       INCREMENTAL DISK ADDRESS TEST
;         503       COMMAND STRING INTERPRETER
;         504       QUICKIE FORMATTER
;         505       RUN ALL
;         506       SEEK EXERCISER (CONVERGING,DIVERGING PATTERN)
;         507       SEEK EXERCISER (RANDOM PATTERN)
;         510       ERROR COUNT/LOG RECOVERY
;         511       MULTIPLE DEVICE CODE ENTRY

;9.1      Operator is requested to enter DEVICE CODE of CONTROLLER
;         (DEFAULT 27).
;9.2      STARTING ADDRESS is Displayed and Operator is requested to
;         SET SWPAK followed by a Carriage Return (SEE 8.3).
;9.3      Operator is requested to enter YES/NO to Exercise Maps, if
;         present and supported.
;9.4      MONTH, DAY, YEAR (I.E. 77...), HOUR, & MINUTE (If [CR] is
;         given this routine is bypassed).
;9.5      Operator is requested to enter YES/NO if any DUAL VOLUME
;         DRIVES (CMD'S).
;9.6      Operator is requested to enter YES/NO to CONTROLLER CORRECTION,
;         if it is enabled.
;9.7      Unit Numbers, Types, and their Characteristics are then
;         Displayed, (The Operator should Verify these values) Operator
;         is then requested to enter UNIT NUMBERS to be tested (0-3).
;9.8      Operator is then requested to enter TYPE of disk ( to create a
;         User Defined enter 10)
;         A.        If TYPE entered is 10, enter 0, 1, 2, or 3 to
;                   RE-DEFINE a disk TYPE
;         B.        # of HEADS for NEW TYPE (in DECIMAL)
;         C.        # of CYLINDERS for NEW TYPE (in DECIMAL)
;         D.        # of SECTORS for NEW TYPE (in DECIMAL, CANNOT be
;                   DOWNSIZED)
;         E.        RETURN to 9.7

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

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

;         OPERATOR INPUT CONTROLLED PRINTOUTS ARE AS FOLLOWS:

;         L         = FIRST 100. BAD SECTORS, DATA, or ADDRESSES
```

; W = SECTORS W/R, ERROR COUNTS, and on BOARD ECC and
; OFFSET CORRECTS
; **NOTE** Any Character typed will end Printouts at the next
; change of Data Type.

;10.0 PROGRAM OUTPUT/ERROR DESCRIPTION:

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

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

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

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

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

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

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

; If a Hard Cylinder Address Error occurs, a Read on an
; adjacent Head will be attempted to determine whether the
; Fault should be classed as a Seek Error or an Address Error.
; The First 20. Address Errors will have their Addresses Logged.
;
; 3. BAD SECTOR- Log the Disk Address (1st 100.) and do a Normal
; Return. No Printout will result unless SW11=1, although the
; I/O Operation was prematurely terminated. A "SOFT" Error will
; be Recorded if the Sector under Test Passes at Least 1 of 4
; Retrys. The Log denotes SOFT Errors by a count greater than 0,
; representing the Error Count tallied. ***SEE 10.3A.

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

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

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

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

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

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

;       Any Successful REREADS while in an Offset Mode will be
;       Printed and Logged. The Disk Addresses of all Data problems
;       will be Printed and the First 100. will be Logged. The First
;       Three Good/Bad word pairs and respective Addresses will be
;       Printed.

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

;10.3A  ECC (ERROR CORRECTION CODE) ANALYSIS

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

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

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

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

;       A Failure of the Drive to Write a Sector.
;       *NOTE- A Check should be made in the Bad Sector Log to see
;       whether a Write Operation may have encountered a Soft or
;       Faulty Bad Sector indication, which would have terminated
;       the Write.

;       A Failure in the Controller Data paths.

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

;       4A. An ECC Error was detected but with no Accompanying
;       Data Error. A Check is made to see whether the ECC Words
;       point to an Error within the two Appended Write ECC Words.
;       If such an Error is determined to be the case, the Error
;       will be Logged as Correctable and no ECC Failed message
;       will result. This type of Error should represent only a
```

Sample). If a Significantly Higher Percentage of this Error results, Then an ECC Problem would be Indicated.

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

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

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

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

10.4 ERRORS- Error Status is printed whenever encountered as follows:

```
;       'MODE'  UNIT:   'N'
;       CYL-  'N'       HEAD  'N'       SECT  'N'    #SECT  'N'
;       DIA/DIB STATUS= 'N'     'DESCRIPTIVE MESSAGE'
```

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

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

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

;10.5   STATISTICS -

;       Type a W during random testing to get a Report of the
;       Number of Sectors Written(and/or)Read, plus Error Counts
;       in Decimal. Also Listed is a Count for Controller
;       Corrects/Unit (on Board ECC Correction and Offset Corrects)

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

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

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

```
;11.0   DEBUG HELP:
;
;OCTAL DEBUGGER  (ODT)
;
;       This Reliability is equipped with a built in ODT which can be
;       accessed by hitting CONTROL O at any time during the execution
;       of the Program (after Setting the Parameters). On entering ODT
;       the Address of the Location having the next instruction to be
;       executed will be typed-out.
;
;       The following Conventions are used by the ODT:
;       ?       Pressing any Illegal key causes the ODT to respond
;               with a "?".
;       @       ODT is ready and at your service.
;
;       An ODT Command has the following Format:
;               [ARGUMENT][COMMAND]
;       An Argument may be one of the following:
;       "EXP"   An OCTAL Expression consisting of OCTAL Numbers
;               separated by Plus (+) or Minus (-) signs. Leading
;               Zeros need not be typed.
;       "ADR"   An Address is the same as an Expression except
;               that Bit 0 is neglected.
;       A Command is a single teletype character
;
;       The Locations that can be EXAMINED and MODIFIED by the user
;       are called CELLS. These CELLS are of two Types: Internal CPU
;       Cells and Memory Locations. The Command to OPEN one of the
;       Internal Registers is of the form "nA" where n is any OCTAL
;       Expression between 0 and 7.
;
;       0-3     For ACCUMULATORS 0-3
;       4       For PC of the next Instruction to be Executed in the
;               event of a "P" Command.
;       5       CPU and TTO Status
;               BIT     INTERPRETATION
;               15      Status of TTO DONE FLAG
;               14      Status of INTERRUPTS (ION FLAG)
;               13      Status of CARRY BIT
;       6       Address of the Location having the BREAK POINT (if any)
;       7       Instruction at the BREAK POINT Location
;
;       Other Commands to OPEN Cells are:
;
;       "ADR"/  Open the Cell and Print its contents
;       ./      Open the Cell currently pointed to by the Pointer and
;               Print its contents.
;       .+"ADR"/ Add "ADR" to the Pointer, Open the Cell and Print its
;               contents.
;       .-"ADR"/ Subtract "ADR" from the Pointer, Open the Cell and
;               Print its contents.
;       "CR"    The Return Key is used to Close the Open Cell with or
;               without Modification.
;       "LF"    Line Feed is used to Close the Open Cell with or without
;               Modification and to Open the succeeding Cell.
;       CTRL    Close the Open Cell with or without Modification and
;               Open the preceeding Cell.
;       /       Close the Open Cell without Modification, and Open the
;               Cell pointed to by its contents.
;       +"ADR"/ Close the Open Cell without Modification, and Open the
;               Cell pointed to by its contents + "ADDR".
;       -"ADR"/ Close the Open Cell without Modification, and Open the
;               Cell pointed to by its contents - "ADR".
```

```
;       Modification of a Cell:
;
;       Once a Cell has been opened its contents can be Modified by
;       typing the New Value the Cell is to contain in the form of
;       an OCTAL Expression followed by "CR" or "LF". If a + or - is
;       typed as the first character of the Expression then the Value
;       of the Expression is Added to or Subtracted from the Old
;       contents of the Cell. The Address itself or an Expression
;       relative to the Address can be Deposited by typing a "." or
;       :,+/-OCTAL Expression". A Rubout Command given right after
;       opening a Cell allows the Modification of its contents as if
;       they were typed in just before the Command was issued.
;
;       Other ODT Commands:
;
;       RUBOUT  This Key is used to Delete ERRONEOUSLY typed digits.
;               Each time the Key is pressed the right most digit is
;               Deleted and Echoed on the Terminal. If the Rubout
;               Key is pressed right after opening a Cell then it
;               Deletes the right most digit of the Cells contents.
;               This allows the Modification of the Cell as if its
;               contents were typed in just before the Key was pressed.
;       "ADR"B  Insert a BREAK POINT at Location "ADR".
;               Only one Break Point can be inserted and any entry to
;               ODT after Executing a Break Point will cause it to be
;               Deleted.
;       D       Delete the Break Point if any.
;       P       Restart the Execution of the program at CURRENT Location
;       "ADR"R  Start Executing the program at "ADR" after an IORST.
;       K       Kill the String typed so far. The ODT responds with a
;               "?" and the Open Cell is closed without Modification.
;       =       Print the OCTAL Value of the INPUT only.
;               This will Close any Open Cells without  Modification and
;               will not Open a Cell
;
;       NOTE:   In Programs which RELOCATE THEMSELVES the
;               user should place Break Points ONLY in the
;               ORIGINAL PROGRAM AREA. If a Break Point is
;               placed outside this area the results will
;               be unpredictable.
;
```

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

;       The Letter "M" is used to specify a Map Command and is
;       used in conjuction with the Set of Characters that form
;       the Map Command Group. A Map Command is thus formed by
;       using the Letter "M" and following it with the desired
;       Command Letter (Such as "MT", "MA", ETC.)
;
;       Map Command Errors
;
;       If a Map Command is entered and the Error Message "No Map"
;       appears, then either:
;       A) A Map was not found
;       B) The Program does not support Mapped ODT.

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

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

```
;12.0    SPECIAL NOTES/SPECIAL FEATURES:
;
;        1. A CR only response to Unit Numbers, ETC will leave
;        information in Previous State.
;
;        2. The Program will Account for up to a MAX. of 2**31 Sectors
;        Written or Read. Special Test runs exceeding this facility
;        will require an OPERATOR'S TEST LOG to augment software
;        accounting. 2**31 Sectors = Approx. 2* 10**9 Words.
;
;        4. SWPAK7=1, Program halts after write with Read Verification
;        allowing operator to change packs. SWPAK8=1, Puts Program into
;        Read only mode ## SA'S 501,502 Only. If SA 501-Data must INOTI
;        be Variable. Start at the above selected Address.

;        5. All Numbers entered in 7.0 must be in Octal. Any Non-Octal
;        input is treated as a Letter. Any Letter input for CYL, HEAD,
;        SECTOR, or # of SECTORS gets Random function in the Reliability
;        Test with Options.
;
;        6. At times the ECC may attempt to Correct a Non-Correctable
;        Data Error and the Simulated ECC and Actual ECC will Match
;        even though an ECC Failure will have been Printed. This is
;        Due to a Failure of the ECC Polynomial itself to Distinguish
;        between two different Error Patterns. One Correctable and one
;        Uncorrectable. This is INOTI a Hardware Failure.

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

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

```
*****************************************************************
.................................................................

 DESCRIPTION: ZETACO DISK CONTROLLER FORMATTER PROGRAM


 Product of ZETACO, 1986
*****************************************************************
.......;TITL  DISKF.....................................................
       .DUSR   X=1
       .NOMAC  X
1.0    PROGRAM NAME:   DISKF.SR

2.0    REVISION HISTORY:

;      REV.       DATE
;       00      02/09/83        ;

;       01      08/23/83        ;ADUB FOR ALT1 (STTD), AOS BSTRAP
;                               ;(400'S)
;       02      03/28/84        ;DISK PULSE COUNTER, ERROR LOGS,
;                               ;200. ERRORS, MSB FOR BAD SECTOR
;                               ;LOG, DEVICE CODE CHANGE ROUTINE
;       03      05/30/84        ;ECC ON WRITE, ZDF1
;
;       04      08/21/85        ;DISABLE VIRTUAL, UP TO 2048. CYLS
;
;       05      11/20/86        ;297, 40 HDS, DMA PTR, WELLEX,
;                               ;IORST

;3.0    MACHINE REQUIREMENTS:

;      NOVA/ECLIPSE/MV FAMILY CENTRAL PROCESSOR
;      16K READ/WRITE MEMORY
;      ZETACO DISK CONTROLLER (ZEBRA TYPE)
;      0-3 DISK DRIVES
;      TELETYPE or CRT and CONTROL

;4.0    TEST REQUIREMENTS:      N/A

;5.0    SUMMARY:

;      The ZETACO DISK CONTROLLER FORMATTER PROGRAM
;      is designed to FORMAT and CHECK DISK PACKS and
;      MEDIA to be used in DISK SYSTEMS. The PROGRAM is
;      !NOT! A MAINTENANCE PROGRAM and ASSUMES the HARDWARE
;      to be in WORKING ORDER. The PROGRAM will HALT on
;      any NON-DATA related ERRORS. It is also recommended
;      that ON-BOARD ECC be SOFTWARE or CONFIGURED DISABLED
;      when FORMATTING. The Device Code may be 20-76 OCTAL
;      with the Default being 27.

;6.0    RESTRICTIONS:
;      This Program has no Restrictions as to Single or
;      Dual Processor Hardware Configuration. However, the
;      Formatter may be run on ONLY ONE CPU at a time and
;      must be the only Program being run within the Disk
;      System.
```

```
;7.0     PROGRAM DESCRIPTION/THEORY OF OPERATION:

;       A. FORMATTER PROGRAM (STARTING ADDRESS <SA> 500)
;       The disk is first formatted after which a "FORMAT DONE"
;       message is printed. Then a 055555 pattern is written to
;       the entire pack and read back 2 times, A random seek
;       test is performed, and "PASS" is printed. The data pattern
;       is then rotated 1 bit and the WRITE/READ/READ/SEEK process
;       is repeated. At the completion of the number of passes
;       entered by the operator, A log is available to be printed
;       and the drives are released.
;*****************************************************
;       It is Recommended that at LEAST 3 PASSES (W/R/R/S);with
;       On-Board ECC DISABLED, be allowed to insure Pack Quality.
;       If time permits, longer runs will further insure
;       Reliability.
;*************************************************************
;       Any HARD DATA or ADDRESS ERRORS will result in the BAD
;       SECTOR FLAG being set in that sector. Any "SOFT DATA" or
;       "ADDRESS ERROR" ADDRESS encountered TWICE cause the BAD
;       SECTOR FLAG to be set. Any other error will cause the
;       program to print the failure and halt.

;       A HARD ADDRESS ERROR is defined as such after 2 ATTEMPTS
;       have been made BOTH resulting in an ADDRESS ERROR. A HARD
;       DATA ERROR is defined as such after 2 or MORE of 10
;       WRITE/READ RETRY'S have been unsuccessful.

;       B. CHECK PROGRAM ONLY (SA 501)
;       Same as SA 500 except that initial pack format operation is
;       bypassed.

;       C. STATISTICS
;       Type L for 1ST 200. disk addresses of BAD SECTORS, DATA and
;       ADDRESS ERRORS, plus a statistic table of overall errors.
;       **NOTE** Any character typed while executing this log will
;       end it at the next change of data type.

;       D. LOG RECOVERY (SA 502)
;       Use to recover log of program after it has stopped to get a
;       LOG PRINTOUT.

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

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

;       II.     DATA:   RAN=RANDOM
;                       ALO=ALL ONES
;                       ALZ=ALL ZEROS
;                       PAT=110110 PATTERN
;                       FLO=FLOATING ONE PATTERN
;                       FLZ=FLOATING ZERO PATTERN
;                       ADR=ALTERNATING CYLINDER and
;                       HEAD,SECTOR WORDS
;                       VAR=Existing words entered previously as
;                       described below

;                       Alternatively enter a string of up to 7
```

```
;                       The words entered are used repeatedly
;                       to make up a sector block. Type carriage
;                       return to use the previous entry.

;       III.    COMMAND STRING:

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

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

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

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

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

;       The following example would WRITE 0 to
;       CONTROLLER MEMORY location 1500 (OCTAL)

;       UNIT:   1
;       DATA:   N/A
;       COMMAND STRING: MEMORY 101500,0
;       NOTE: Upper memory bit = 1 defines a WRITE
```

```
;8.0  OPERATING MODES/SWITCH SETTINGS:

;8.1     SWITCH SETTINGS
;
;        Location "SWREG" is used to select the program options.
;        This Location will be set according to the answers
;        supplied by the Operator. The Options can be changed
;        or verified by using one of the commands given in Sec.
;        8.3
;
;8.2     SWITCH OPTIONS
;        Different bits and their interpretation at location
;        "SWREG" is as follows:
;
;        BIT      OCTAL    BINARY   INTERPRETATION
;                 VALUE    VALUE
;
;        1         40000     0       LOOP on ERROR
;                 000000     1       SKIP LOOPING on ERROR
;
;        2         20000     0       PRINT to CONSOLE
;                 000000     1       ABORT PRINT OUT to CONSOLE
;
;        5         02000     0       DO NOT PRINT on the LINE PRINTER
;                 000000     1       PRINT on the BYTE I/O LINE PRINTER(DC17)
;
;        11(B)     00020     0       N/A
;                 000000     1       ENABLE BAD SECTOR PRINTOUT
;
;        16(G)     00000     0       DO NOT PRINT on DMA LINE PRINTER
;                 100000     1       PRINT on DMA LINE PRINTER(DC17)
;
;8.3     SWITCH COMMANDS
;        Once the Program starts executing the state of any of
;        the Bits can be changed by Hitting KEYS 1-9, A-Z. The
;        Program will Continue Running after Updating the Options.
;        Each Key will Complement the state of the Bit affiliat-
;        ed with it, thus Bit 4 can be Altered by Hitting Key 4.
;        Setting of any Bit of Location "SWREG" will Set Bit 0.
;        (Default Mode is defined as all Bits of SWREG Set to 0)
;
;8.4     OTHER COMMANDS  (° = CONTROL KEY)
;
;        "CR"     A "RETURN" can be typed to Continue the Program
;                 after its locked in a Switch Modification Mode
;
;        °D       This Command given at any time will reset "SWREG"
;                 to Default Mode and Restart the Program.
;
;        °R       This Command given at any time will Restart the
;                 Program. Switches are left with the values they
;                 had before the Command was issued.
;
;        °O       This Command given at any time will cause the
;                 Program Control to go to ODT.
;
;        M        This Command given at any time will print the
;                 Current Operating Modes.
;
;        0        This Command given at any time will lock the
;                 Program into Switch Modification Mode where
;                 more than 1 Bit can be changed.
;
```

```
;9.0     OPERATING PROCEEDURE/OPERATOR INPUT:

;        A. Verify drive (s) are ready on-line
;        B. Load Program
;        C. To RUN other than TEST 500, Enter CONTROL "0"
;           at 9.2, Enter STARTING ADDRESS followed by an "R"

;        STARTING ADDRESS (SA)
;        200      Read Unit Characteristics and then Run FORMATTER (500)
;        500      FORMATTER/CHECK PROGRAM
;        501      CHECK PROGRAM ONLY
;        502      ERROR LOG RECOVERY
;        503      COMMAND STRING INTERPRETER

;9.1     Operator is requested to enter DEVICE CODE of CONTROLLER
;        (DEFAULT 27)
;9.2     Operator is requested to SET SWPAK followed by a Carriage
;        Return (SEE 8.3)
;9.3     MONTH, DAY, YEAR (I.E. 77...), HOUR, & MIN (If [CR] is
;        given this routine is bypassed)
;9.4     Enter # of Passes for Test Completion (If [CR] is given
;        this routine is bypassed)
;9.5     Operator is requested to enter YES/NO to CONTROLLER CORRECTION,
;        if it is enabled
;9.6     Unit Numbers, Types, and their Characteristics are then
;        Displayed, (The Operator should Verify these values) Operator
;        is then requested to enter UNIT NUMBERS to be tested(0-3)
;9.7     Operator is then requested to enter TYPE of disk ( to create a
;        User Defined enter 10)
;        A.       If TYPE entered is 10, enter 0, 1, 2, or 3 to
;                 RE-DEFINE a disk TYPE
;        B.       # of HEADS for NEW TYPE (in DECIMAL)
;        C.       # of CYLINDERS for NEW TYPE (in DECIMAL)
;        D.       # of SECTORS for NEW TYPE (in DECIMAL, CANNOT be
;                 DOWNSIZED)
;        E.       Return to 9.7

;        OPERATOR INPUT CONTROLLED PRINTOUTS ARE AS FOLLOWS:
;
;        L        = First 200. BAD SECTORS, DATA, or ADDRESSES
```

;10.0 PROGRAM OUTPUT/ERROR DESCRIPTION:

; 1. ERRORS- Error status is printed whenever encountered.
; When Data Errors are found ONLY THREE are printed per
; encounter. (see paragraph 10.3)

; 2. If Errors are encountered more than once, a count
; will be recorded and a BAD SECTOR FLAG SET. All address
; information will be printed in OCTAL.

; 3. ERROR REPORTING AND RECOVERY

; All Errors are identified, and the program is routed
; via base to a call to CKSW. with the exception of
; ADDRESS and DATA ERRORS. The program will then loop
; for operator intervention, on the basis of SWPAK (see 8.)

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

; SEEK - Positioner Fault Status results in Status Printout
; and Error return.

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

; DRIVE STATUS (DIB) is checked 1st for both Read and Write
; before any DIA checks are made.

; 4. READ/WRITE TIMEOUTS, DATA LATE, ILLEGAL SECTOR,
; ECC(DATA OK), or any DRIVE FAULT- Print the Illegal Status
; and do an Error return.

; 5. ADDRESS ERROR- Repeat the Write, If Test passes the
; second time, do a Normal return; Otherwise flag as Hard, Set
; the BAD SECTOR FLAG for that Sector and do an Error return.

; If a HARD Cylinder Address Error occurs, a Read on an
; adjacent Head will be attempted to determine whether the
; Fault should be classed as a Seek Error or an Address
; Error. The First 30. Hard Address Errors will have their
; Addresses Logged.

; 6. ENDING MEMORY ADDRESS -Print the Error Message,
; Check for a DISK ADDRESS and do an Error return.

; 7. ENDING DISK ADDRESS -Print the Error Message and
; do an Error return.

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

; DATA ERRORS - Data is reread 9 times. If Data is BAD on
; 2 or more of 10 tries, a HARD Error Count is incremented,
; the BAD SECTOR FLAG is set in that Sector, and an Error
; return is taken. If Data is good on all retries, the
; Error is considered SOFT and a normal return is taken.

; The 1st 200. Data Errors (HARD or SOFT) are Logged.

11.0 DEBUG HELP:

OCTAL DEBUGGER (ODT)

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

The following Conventions are used by the ODT:

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

@ ODT is ready and at your service.

An ODT Command has the following Format:

[ARGUMENT][COMMAND]

An Argument may be one of the following:

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

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

A Command is a single teletype character

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

0-3 For ACCUMULATORS 0-3

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

5 CPU and TTO Status

BIT	INTERPRETATION
15	Status of TTO DONE FLAG
14	Status of INTERRUPTS (ION FLAG)
13	Status of CARRY BIT

6 Address of the Location having the BREAK POINT (if any)

7 Instruction at the BREAK POINT Location

Other Commands to OPEN Cells are:

"ADR"/ Open the Cell and Print its contents

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

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

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

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

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

CTRL Close the Open Cell with or without Modification and Open the preceeding Cell.

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

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

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

```
;       Modification of a Cell:
;
;       Once a Cell has been opened its contents can be Modified by
;       typing the New Value the Cell is to contain in the form of
;       an OCTAL Expression followed by "CR" or "LF". If a + or - is
;       typed as the first character of the Expression then the Value
;       of the Expression is Added to or Subtracted from the Old
;       contents of the Cell. The Address itself or an Expression
;       relative to the Address can be Deposited by typing a "." or
;       :,+/-OCTAL Expression". A Rubout Command given right after
;       opening a Cell allows the Modification of its contents as if
;       they were typed in just before the Command was issued.
;
;       Other ODT Commands:
;
;       RUBOUT  This Key is used to Delete ERRONEOUSLY typed digits.
;               Each time the Key is pressed the right most digit is
;               Deleted and Echoed on the Terminal. If the Rubout
;               Key is pressed right after opening a Cell then it
;               Deletes the right most digit of the Cells contents.
;               This allows the Modification of the Cell as if its
;               contents were typed in just before the Key was pressed.
;       "ADR"B  Insert a BREAK POINT at Location "ADR".
;               Only one Break Point can be Inserted and any entry to
;               ODT after Executing a Break Point will cause it to be
;               Deleted.
;       D       Delete the Break Point if any.
;       P       Restart the Execution of the program at CURRENT Location
;       "ADR"R  Start Executing the program at "ADR" after an IORST.
;       K       Kill the String typed so far. The ODT responds with a
;               "?" and the Open Cell is closed without Modification.
;       =       Print the OCTAL Value of the INPUT only.
;               This will Close any Open Cells without  Modification and
;               will not Open a Cell
;
;       NOTE:   In Programs which RELOCATE THEMSELVES the
;               user should place Break Points ONLY in the
;               ORIGINAL PROGRAM AREA. If a Break Point is
;               placed outside this area the results will
;               be unpredictable.
;
;
;12.0   SPECIAL NOTES/SPECIAL FEATURES:

;       1. The Program is !NOT! a Maintenance Program and assumes
;       the HARDWARE to be in working order. The Program will
;       HALT on any NON-DATA related Errors.

;       2. It is recommended that at Least 3 Passes (W/R/R/S) be
;       allowed (see below) to insure pack quality. If time
;       permits, longer runs will further insure quality.

;13.1   PROGRAM RUNTIME:

;       Program runtimes are substantially reduced with memories
;       of 24K or larger. Runtimes are also dependant on CPU
;       Type, Drive Size and Drive Type.

        .EOT
```

```
 0001  MTAFD    AOS ASSEMBLER REV 04.20        13:26:46 06/08/84
01               ;
02               ;
03               ;
04               ;*****************************************************
05               ;
06               ;
07               ;
08               ; DESCRIPTION: FORMATTED MAG TAPE COUPLER  DIAGNOSTIC
09               ;              FOR MTA/MTC UNITS.  EMULATION 6021 OR 6125.
10               ;
11               ;
12               ; PRODUCT OF ZETACO 1984
13               ;*****************************************************
                         .TITL   MTAFD
15       000001          .DUSR   X=1
16       000001          .NOMAC  X
17       000000          .TXTM   0
18               ;1       PROGRAM NAME: MTAFD.SR
19               ;2      REVISION HISTORY:
20               ;
21               ;               REV.      DATE
22               ;               00       03/24/81
23               ;               01       05/27/81        DISK BOOTABLE
24               ;               02       12/10/81        ALLOW FOR STATUS OF OTHER
25               ;                                        DRIVES
26               ;               03       03/25/82        KSS
27               ;               04       06/20/83        GET RID OF AUTO INC STUFF
28               ;       (PREL ) 05.00    08/83           -UPGRADE TO USE DTOS REV 6.
29               ;                                        SOME TESTS RUN DIFFERENTLY.
30               ;                                        (BUILT FROM MT110D PROGRAM)
31               ;                                        -ID BURST NO LONGER REQUIRED
32               ;                                        ON PE NOR EXCLUDED ON NON-PE.
33               ;                                        -MODS FOR 6125 EMULATION(130A):
34               ;                                        BIT 11 (ID BURST) MUST = 0
35               ;                                        DOB/DIB (TEST A4) USES ALL 16
36               ;                                              BITS.
37               ;               06        9/83          ------------------------
38               ;                                        INCLUDE TEST NUMBER AND SUBTEST
39               ;                                         CHARACTER FOR ALL TESTS.  USED
40               ;                                         TO DISPLAY CURRENT TEST NUMBER
41               ;                                         AND TO SUGGEST INSTALLATIONAL
42               ;                                         OR OPERATIONAL CAUSES FOR SOME
43               ;                                         ERRORS.  (SEE RTN SUGJEST.)
44               ;                                        FIXED BUGS:
45               ;                                        - WAIT EXPECTS THE IN-LINE PARM
46               ;                                          TO BE DIRECT NOT INDIRECT.
47               ;                                        - MODIFY ALL .MTA INSTRUCTIONS
48               ;                                          WAS NOT DOING SO TO THE LAST
49               ;                                          FEW INSTRUCTIONS.
50               ;                                        - SOFT SW 1 ON SHOULD NOT FORCE
51               ;                                          ERROR DISPLAY ON EACH ROUND.
52               ;
53               ;                                        - REVISED CAL?B (IN DLIB) TO
54               ;                                          ALLOW FOR ANY OF 3 CLOCKS:
55               ;                                          CLOCK 1,2 OR 3.  THIS PROGRAM
56               ;                                          USING CLOCK 1 (10 HERTZ).
57               ;                                        - MOVED MOST DATA TO END OF
58               ;                                          LISTING SO THAT THE MODIFY
59               ;                                          DEVICE CODE ROUTINE NOT DOING
60               ;                                          STUFF TO DATA FIELDS.
```

```
0002  MTAFD
01              ;
02              ;               07      03/22/84        ------------------------------
03              ;                                       130 TO 133 AND PROPER DEVICE
04              ;                                       CODE CHANGE ROUTINE.
05              ;               08      6/4/84          BY PAN - COSMETICS:
06              ;                                       CHANGE 133 TO FORMATTED TAPE
07              ;                                       COUPLER (ALSO RUNS ON ZDF1
08              ;                                       BOARD.)
09              ;                                       PROGRAM NAME FROM MT133D TO
10              ;                                       MTAFD.
11              ;3.     MACHINE REQUIREMENTS
12              ;       3.1     NOVA OR ECLIPSE FAMILY CPU'S.
13              ;       3.2     MINIMUM OF 16K MEMORY.
14              ;       3.3     ZETACO FORMATTED (6021 OR 6125) MAG TAPE COUPLER BOARD,
15              ;               WITH A FORMATTED TAPE DRIVE.
16              ;       3.4     TELETYPE OR CRT AND CONTROLLER.
17              ;
18              ;4.     TEST REQUIREMENTS
19              ;       N/A
20              ;
21              ;5.     SUMMARY
22              ;       THIS PROGRAM IS A HARDWARE DIAGNOSTIC FOR THE ZETACO FORMATTED
23              ;       (6021 OR 6125) TAPE CONTROLLER.  THE DEVICE CODE CAN BE 20 THRU
24              ;       76.  ONLY ONE READY, WRITE ENABLED DRIVE CAN BE ON LINE AT A TIME.
25              ;
26              ;6.     RESTRICTIONS
27              ;
28              ;       ONLY ONE(1) DRIVE CAN BE ONLINE AT ANY TIME.  THE DEVICE
29              ;       CODE MUST BE 20 THRU 76.  ALL RESPONSES TO PROGRAM REQUESTS
30              ;       MUST BE ANSWERED PROPERLY TO CONTINUE THE SEQUENTIAL
31              ;       TESTING OF THE TAPE DRIVE.
32              ;7.     PROGRAM DESCRIPTION/THEORY OF OPERATION
33              ;       7.1     INITIALIZATION
34              ;               7.1.1   I/O MODULE INITIALIZED
35              ;               7.1.2   TEST SELB LINE SET, IF LINE SET IR-
36              ;                       RECOVERABLE ERROR.  PROGRAM HALTS AT
37              ;                       BHALT.
38              ;                               1.      SELECT UNIT NUMBER
39              ;                               2.      DEVICE CODE CHANGE
40              ;                               3.      SET SOFT SWITCH REGISTER
41              ;       7.2     PRELIMINARY TESTS
42              ;               7.2.1   TEST A1 - TEST SYSTEM SELD LINE.
43              ;               7.2.2   TESTS A2 AND A3 - TEST CONTROLLER BUSY
44              ;                       AND DONE STATUS.
45              ;               7.2.3   TESTS A4 THRU A8 - TEST FOR UNIT SELECT
46              ;                       BY LOADING AND TESTING THE MEMORY
47              ;                       ADDRESS REGISTER.
48              ;               7.2.4   TESTS A9 THRU A14 - TEST FOR SETTING AND
49              ;                       RESETTING OF BUSY AND DONE BY START
50              ;                       COMMAND.
51              ;       7.3     FIRST TAPE MOTION
52              ;               7.3.1   TESTS A15 AND A16 - TEST REWIND AND
53              ;                       ERASE OPERATION AND STATUS.
54              ;       7.4     FIRST DATA TRANSFER
55              ;               7.4.4   TESTS A20 AND A21 - TEST FOR TOTAL DATA
56              ;                       DATA WRITE WITH INTERRUPT.
57              ;               7.4.5   TEST A22 - TEST WRITE ODD PARITY.
58              ;       7.5     STATUS BIT TESTS
59              ;               7.5.1   TEST A24 AND A25 - TEST FOR ILLEGAL
60              ;                       COMMAND STATUS BIT SETTING.
```

```
01              ;               7.5.2   TEST A26 - TEST FOR EOF STATUS BIT
02              ;                       SETTING.
03              ;               7.5.4   TESTS A28, A30, A31, A32- TEST STATUS BITS
04              ;                       AND MEMORY ADDRESS REGISTER DURING BACK
05              ;                       AND FORWARD SPACING.
06              ;       7.6     DATA TRANSFER TESTS
07              ;               7.6.1   TEST A33  - TEST WRITE AND READ ODD PARITY.
08              ;               7.6.2   TESTS A35 AND A36 - TEST WRITE AND READ
09              ;                       WITH DIFFERENT WORD COUNTS.
10              ;               7.6.4   TESTS A39 THRU A41 - TEST EOF WRITE AND
11              ;                       READ.
12              ;               7.6.6   TESTS A50 THRU A53 - TEST FOR SPACING
13              ;                       ERRORS BY GENERATING NOISE WITH I/O
14              ;                       COMMANDS.
15              ;       7.7     WRITE LOCK TEST
16              ;               THIS TEST DETERMINES IF WRITE RING OUT
17              ;               WILL DISABLE THE WRITE.  THIS TEST IS ONLY
18              ;               PERFORMED DURING THE FIRST PASS AND CAN BE DE-
19              ;               LETED BY SETTING SOFT SWITCH REGISTER BIT 15.
20              ;       7.8     END OF TAPE TEST
21              ;               THIS TEST WRITES 4K BLOCKS FROM BOT TO EOT.  DUR-
22              ;               ING THE TAPE WRITE ALL ERROR STATUS CONDITIONS
23              ;               ARE MONITORED.  WHEN THE EOT SENSOR IS DETECTED
24              ;               THE WRITE OPERATION IS TERMINATED AND THE TAPE IS
25              ;               COMMANDED TO REWIND.  IF THE EOT SENSOR IS NOT DE-
26              ;               TECTED THE WRITE WILL CONTINUE UNTIL THE TAPE
27              ;               COMES OFF THE SUPPLY REEL.  THIS TEST CAN BE DE-
28              ;               LETED BY SETTING SOFT SWITCH REGISTER BIT 14.
29              ;8.     SOFT SWITCH REGISTER SETTINGS
30                      S?WPD 8
31              ;       8.3     SWITCH OPTIONS
32              ;
33              ;               DIFFERENT SWITCH BITS AND THEIR INTERPRETATION
34              ;                AT LOCATION "SWREG" ARE AS FOLLOWS:
35              ;
36              ;               BIT     OCTAL   BINARY  INTERPRETATION
37              ;                       VALUE   VALUE
38              ;               14(E)   00002   0       ENABLE WRITE TO EOT TEST
39              ;                               1       INHIBIT WRITE TO EOT TEST
40              ;
41              ;               15(F)   00001   0       ENABLE WRITE LOCK TEST
42              ;                               1       INHIBIT WRITE LOCK TEST
43              ;
44              ;               NOTE:   SWITCH BITS 14 AND 15 CAN ONLY BE
45              ;                       ENABLED DURING THE FIRST PASS OF THE
46              ;                       DIAGNOSTIC.  IF THE TESTS ARE TO BE PER-
47              ;                       FORMED AFTER THE FIRST PASS, THEY CAN BE
48              ;                       DIRECTLY ENTERED.
49              ;9.     OPERATING PROCEDURES
50              ;       9.1     PROGRAM LOAD
51              ;               LOAD THE PROGRAM BY USING THE BINARY LOADER.
52              ;       9.2     STARTING ADDRESSES
53              ;               201     DIRECT ENTRY TO OCTAL DEBUGGER(ODT)
54              ;               500     START DIAGNOSTIC
55              ;               501     DIRECT ENTRY TO WRITE LOCK TEST
56              ;               502     DIRECT ENTRY TO WRITE TO EOT TEST
57              ;       9.3     PROGRAM OPERATION
58              ;
59              ;
60              ;       THE DIAGNOSTIC PROGRAM IS PROVIDED TO FIND FAILURES THAT
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0004  MTAFD
01              ;       ARE RELATED TO THE BASIC OPERATIONS OF TAPE CONTROL.  THE
02              ;       DIAGNOSTIC ASSUMES THAT THE TAPE MEDIA IS PERFECT AND NOT
03              ;       THE CAUSE OF ANY ERROR.
04              ;
05              ;       YOU SHOULD LOAD THE PROGRAM FROM THE RELEASE TAPE.  REFER
06              ;       TO THE MANUAL FOR INFORMATION ON PROGRAM LOADING.  ONCE THE
07              ;       PROGRAM HAS LOADED THE FOLLOWING MESSAGE WILL DISPLAY:
08              ;
09              ;       -          MTAFD RELEASE 8.0
10              ;       -      FORMATTED TAPE COUPLER DIAGNOSTIC
11              ;       -          PRODUCT OF ZETACO
12              ;       -
13              ;       - PLEASE MOUNT A WRITE-ENABLED ERROR FREE SCRATCH TAPE.
14              ;       - ONLY THE DRIVE YOU ARE TESTING CAN BE ON-LINE.
15              ;              PRESS ANY KEY TO CONTINUE.
16              ;
17              ;       THE TAPE UNIT NUMBER IS REQUESTED AS FOLLOWS:
18              ;
19              ;       - DRIVE UNIT #:
20              ;
21              ;       YOU SHOULD ENTER THE NUMBER OF THE UNIT YOU WANT TO TEST.
22              ;       (0,1,2 OR 3)
23              ;       ------------
24              ;
25              ;       THE NEXT REQUEST IS:
26              ;
27              ;       - IF DRIVE SET FOR NRZ (800 BPI), ENTER 0; OTHERWISE, ENTER 1.
28              ;
29              ;       YOU SHOULD ENTER 0 OR 1 IN ACCORDANCE WITH THE RECORDING MODE
30              ;                      -----
31              ;       SET FOR THE TAPE DRIVE.
32              ;
33              ;       YOU MUST NEXT RESPOND TO:
34              ;
35              ;       - SPECIFY THE ZETACO EMULATION TYPE OF THE UNIT BEING TESTED.
36              ;         (6021 EMULATION = 0, 6125 EMULATION = 1.)
37              ;
38              ;       WHEN THE ZETACO FORMATTED COUPLER EMULATES DATA GENERAL'S 6125
39              ;       TAPE UNIT, IT WILL WRITE RECORD LENGTHS UP TO 77777(OCTAL) AND
40              ;       ALWAYS RETURNS BITS 11 AND 12 = 0 ON DIA.  DEPENDING ON WHICH
41              ;       EMULATION YOU ARE TESTING, ENTER 0 OR 1.
42              ;                                      -------
43              ;       NEXT YOU WILL NEED TO ENTER THE DEVICE CODE OF THE TAPE DRIVE.
44              ;
45              ;       - ENTER DEVICE CODE [22   ]
46              ;                           --------
47              ;       - SET SWITCH REGISTER TO DESIRED VALUE, THEN PRESS RETURN TO
48              ;                                                          ------
49              ;       CONTINUE.
50              ;
51              ;       REFER TO THE SWITCH OPTIONS IN THE MTAFD PROGRAM LISTING IF
52              ;       YOU WISH TO SET THEM.
53              ;
54              ;       IF YOU ARE RUNNING THE WRITE LOCK TEST, THE FOLLOWING MESSAGE
55              ;       WILL BE DISPLAYED:
56              ;
57              ;       - REMOVE WRITE ENABLE RING.  DON'T STOP THE PROGRAM.
58              ;
59              ;       RESPOND BY DISMOUNTING THE TAPE, REMOVING THE WRITE RING, AND
60              ;       REMOUNTING THE TAPE.  THE PROGRAM WILL AUTOMATICALLY CONTINUE.
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01              ;       VERY SHORTLY, THE PROGRAM WILL DISPLAY:
02              ;
03              ;       - PUT WRITE RING BACK ON TAPE.
04              ;
05              ;       WHEN THE LAST TEST HAS BEEN COMPLETED THE PROGRAM DISPLAYS:
06              ;
07              ;       - CYCLE
08              ;       - PASS 1
09              ;
10              ;       THE PROGRAM WILL CONTINUE INDEFINITELY, ALTHOUGH THE WRITE LOCK
11              ;       AND THE EOT TEST WILL ONLY BE PERFORMED ON THE FIRST PASS.
12              ;
13              ;10.    PROGRAM ERROR DESCRIPTION
14              ;       10.1    PRELIMINARY TEST ERRORS
15              ;               THE FOLLOWING IS A LIST OF PRELIMINARY CON-
16              ;               TROLLER AND DRIVE ERROR MESSAGES.
17              ;               10.1.1  BUSY AND DONE ERRORS
18              ;       "SELD LINE NOT RESET BY IORST, PC = XXXXX"
19              ;       "BUSY FLIP-FLOP NOT RESET ERROR, PC = XXXXX"
20              ;       "BUSY FLIP-FLOP NOT RESET BY IORST, PC = XXXXX"
21              ;       "BUSY FLIP-FLOP NOT SET ERROR, PC = XXXXX"
22              ;       "DONE FLIP-FLOP NOT RESET ERROR, PC = XXXXX"
23              ;       "DONE FLIP-FLOP NOT SET ERROR, PC = XXXXX"
24              ;               10.1.2  CONTROLLER DATA TRANSFER ERRORS
25              ;       "SEND CLOCK BIT ON TOO LONG ERROR, PC = XXXXX"
26              ;       "FIRST CHARACTER TIME OUT ERROR, PC = XXXXX"
27              ;       "DATA TRANSFER TIME OUT ERROR, PC = XXXXX"
28              ;       "NO INTERRUPT ERROR, PC = XXXXX"
29              ;       "ILLEGAL INTERRUPT WITH MASK BIT SET, MASK = XX, /
30              ;       PC = XXXXX"
31              ;       "MTU SELECT ERROR, DIB COMMAND = XXXXXX, PC = XXXXX"
32              ;       "MA REGISTER NOT RESET BY IORST"
33              ;       "GOOD WORD = XXXXXX, BAD WORD = XXXXXX, PC = XXXXX"
34              ;       "MA REGISTER SETTING ERROR"
35              ;       "GOOD WORD = XXXXXX, BAD WORD = XXXXXX, PC = XXXXX"
36              ;       "INTA DEVICE CODE ERROR"
37              ;       "DEVICE CODE = XX, UNIT DEVICE CODE = XX, PC = XXXXX"
38              ;       10.2    SYSTEM ERRORS
39              ;               THE FOLLOWING ERRORS OCCURE DURING COMBINED CON-
40              ;               TROLLER AND DRIVE OPERATIONS.
41              ;               10.2.1  DATA TRANSFER AND MA REGISTER ERRORS
42              ;       "MA REGISTER COUNTING ERROR"
43              ;       "GOOD VALUE = XXXXXX, BAD VALUE = XXXXXX, PC = XXXXX"
44              ;       "DATA COMPARE ERROR"
45              ;       "GOOD WORD = XXXXXX, BAD WORD = XXXXXX, /
46              ;       MEMORY ADDRESS = XXXXXX, PC = XXXXX"
47              ;               10.2.2  STATUS ERRORS
48              ;       "EXPECTED STATUS = XXXXXX, ACTUAL STATUS = XXXXXX, /
49              ;       PC = XXXXX"
50              ;       10.3    STATUS WORD
51              ;               BIT     DESCRIPTION
52              ;               0       ANY ERROR, SET BY BITS 1,3,5,6,7,8,10,14
53              ;               1       DATA LATE
54              ;               2       REWINDING
55              ;               3       ILLEGAL COMMAND
56              ;               4       HIGH DENSITY
57              ;               5       PARITY ERROR
58              ;               6       EOT MARK SENSED
59              ;               7       EOF MARK SENSED
60              ;               8       BOT MARK SENSED
```

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0006  MTAFD
01              ;               9       9 TRACK TAPE
02              ;               10      BAD TAPE
03              ;               11      ID BURST (PE ONLY)
04              ;                       ALWAYS 0 FOR 6125 EMUALTION
05              ;               12      CORRECTED PARITY ERROR (PE ONLY)
06              ;                       ALWAYS 0 FOR 6125 EMULATION
07              ;               13      WRITE LOCKOUT
08              ;               14      CRC ERROR
09              ;               15      UNIT READY
10                      O?DTD   11
11              ;12.    SPECIAL NOTES
12              ;       12.1    MEDIA SELECTION
13              ;               IT IS IMPORTANT TO SELECT A KNOWN GOOD TAPE WHEN
14              ;               PERFORMING THE DIAGNOSTIC.  ANY ERRORS CAUSED BY
15              ;               THE MEDIA WILL BE CONSIDERED A CONTROLLER AND/OR
16              ;               DRIVE FAULT.
17              ;       12.2    SCOPE LOOPS
18              ;               WHEN A SCOPE LOOP IS BEING IMPLEMENTED TO LOCATE
19              ;               A FAILING MODULE AND FORWARD TAPE MOTION IS
20              ;               USED, THE TAPE WILL COME OFF THE SUPPLY REEL IF
21              ;               THE LOOP IS ALLOWED TO CONTINUE.  WHEN THE TAPE
22              ;               APPROACHES THE EOT SENSOR, ENTER THE ODT PROGRAM
23              ;               BY TYPING A CONTROL "O" CHARACTER, MANUALLY RE-
24              ;               WIND THE DRIVE AND TYPE A "P" CHARACTER TO CON-
25              ;               TINUE.
26              ;13.    RUN TIME
27              ;       THE PROGRAM RUN TIME DEPENDS ON THE LENGTH OF THE TAPE.
28              ;       IT IS RECOMMENDED THAT A 600 FOOT REEL BE USED TO SPEED
29              ;         UP THE WRITE TO EOT SENSOR TEST.
```

```
0001  UMTR     AOS ASSEMBLER REV 04.20        14:09:22 06/07/84
01              ;
02              ;
03              ;
04              ;*********************************************************************
05              ;
06              ; DECRIPTION: UNIVERSAL MAGNETIC TAPE RELIABILITY
07              ;
08              ;
09              ; PRODUCT OF ZETACO 1984
10              ;*********************************************************************
                        .TITL   UMTR
12      000001          X=1
13      000001          .NOMAC  X
14              ;1.     PROGRAM NAME:   UMTR.SR
15              ;
16              ;2.     REVISION HISTORY:
17              ;
18              ;               REV.      DATE
19              ;       .REV     00,0   ;06/07/82
20              ;       .REV     01,0   ;08/83 BY P.A.N. FOR CSI
21              ;                       TO HANDLE CSI MODEL 130A (6125 EMULATION)
22              ;                       ASK FOR MODEL NUMBER.
23              ;                       IF 130A BIT 0 OF DOB/DIB WONT'T BE MASKED.
24              ;                       9/83 - FOR 130A ALLOW FOR BIGGER RECORD.
25              ;                              (8K WORDS)
26              ;       .REV    02,0    ;03/22/84
27              ;                       130 TO 133 AND PROPER DEVICE CODE CHANGE
28              ;                       ROUTINE.
29                      .REV    03,0    ;6/1/84 BY P.A.N.
30              ;                       REFER TO ZDF1 BOARD, NOT JUST 133
31              ;                       FIX COUNT DOWN BUG IN DWWAIT
32              ;
33              ;3.     MACHINE REQUREMENTS
34              ;
35              ;       3.1     NOVA OR ECLIPSE FAMILY CPU'S
36              ;       3.2     MINIMUM OF 16K MEMORY
37              ;       3.3     ZETACO MAG TAPE COUPLER (CONTROLLER) BOARD
38              ;       3.4     TELETYPE OR CRT AND CONTROLLER
39              ;       3.5     TAPE DRIVE (S)
40              ;4.     TEST REQUIREMENTS
41              ;
42              ;       N/A
43              ;
44              ;5.     SUMMARY
45              ;
46              ;       THE TAPE RELIABILITY PROGRAM IS A MAINTENANCE
47              ;       PROGRAM INTENDED TO VERIFY THE MAGNETIC TAPE
48              ;       SUB-SYTEM OPERATION.
49              ;
50              ;6.     RESTRICTIONS
51              ;
52              ;       ONLY THOSE TAPE DRIVES TO BE TESTED ARE TO
53              ;       BE ONLINE.  ALL ONLINE DRIVES MUST BE WRITE ENABLED.
```

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!0002  UMTR
01              ;7.     PROGRAM DESCRIPTION/THEORY OF OPERATION
02              ;
03              ;       7.1     RANDOM RELIABILITY (SA 500)
04              ;
05              ;               THE RANDOM RELIABILITY TEST WRITES RANDOM
06              ;               LENGTH FILES. EACH FILE CONSISTS OF FROM
07              ;               1 TO 7 RANDOM LENGTH, RANDOM PATTERN REC-
08              ;               ORDS. THE RANDOM FILES ARE WRITTEN AND
09              ;               READ THE FULL LENGTH OF THE MEDIA. IF
10              ;               MORE THAN ONE(1) TAPE DRIVE IS AVAILABLE,
11              ;               A UNIQUE RANDOM FILE WILL BE WRITTEN ON EACH
12              ;               UNIT SEQUENTIALILY. WHEN EACH UNIT'S EOT
13              ;               SENSOR IS DETECTED, ITS ACCUMULATED
14              ;               HISTORY IS PRINTED AND THE UNIT IS COM-
15              ;               MANDED TO REWIND. ALL WRITE ENABLED,
16              ;               READY TAPE UNITS WILL BE TESTED. A UNIT
17              ;               CAN BE MADE READY AND WILL BE TESTED AFTER
18              ;               THE TEST HAS BEEN INITIATED. IF A UNIT
19              ;               BECOMES NOT READY DURING THE TEST, ITS
20              ;               HISTORY WILL BE PRINTED AND THE UNIT
21              ;               WILL BE REMOVED FROM THE AVAILABLE UNITS
22              ;               LIST. THE TEST WILL CONTINUE UNTIL STOPPED
23              ;               BY THE OPERATOR.
24              ;
25              ;       7.2     INTERCHANGE TEST, WRITE/READ (SA 501)
26              ;
27              ;               THE INTERCHANGE TEST IS USED TO VERIFY THE
28              ;               INTERCHANGABLITY OF THE TAPE UNITS. THIS
29              ;               TEST GENERATES 200, 2000 WORD RECORDS OF
30              ;               SKEW PATTERNS FOLLOWED BY 200, 2000 WORD
31              ;               RECORDS OF RANDOM DATA. AFTER ALL THE
32              ;               ONLINE, WRITE ENABLED UNITS HAVE BEEN
33              ;               WRITTEN, THEY ARE ALL READ TO INSURE
34              ;               PROPER WRITTING. THE OPERATOR THEN INTER-
35              ;               CHANGES THE TAPES AND PERFORMS ANOTHER
36              ;               READ VERIFICATION. THIS PROCEDURE IS CON-
37              ;               TINUED UNTIL EACH TAPE HAS BEEN READ BY
38              ;               ALL THE UNITS. AFTER EACH READ, A SUMMARY
39              ;               OF THE ACCUMULATED STATISTICS FOR EACH
40              ;               UNIT IS PRINTED. AFTER ALL THE UNITS HAVE
41              ;               BEEN READ, A TEST COMPLETE MESSAGE IS
42              ;               PRINTED. IF THE OPERATOR WISHES TO CON-
43              ;               TINUE THE TEST, TYPING A 'P' CHARACTER
44              ;               WILL REPEAT THE ENTIRE TEST.
45              ;
46              ;       7.3     INTERCHANGE, READ ONLY (SA 502)
47              ;
48              ;               THE READ ONLY INTERCHANGE TEST PROVIDES
49              ;               A MEANS OF TESTING TAPE UNITS WITH PRE-
50              ;               RECORDED TAPES. THE TAPES MUST BE RECORDED
51              ;               IN THE FORMAT DESCRIBIED BY SECTION 7.2.
52              ;               THE READ OPERATION IS IDENTICAL TO
53              ;               SECTION 7.2.
54              ;       7.4     COMMAND STRING INTERPRETER (SA 504)
55              ;
56              ;               THE COMMAND STRING INTERPRETER PROVIDES
57              ;               A TROUBLE SHOOTING AID TO ISOLATE A
58              ;               FAULT. THE OPERATOR CAN SELECT ALL POS-
59              ;               IBLE OPERATING MODES BY RESPONDING TO
60              ;               CONSOLE REQUESTS. ALL NUMBERS MUST BE
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01              ;               ENTERED IN OCTAL.
02              ;
03              ;               7.4.1   UNIT
04              ;
05              ;                       UNIT NUMBER AND/OR CARRIAGE
06              ;                       RETURN TO USE PREVIOUS COMMAND
07              ;                       STRING.  IF ONLY A CARRIAGE
08              ;                       RETURN IS TYPED, NO OTHER RE-
09              ;                       QUESTS WILL BE MADE AND THE LAST
10              ;                       ENTERED COMMAND STRING WILL BE
11              ;                       RUN.  THE ENTRY IS IN THE RANGE
12              ;                       OF 0 TO 7.  THE DEFAULT UNIT NUM-
13              ;                       BER IS 0.
14              ;
15              ;               7.4.2   WC (WORD COUNT)
16              ;
17              ;                       TYPE AN OCTAL NUMBER TO SELECT
18              ;                       THE DATA BLOCK SIZE AND/OR A
19              ;                       CARRIAGE RETURN TO USE THE PRE-
20              ;                       VIOUS ENTRY.  THE DEFAULT VALUE
21              ;                       IS THE MAXIMUM BLOCK SIZE.  THE
22              ;                       ENTRY IS IN THE RANGE OF 2 TO
23              ;                       THE MAXIMUM BLOCK SIZE.
24              ;
25              ;               7.4.3   DATA
26              ;
27              ;                       SELECT ONE OF THE FOLLOWING DATA
28              ;                       PATTERNS AND/OR A CARRIAGE RETURN
29              ;                       TO USE THE PREVIOUS ENTRY.  THE
30              ;                       DEFAULT PATTERN IS RANDOM.
31              ;
32              ;                       RAND - RANDOM
33              ;                       ALL1 - ALL ONE'S
34              ;                       ALL0 - ALL ZERO'S
35              ;                       ALT0 - ALTERNATING ZERO/ONE (000377)
36              ;                       ALT1 - ALTERNATING ONE/ZERO (177400)
37              ;                       FLT0 - FLOATING ZERO
38              ;                       FLT1 - FLOATING ONE
39              ;                       SKEW - SKEW
40              ;                       VARIABLE - THE VARIABLE PATTERN IS
41              ;                                  ENTERED BY THE OPERATOR
42              ;                                  AS OCTAL CHARACTER STRINGS.
43              ;                                  UP TO 8, 16 BIT OCTAL NUMBERS
44              ;                                  CAN BE ENTERED.  THE DATA
45              ;                                  BUFFER IS BUILT BY REPEATING
46              ;                                  THE ENTERED CHARACTER STRINGS.
47              ;               7.4.4   PARITY
48              ;
49              ;                       TYPE 'EVEN' OR 'ODD' AND/OR
50              ;                       CARRIAGE RETURN TO SELECT THE
51              ;                       PARITY OR USE THE PREVIOUS
52              ;                       ENTRY.  THE DEFAULT PARITY IS
53              ;                       ODD.
54              ;
55              ;               7.4.5   COMMAND STRING
56              ;
57              ;                       THE OPERATOR CAN SELECT THE SUB-
58              ;                       SYSTEM OPERATION BY TYPING THE
59              ;                       DESIRED COMMANDS AND/OR CARRIAGE
60              ;                       RETURN.  ALL N(NUMBER) ENTRIES MUST
```

```
;                       BE IN OCTAL.  IF THE COMMAND STRING
;                       EXCEEDS THE LINE LENGTH, TYPE A
;                       LINEFEED TO CONTINUE ON THE NEXT
;                       LINE.  THE FOLLOWING IS A LIST OF
;                       AVAILABLE SUB-SYSTEM COMMANDS.
;
;                       RD N    READ N RECORDS
;                       RW      REWIND
;                       SB N    SPACE BACK N RECORDS
;                       SF N    SPACE FORWARD N RECORDS
;                       WT N    WRITE N RECORDS
;                       WE      WRITE END OF FILE MARK
;                       ER      ERASE 3" OF TAPE
;                       RE      READ END OF FILE MARK
;                       LOOP    LOOP BACK TO FIRST COMMAND
;                       *       LOOP TO HERE
;                       LOOP *  LOOP TO *
;
;                       SAMPLE COMMAND STRINGS
;
;                       RW WT 10 SB 10 RD 10 LOOP
;
;                       THE ABOVE COMMAND STRING WILL REWIND,
;                       WRITE 8 RECORDS, SPACE BACK 8 RECORDS,
;                       AND READ 8 RECORDS.  THIS TEST WILL
;                       CONTINUE UNTIL STOPPED BY THE OPERATOR.
;
;                       RW,WT 10,WE * RW,SF,10,SB,10,RD,10,RE,
;                       LOOP *
;
;                       THE ABOVE COMMAND STRING WILL REWIND,
;                       WRITE 8 RECORDS, WRITE AN EOF MARK,
;                       AND THEN LOOP ON REWIND, SPACE FORWARD
;                       8 RECORDS, SPACE BACK 8 RECORDS, READ
;                       8 RECORDS AND READ EOF MARK.
;                   NOTE:  EITHER A SPACE OR COMMA CAN BE
;                       USED AS AN ARGUEMENT DELIMITER.
;                       IF AN INCORRECT CHARACTER OR
;                       CHARACTERS ARE TYPED, TYPE A RUB-
;                       OUT CHARACTER TO DELETE THE PRE-
;                       VIOUSLY TYPED CHARACTER.  THE DELE-
;                       TED CHARACTER WILL BE PRINTED.
;
;               WHILE THE COMMAND STRING IS BEING EXECUTED,
;               TYPE A 'R' CHARACTER TO CAUSE THE PROGRAM
;               TO RETURN TO THE UNIT PROMPT.  THE ESCAPE
;               KEY WILL CAUSE THE PROGRAM TO RETURN TO THE
;               COMMAND STRING ENTRY POINT.
;
;       7.5     HISTORY RECOVERY (SA 504)
;
;               IF THE PROGRAM HAS STOPPED DURING AN OPERATION,
;               THE ACCUMULATED ERROR AND PASS HISTORY CAN BE
;               RECOVERED BY THIS PROGRAM.  THIS PROGRAM MUST
;               BE RUN BEFORE ANY OTHER PROGRAM IS RESTARTED.
;
;               TO RETRIEVE THE ACCUMULATED ERROR AND PASS
;               HISTORY WHILE THE RELIABILITY TEST IS RUNNING,
;               TYPE A SPACE.  THIS WILL CAUSE THE ACCUM-
;               ULATED HISTORIES OF ALL TESTED UNITS TO BE
```

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0005  UMTR
01              ;               PRINTED.
02              ;8. OPERATING MODES/SWITCH SETTINGS:
03              ;               SWITCH OPTIONS
04              ;               BIT     OCTAL   BINARY  INTERPRETATION
05              ;                       VALUE   VALUE
06              ;
07              ;               2       20000   0       ENABLE PRINT ON CONSOLE
08              ;                               1       INHIBIT PRINT ON CONSOLE
09              ;
10              ;               5       02000   0       INHIBIT LINEPRINTER
11              ;                               1       ENABLE LINEPRINTER
12              ;
13              ;               7       00400   0       ENABLE PRINT PARITY ERRORS
14              ;                               1       INHIBIT PRINT PARITY ERRORS
15                      S?MPD   8
16              ;               "ESC"   THIS COMMAND GIVEN WHILE RUNNING THE
17              ;                       ENTERED COMMAND STRING WILL CAUSE THE
18              ;                       PROGRAM TO RESTART AT THE COMMAND STRING
19              ;                       ENTER PROMPT.
20              ;
21              ;9.     OPERATING PROCEDURES/OPERATOR INPUT
22              ;
23              ;       9.1     PROGRAM LOAD
24              ;
25              ;               LOAD THE PROGRAM BY USING THE BINARY LOADER.
26              ;
27              ;       9.2     STARTING ADDRESSES
28              ;
29              ;               SA      PROGRAM FUNCTION
30              ;
31              ;               500     START RELIABILITY TEST
32              ;               501     START INTERCHANGE TEST, WRITE/READ
33              ;               502     START INTERCHANGE TEST, READ ONLY
34              ;               503     START COMMAND STRING INTERPRETER
35              ;               504     DIRECT ENTRY FOR ERROR LOG RECOVERY
36              ;
37              ;       9.3     PROGRAM OPERATION
38              ;
39              ;               9.3.1   INITIALIZATION
40              ;
41              ;                       THE FOLLOWING MESSAGE IS PRINTED REQUESTING
42              ;                       THE SETTING OF THE SOFT SWITCH REGISTER.
43              ;
44              ;       "SET SWITCH REGISTER TO DESIRED VALUE, THEN PRESS RETURN TO CONTINUE"
45              ;       M
46              ;       0  1  2  3  4  5  6  7  8  9  10 11 12 13 14 15
47              ;       1  1  0  0  0  0  0  0  0  0  0  0  0  0  0  0
48              ;
49              ;       0
50              ;
51              ;                       MODIFY THE SWITCH REGISTER SETTING AS
52              ;                       DESCRIBIED IN SECTION 8.3, FOLLOWED BY
53              ;                       A CARRIAGE RETURN. THE FOLLOWING MESSAGES
54              ;                       WILL BE PRINTED.
55              ;
56              ;                       IF  A REAL TIME CLOCK IS NOT PRESENT IN
57              ;                       THE SYSTEM, THE FOLLOWING MESSAGE WILL
58              ;                       BE PRINTED.
59              ;
60              ;       "TTO BAUD RATE = ?..."
```

```
01              ;
02              ;                       RESPOND TO THE REQUEST BY TYPING THE
03              ;                       CORRECT CONSOLE DEVICE BAUD RATE FOR
04              ;                       I/O TIMING CALIBRATION.  IF THE RESPONSE
05              ;                       IS 110, THE FOLLOWING REQUEST MESSAGE
06              ;                       WILL BE PRINTED.
07              ;       "10 OR 11# BITS/CHAR = ?"
08              ;
09              ;                       RESPOND TO THE REQUEST BY TYPING 10 OR
10              ;                       11.
11              ;
12              ;
13              ;       "RELIABILITY TEST"
14              ;       "SPECIFY THE MODEL NUMBER OF THE ZETACO COUPLER(S) BEING TESTED."
15              ;       "(110=1, 120=2, 133 (6021)=3, 133 (6125)=4):"
16              ;
17              ;                       YOU SHOULD RESPOND TO THIS QUESTION BY
18              ;                       ENTERING THE NUMBER ASSOCIATED WITH THE
19              ;                       ZETACO MODEL NUMBER FOR THE COUPLER IN THE
20              ;                       TAPE UNIT(S) BEING TESTED.  FOR EXAMPLE,
21              ;                       IF YOU ARE RUNNING WITH ZETACO COUPLER 133
22              ;                       (6021) ENTER "3".
23              ;
24              ;
25              ;
26              ;       "ENTER DEVICE CODE [22  ]:"
27              ;
28              ;                       ANSWER THE REQUEST BY TYPING OCTAL DEVICE CODE.
29              ;                       IF ANY DEVICE CODE OTHER THEN 20 THRU 76 IS
30              ;                       SELECTED, THE DEVICE CODE ENTRY PROMPT
31              ;                       WILL BE PRINTED AGAIN.
32              ;
33              ;       "ENTER 0 TO TEST CRC (NRZI ONLY).  OTHERWISE, ENTER 1."
34              ;
35              ;       ANSWER 0 IF TAPE DRIVE IS 800 BPI NRZI OTHERWISE
36              ;       ENTER 1.NEXT A REQUEST IS MADE TO DETERMINE THE ERROR RECOVERY
37              ;       SEQUENCE THAT IS TO BE USED.THIS IS DETERMINED BY THE TYPE OF OPERATING
38              ;       SYSTEM THE CONTROLLER WILL BE USED IN.THE REQUEST IS MADE AS FOLLOWS:
39              ;
40              ;   "ENTER 1 IF CONTROLLER WILL BE RUN IN AN AOS SYSTEM.  OTHERWISE, ENTER 0."
41              ;
42              ;           9.3.2   PROGRAM ENTRY
43              ;
44              ;                       WHEN ENTERING THE RELIABILITY PROGRAM,
45              ;                       THE FOLLOWING MESSAGE WILL BE PRINTED
46              ;
47              ;       "MOUNT SCRATCH TAPE(S).  PRESS RETURN TO CONTINUE."
48              ;
49              ;                       THE OPERATOR SHOULD MAKE READY ALL TAPE
50              ;                       UNITS TO BE TESTED.  ANY TAPE UNIT THAT
51              ;                       IS ONLINE WILL BE TESTED.  AFTER ALL
52              ;                       UNITS ARE READY, ENTER CR.  ON THE CON-
53              ;                       SOLE TO CONTINUE.
54              ;
55              ;           9.3.3   INTERCHANGE TEST, WRITE/READ
56              ;
57              ;                       ENTRY TO THE INTERCHANGE TEST IS IDENT-
58              ;                       ICAL TO THE RELIABILITY TEST WITH THE
59              ;                       FOLLOWING EXCEPTION.
60              ;
```

```
01              ;       "INTERCHANGE TEST(WRITE/READ)"
02              ;                       AFTER THE INITIALIZATION SECTION, THE
03              ;                       FOLLOWING MESSAGE IS PRINTED.
04              ;
05              ;       "MOUNT SCRATCH TAPE(S).  PRESS RETURN TO CONTINUE."
06              ;
07              ;                       MAKE READY ALL TAPE UNITS TO BE TESTED
08              ;                       AND ENTER CR. TO CONTINUE.
09              ;               9.3.4   INTERCHANGE TEST, READ ONLY
10              ;
11              ;                       ENTRY TO THE INTERCHANGE TEST IS
12              ;                       IDENTICAL TO THE RELIABILITY TEST
13              ;                       WITH THE FOLLOWING EXCEPTION.
14              ;
15              ;       "INTERCHANGE TEST(READ ONLY)"
16              ;
17              ;                       AFTER THE INTIALIZATION SECTION THE
18              ;                       FOLLOWING MESSAGE IS PRINTED.
19              ;
20              ;       "MOUNT PRE-RECORDED TAPE(S), ENTER CR. TO CONTINUE."
21              ;
22              ;                       MOUNT PRE-RECORDED TAPES ON ALL TAPE
23              ;                       UNITS TO BE TESTED AND ENTER CR..
24              ;
25              ;       9.4     COMMAND STRING INTERPRETER
26              ;
27              ;               9.4.1   INITIALIZATION
28              ;
29              ;                       ALL ERROR AND PASS COUNTERS ARE CLEARED
30              ;                       AND THE FOLLOWING REQUEST MESSAGE IS
31              ;                       PRINTED.
32              ;
33              ;       "SET SWITCH REGISTER TO DESIRED VALUE, THEN PRESS RETURN TO CONTINUE."
34              ;
35              ;                       NOTE:   THE "X" VALUE INDICATE THE UN-
36              ;                               KNOWN STATE OF THE COMMAND BITS.
37              ;
38              ;                       RESPOND TO THE REQUEST BY SETTING THE
39              ;                       "SWREG" LOCATION AS DESCRIBED BY SECTION
40              ;                       8.3, FOLLOWED BY A CARRIAGE RETURN.
41              ;
42              ;                       THE MEMORY IS SIZED NEXT AND THE TIME
43              ;                       BASE IS CALIBRATED.  IF A REAL TIME CLOCK
44              ;                       IS NOT PRESENT IN THE SYSTEM, THE FOL-
45              ;                       LOWING REQUEST IS PRINTED.
46              ;
47              ;       "TTO BAUD RATE = ?"
48              ;
49              ;                       RESPOND TO THE REQUEST BY TYPING THE
50              ;                       CORRECT CONSOLE DEVICE BAUD RATE.  IF THE
51              ;                       RESPONSE IS 110, THE FOLLOWING REQUEST
52              ;                       MESSAGE WILL BE PRINTED.
53              ;
54              ;       "# BITS/CHAR = ?"
55              ;
56              ;                       RESPOND TO THE REQUEST BY TYPING 10 OR
57              ;                       11
58              ;               9.4.2   PROGRAM ENTRY
59              ;
60              ;                       THE FOLLOWING MESSAGES ARE PRINTED
```

```
0000 UMTR
01              ;                       INDICATING THE ENTRY TO THE COMMAND
02              ;                       STRING INTERPRETER.
03              ;
04              ;       "COMMAND STRING INTERPRETER"
05              ;       "MAXIMUM WORD COUNT = XXXX"
06              ;
07              ;                       NOTE:   THE MAXIMUM WORD COUNT VALUE
08              ;                               INDICATES THE LARGEST DATA
09              ;                               BUFFER AVAILABLE.
10              ;
11              ;                       THE SUB-SYSTEM DEFAULT VALUES ARE SET
12              ;                       AS FOLLOWS:
13              ;
14              ;                       UNIT    0
15              ;                       WC      SET TO MAXIMUM WORD COUNT
16              ;                       DATA    RANDOM PATTERN
17              ;                       PARITY  ODD
18              ;
19              ;                       WHEN THE "UNIT" PROMPT IS TYPED, REFER
20              ;                       TO SECTION 7.4, FOR PROGRAM OPERATION.
21              ;10.    PROGRAM OUTPUT/ERROR DESCRIPTION
22              ;
23              ;       ALL ERRORS ARE IDENTIFIED, COUNTED AND PRINTED ON
24              ;       THE BASIS OF THE SETTING OF LOCATION "SWREG".
25              ;
26              ;       IF A UNIT GOES NOT READY, AN APPROPRIATE ERROR
27              ;       MESSAGE AND ITS ACCUMULATED STATISTICAL HISTORY
28              ;       IS PRINTED.  IF ONLY ONE(1) UNIT IS BEING TESTED,
29              ;       AN APPROPRIATE MEESAGE WILL BE PRINTED AND THE
30              ;       PROGRAM WILL WAIT FOR OPERATOR INTERVENTION.  IF
31              ;       MORE THAN ONE UNIT IS AVAILABLE, THE TEST PROCESS
32              ;       WILL CONTINUE.
33              ;
34              ;       ALL ERRORS ARE SOFT UNLESS SPECIFIED AS HARD OR
35              ;       FATAL.
36              ;
37              ;       10.1    STATISTICAL HISTORY PRINTOUT
38              ;
39              ;               THE STATISTICAL HISTORY IS PRINTED FOR
40              ;               EACH UNIT WHEN IT REACHES ITS EOT SENSOR.
41              ;               THE STATISTICAL HISTORY FOR ALL TESTED
42              ;               UNITS CAN BE REQUESTED BY TYPING A
43              ;               "SPACE" CHARACTER.  A SAMPLE OF THE
44              ;               PRINTOUT IS AS FOLLOWS:
45              ;
46              ;       "UNIT    0       1"
47              ;       "PAR WR  1       0"
48              ;       "PAR RD  1       1"
49              ;       "PERM WR 1       0"
50              ;       "PERM RD 0       0"
51              ;       "WDS RD  30348   1075827"
52              ;       "WDS WR  31345   1075827"
53              ;       10.2    STATUS WORD
54              ;
55              ;               BIT     DESCRIPTION
56              ;
57              ;               0       ANY ERROR, SET BY BITS 1,3,5,6,7,8,10,14
58              ;
59              ;               1(E)    DATA LATE
60              ;               2       REWINDING
```

```
0009 UMTR
01              ;               3(E)    ILLEGAL COMMAND
02              ;
03              ;               4       HIGH DENSITY
04              ;               5(E)    PARITY ERROR
05              ;               6(E)    EOT MARK SENSED
06              ;
07              ;               7(E)    EOF MARK SENSED
08              ;               8(E)    BOT MARK SENSED
09              ;               9       9 TRACK TAPE
10              ;
11              ;               10(E)   BAD TAPE
12              ;               11      SEND CLOCK OR ID STATUS
13              ;               12      FIRST CHARACTER OR CORRECTED ERROR
14              ;
15              ;               13      WRITE LOCKOUT
16              ;               14(E)   CRC ERROR OR ODD REC READ
17              ;               15      UNIT READY
18                      O?DTD 11
19              ;12.    SPECIAL NOTES
20              ;
21              ;       12.1    MEDIA SELECTION
22              ;
23              ;               IT IS IMPORTANT TO SELECT KNOWN GOOD TAPES
24              ;               WHEN PERFORMING THE RELIABILITY TESTS. USING
25              ;               MARGINAL TAPE MEDIA WILL CAUSE SOFT AND HARD
26              ;               ERRORS TO OCCURE. TO VERIFIY THE SUB-SYSTEM
27              ;               RELIABILITY THE TAPE MEDIA SHOULD NOT INFLUENCE
28              ;               THE PASS OR FAIL CRITERIA.
29              ;
30              ;       12.2    DATA ENTRY
31              ;
32              ;               ALL NUMBER ENTRIES MUST BE ON OCTAL. ANY OTHER
33              ;               ENTRY WILL BE CONSIDERED AS AN ALPHA CHARACTER.
34              ;
35              ;13.    RUN TIME
36              ;
37              ;       THE PROGRAM RUN TIME IS DEPENDENT ON THE LENGTH OF THE
38              ;       TAPE MEDIA.
39                      .EOT
```

```
0001  TAPEM    AOS ASSEMBLER REV 04.20        11:48:51 03/28/84
01              ;
02              ;
03              ;
04              ;
05              ;
06              ;*****************************************************************
07              ;
08              ;
09              ; DESCRIPTION:  STAND-ALONE STREAMER MAG TAPE CONFIGURATOR(CONSOLE PARAMETERS)
10              ;
11              ;
12              ; PRODUCT OF ZETACO, 1981
13              ;*****************************************************************
                        .TITL   TAPEM
15      000001          .DUSR   X=1
16      000000          .TXTM   0
17              ;1.     PROGRAM NAME TAPEMODE.SR
18              ;
19              ;2. REVISION HISTORY
20              ;
21              ;       REV.              DATE
22              ;        00             12/10/81
23              ;        01             03/27/84        130 TO 133 AND PROPER DEVICE
24              ;                                        CODE ROUTINE
25              ;
26              ;3.     MACHINE REQUIREMENTS:
27              ;3.1    NOVA/ECLIPSE FAMILY PROCESSOR
28              ;3.2    8K READ/WRITE MEMORY
29              ;3.3    CONSOLE DEVICE
30              ;3.4    ZETA 133 (6021 OR 6125) MAG TAPE COUPLER BOARD,
31              ;       WITH A FORMATTED STREAMER TAPE DRIVE.
32              ;
33              ;4.     SUMMARY
34              ;       THIS PROGRAM IS INTENDED FOR USE WITH THE MT133 COUPLER TO SET
35              ;       CONFIGURATION AS DESIRED WHEN PROGRAM ASKS.
36              ;       CONFIGURATION BITS OF DOA WITH BIT 5 = 1:
37              ;                10     MINIMUM GAP*
38              ;                9      DYNAMIC GAP
39              ;                8      HIGH SPEED
40              ;               6-7     LIMITS
41              ;                5      STREAMER MODE SELECT
42              ;                -
43              ;       LIMITS:
44              ;       6   7   10      MAX             MIN
45              ;       0   0   0        75MS           NOMINAL
46              ;       0   1   0       150MS           NOMINAL
47              ;       1   0   0       300MS           NOMINAL
48              ;       1   1   0         4SEC          NOMINAL
49              ;       0   0   0        75MS           30MS
50              ;       0   1   1       150MS           60MS
51              ;       1   0   1       300MS           90MS
52              ;       1   1   1         4SEC         120MS
53              ;
54              ;       *NOTE: MINIMUM GAP IS ONLY TRUE IF DRIVE IS STREAMING, IF
55              ;              REPOSITIONING OCCURS GAP IS OF NOMINAL LENGTH(NOMINAL IS .6 IN)
```

```
 0001  LNG     AOS ASSEMBLER REV 04.20        10:03:53 03/28/84
01              ;
02              ;
03              ;
04              ;*********************************************************************
05              ;
06              ; DESCRIPTION:  STREAMER MAG TAPE CONFIGURATOR (PRE-DEFINED)
07              ;
08              ;
09              ; PRODUCT OF ZETACO, 1984
10              ;*********************************************************************;
11              ;1.     PROGRAM NAME: LNG.SR
12              ;
13              ;2.     REVISION HISTORY:
14              ;
15              ;       REV.       DATE
16              ;        00     11/13/81
17              .REV     01.0  ;03/27/84        ;ZETACO
18              ;3.     REQUIREMENTS:
19              ;       SYSTEM EXECUTATABLE
20              ;4.     SUMMARY:
21              ;       THIS PROGRAM IS PROVIDED TO CONFIGURE A STREAMER MAG TAPE, FOR
22              ;       HIGH SPEED AND DYNAMIC GAP.
23              ;
24              ;       CONFIGURATION BITS OF DOA WITH BIT 5 = 1:
25              ;                10    MINIMUM GAP*
26              ;                9     DYNAMIC GAP
27              ;                8     HIGH SPEED
28              ;               6-7    LIMITS
29              ;                5     STREAMER MODE SELECT
30              ;                -
31              ;       LIMITS:
32              ;       6   7   10      MAX             MIN
33              ;       0   0   0        75MS           NOMINAL
34              ;       0   1   0       150MS           NOMINAL
35              ;       1   0   0       300MS           NOMINAL
36              ;       1   1   0         4SEC          NOMINAL
37              ;       0   0   0        75MS           30MS
38              ;       0   1   1       150MS           60MS
39              ;       1   0   1       300MS           90MS
40              ;       1   1   1         4SEC         120MS
41              ;
42              ;       *NOTE: MIMIMUM GAP IS ONLY TRUE IF DRIVE IS STREAMING, IF
43              ;              REPOSITIONING OCCURS GAP IS OF NOMINAL LENGTH(NOMINAL IS .6 IN)
                .TITL   LNG
45              .NREL
46 00000'020426 LOAD:   LDA     0,C22                  ;PRIMARY TAPE
47                      ?DEBL                          ;ENABLE         ;.SYSTM (RDOS)
48 00003'000401         JMP     .+1                    ;NO ERROR       ;.DEBL
49 00004'020424         LDA     0,CWORD                ;CONFIGURATION WORD
50 00005'061022         DOA     0,22                   ;CONFIGURE PRIMARY MT
51 00006'020420         LDA     0,C22
52                      ?DDIS                                          ;.SYSTM (RDOS)
53 00011'000401         JMP     .+1                                    ;.DDIS
54 00012'020415         LDA     0,C62
55                      ?DEBL                                          ;.SYSTM (RDOS)
56 00015'000401         JMP      +1                                    ;.DEBL
57 00016'020412         LDA     0,CWORD
58 00017'061062         DOA     0,62                   ;CONFIGURE SECONDARY
59 00020'020407         LDA     0,C62
60                      ?DDIS                                          ;.SYSTM (RDOS)
```

```
 0002  LNG
01 00023'000401          JMP     .+1                                     ;.DOIS
02                       ?RETURN                                         ;.SYSTM (RDOS)
03 00026'000022 C22:     22                                              ;.RTN
04 00027'000062 C62:     62
05 00030'002000 CWORD:   2000                    ;NOMINAL GAP, LOW SPEED, AND STREAMER SELECT MODE
06                       .END    LOAD
++00000 TOTAL ERRORS, 00000 FIRST PASS ERRORS
```