Model ZDF-1

Disk & Tape Drive Controller

600294-000 A

REVISION HISTORY		
ECO #	DATE	DESCRIPTION
0346	8/16/84	See ECO
0382	9/25/84	See ECO
0393	10/2/84	See ECO

TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

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 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 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

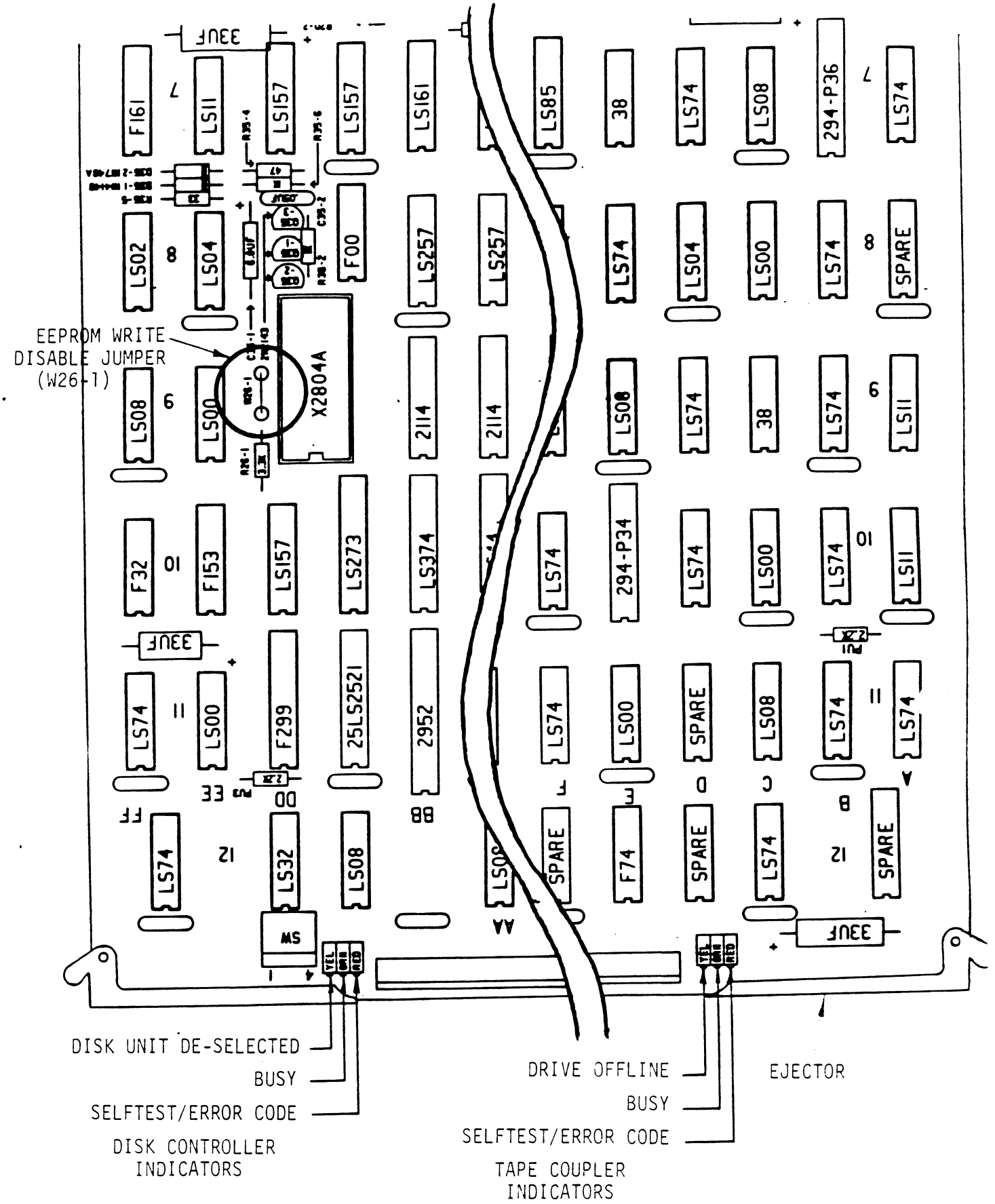
.Automatic high speed file search

2.0 SPECIFICATIONS

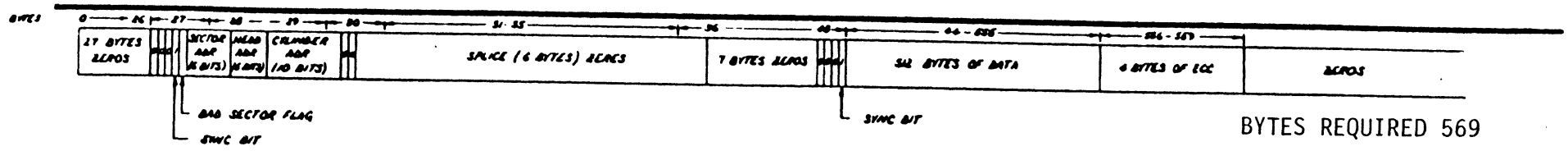
2.1 FUNCTIONAL CHARACTERISTICS

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.

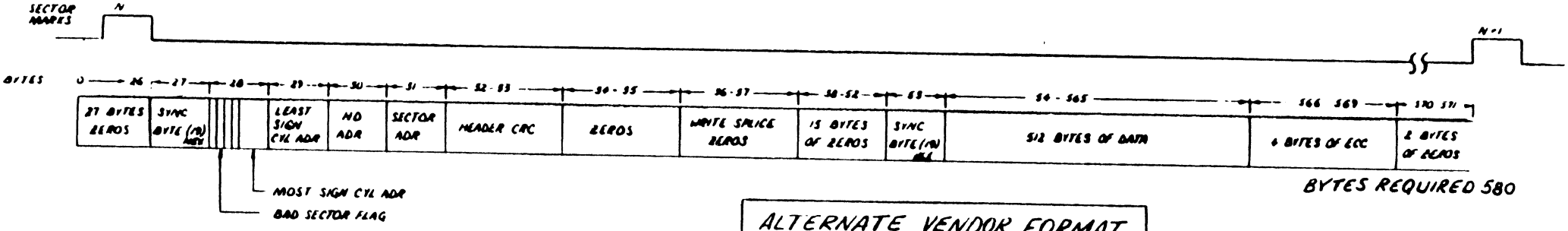


INDICATOR LAYOUT
FIGURE 2.1



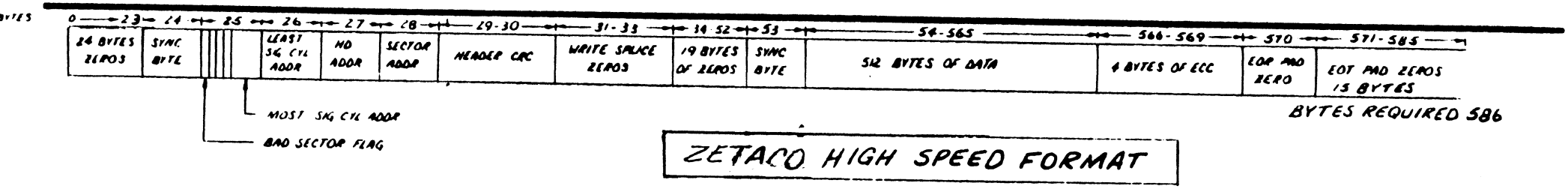
BYTES REQUIRED 569

DATA GENERAL FORMAT



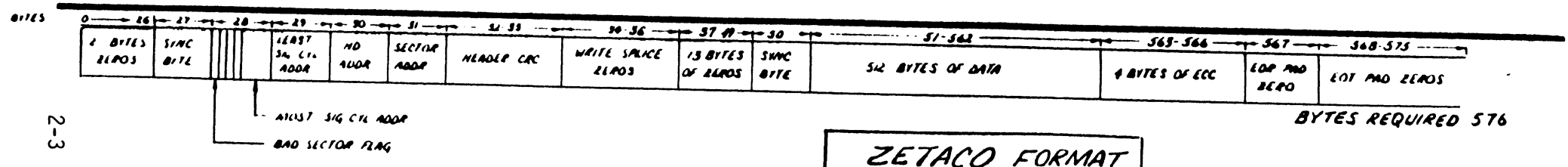
BYTES REQUIRED 580

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")

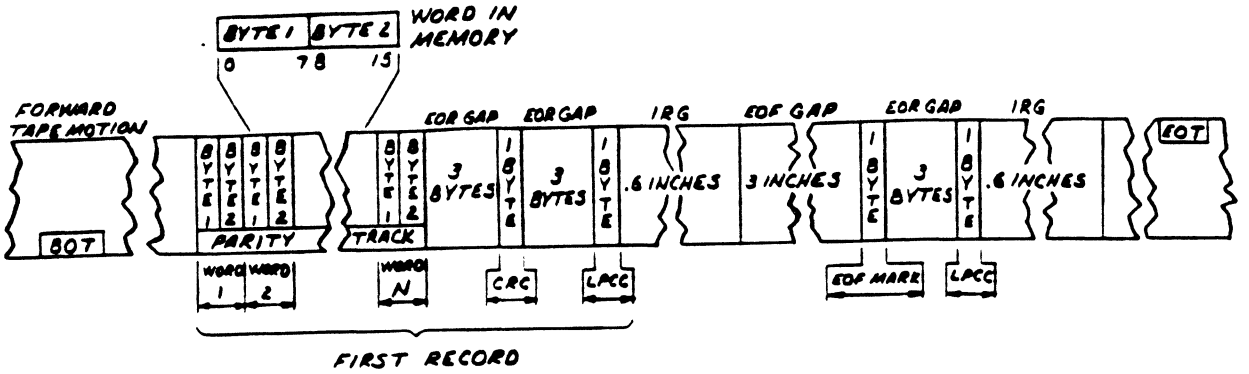
INDICATOR LEDS: (See Figure 2.1)

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

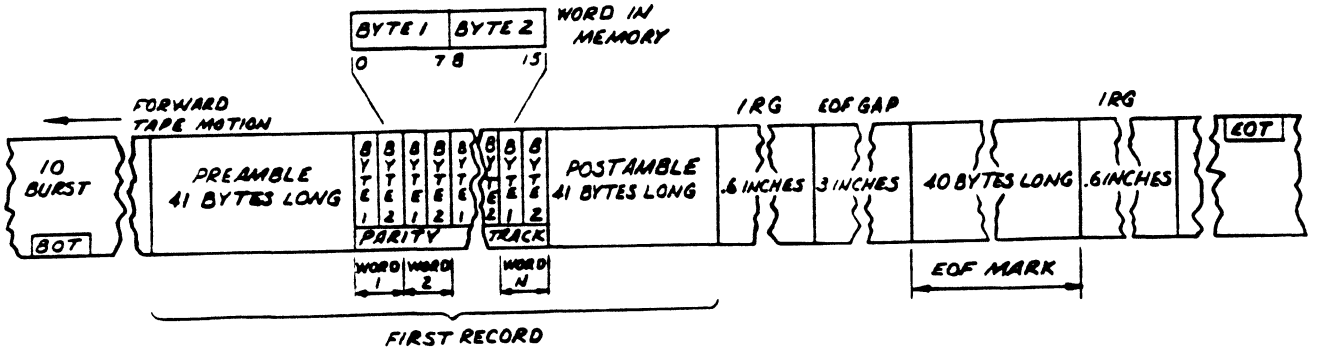
GREEN: TAPE COUPLER BUSY - Indicates tape coupler busy flag is set.

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 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.

CABLING:

EXTERNAL: 60 conductor, flat ribbon shielded round "A" cable daisy-chain connected, computer to first drive, to next drive, etc. See Table 2.1 for pin assignments.

26 conductor, flat ribbbon shielded round "B" cable radially connected, computer to drive(s). See Table 2.2 for pin assignments.

INTERNAL: Internal cabling consists of the "A" and "B" paddle boards with attached ribbon cabling. Cabling is available terminated with "D" connectors for panel mounting or 2-row headers for flat ribbon external cabling.

(Overall cable length between Coupler and last drive must not exceed 20 feet).

2.4 TAPE DRIVE INTERFACE

FUNCTIONAL: 1/2" Industry standard 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:

EXTERNAL: (2) 50 conductor, flat ribbon shielded round cables daisy-chain connected, computer to first drive, to next drive, etc. See Tables 2.3 and 2.4 for pin assignments.

INTERNAL: See disk drive interface section.

2.5 POWER REQUIREMENTS

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

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, internal cabling, software tape and documentation. (External cabling not included.)

CABLES:

INTERNAL: "A" backpanel cable assembly consists of: 100 pin active paddle board, 2 ft. 60 conductor ribbon cable (disk "A" cable) and 2 ft. 50 conductor ribbon cable (tape P2 cable).

"B" backpanel cable assembly consists of 100 pin active paddle board, (4) 2 ft. 26 conductor ribbon cables (disk "B" cables) and 2 ft. 50 conductor ribbon cable (tape P1 cable).

EXTERNAL: 6' or 16', 60 conductor disk "A" cable
6' or 16', 26 conductor disk "B" cable
(2) 10', 50 conductor tape cables

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 are shipped in one container and consist of the following:

ITEM	P/N
a) ZDF-1 controller board	100674-000
b) "A" paddle board/internal cabling	
for use with round shielded cabling	300029-000
for use with flat ribbon cabling	300027-000
c) "B" paddle board/internal cabling	
for use with round shielded cabling	300031-000
for use with flat ribbon cabling	300028-000
d) 1/2" magnetic tape containing configurator, diagnotstics, utilities	M294
e) Manual	600294-000

In addition, the following external disk and tape cables may be optionally ordered with the controller:

Round, shielded cables		
a) Disk "A" cable (panel to drive)	6'	300013-001
	16'	300013-002
b) Disk "B" cable	6'	300011-001
	16'	300011-002
c) Disk daisy-chain "A" cable	6'	100915-001
	16'	100915-002
d) (2) Tape cables (single formatter)	10'	300001-001
e) (2) Tape cables (two formatters)	20'	300012-001
Flat ribbon cables		
a) Disk "A" cable	16'	100911-002
b) Disk "B" cable	16'	100916-002
c) (2) Tape cables	10'	100914-001

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 M294 tape. After all hardware installation is completed, section 3.10 describes loading and using the Configurator.

The only selectable hardware options on the controller are described in the following sections.

3.2.1 DEVICE CODE DEFAULT JUMPER

The controller is normally factory set to the SECONDARY device codes for disk (67 octal - DSKP) and tape (62 octal - MTA) to avoid conflict if primary disk or tape subsystems are already installed in your system. Upon configuration, you should boot the M294 tape using the secondary tape device code. The secondary disk device code is then used to access the controller for configuration. Device codes may then be changed to their primary values of 27 and 22, or to any values from 20 to 76.

In the event that the current device codes of the controller are unknown or the controller cannot be configured while set to the secondary values, a jumper is provided which, when cut, forces the controller to the primary disk (27) and tape (22) device codes.

--To force the controller to primary disk and tape device codes, cut jumper W36-1 on the controller, located near the "B" side backpanel tabs on the rear edge of the controller. The jumper must be wired back in if you want to configure the controller for any device codes other than primary.

3.2.2 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, cut foil jumper W26-1 at location DD9 on the controller board (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.

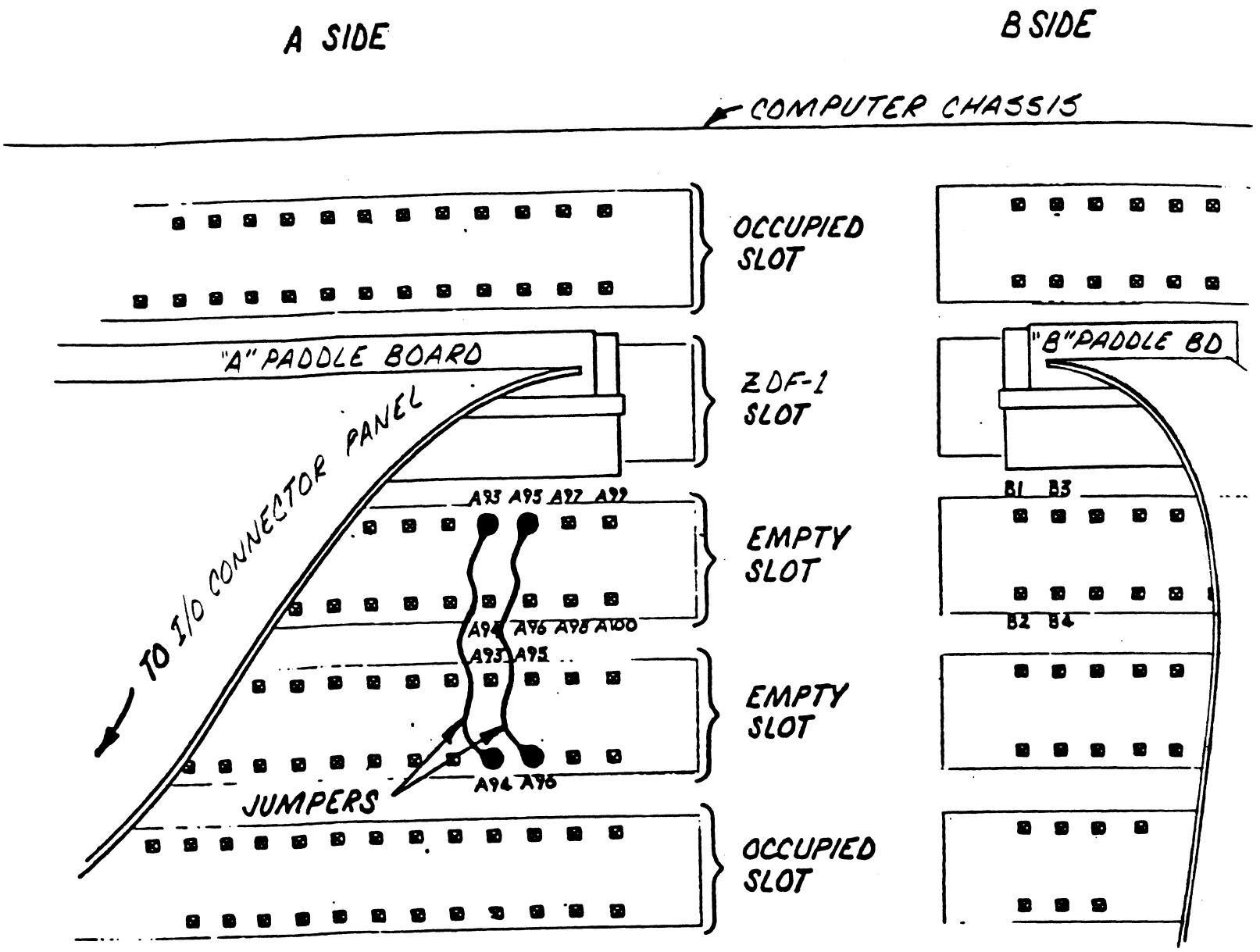
If the ZDF-1 is to be configured at or near highest priority in an S140 Computer, (Slots 12-16 I/O Only) jumper the priority first up to the ZDF-1, then back down to the additional Controller Boards in Slots 4 and up.

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 BOARD INSERTION

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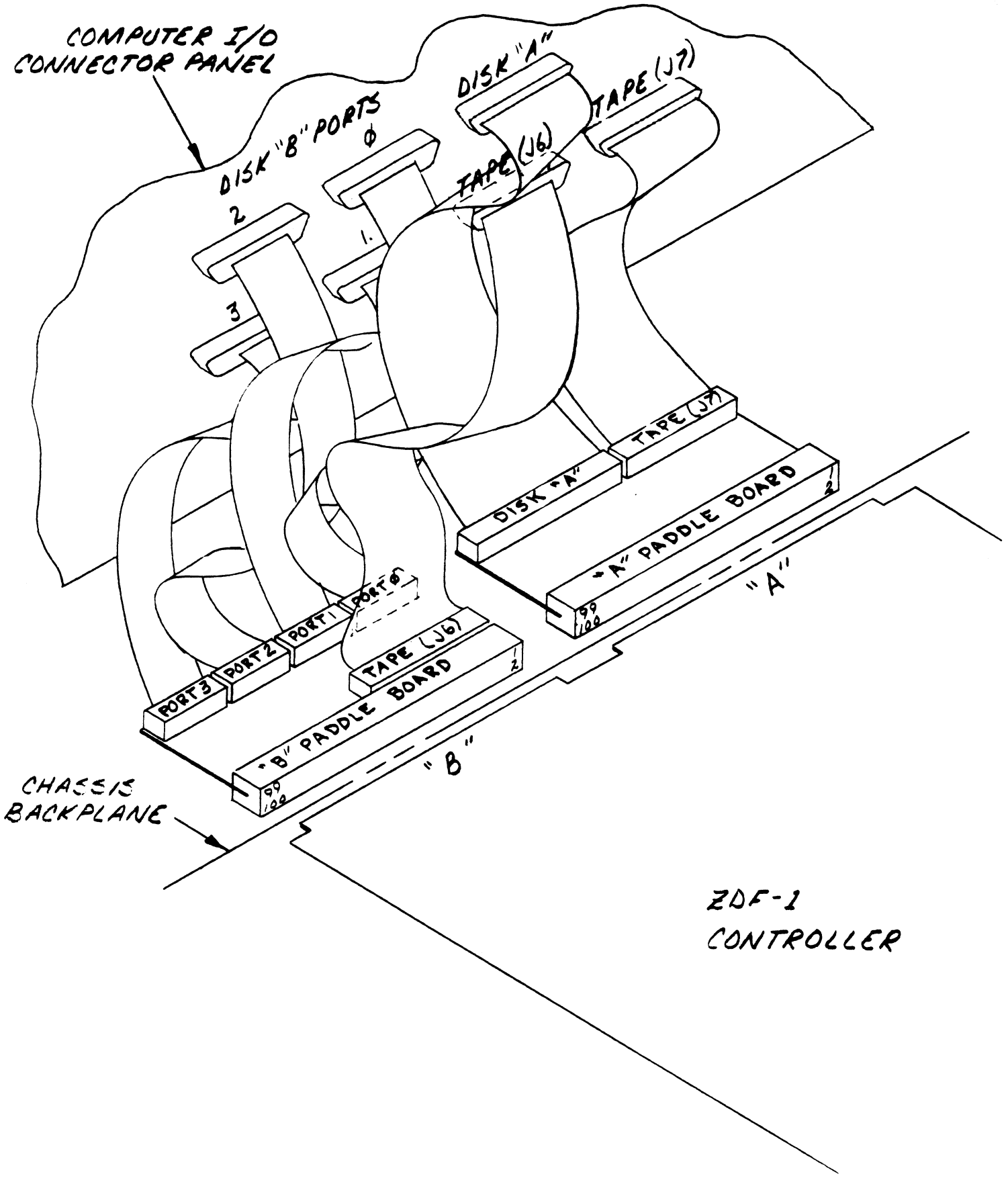
*CAUTION: THE ZDF-1 CONTROLLER MAY ONLY BE INSERTED IN AN I/O ONLY SLOT. COMPONENT DAMAGE WILL OCCUR IF A SLOT OTHER THAN AN I/O ONLY SLOT IS USED. ZETACO'S WARRANTY IS VOID IF A NON-I/O ONLY SLOT IS USED.

3.5 CABLING

3.5.1 INTERNAL CABLING

Internal cabling is shown in Figure 3.2. Each assembly consists of an active paddle board containing interface circuitry and ribbon cabling. The cables are available terminated either with shielded connectors which mount on the I/O connector panel or with 2-row ribbon cable headers. Attached to each paddle board is a 100-pin block connector which mounts on to the chassis backpanel pins.

The "A" backpanel internal cable contains the disk A (control) cable and the tape J7 cable. The "B" internal cable contains the four disk B (data) cables and the tape J6 cable. Each connector is labeled appropriately.



INTERNAL CABLING
FIGURE 3.2

3.5.1.1 PADDLE BOARD INSTALLATION

Because the paddle boards are active and receive power from the backpanel, care must be taken in aligning them over the proper backpanel pins.

The computer backpanel, viewed from the rear, has the "A" side pins on the left. On computers with vertically mounted controller boards, the "A" side is on bottom.

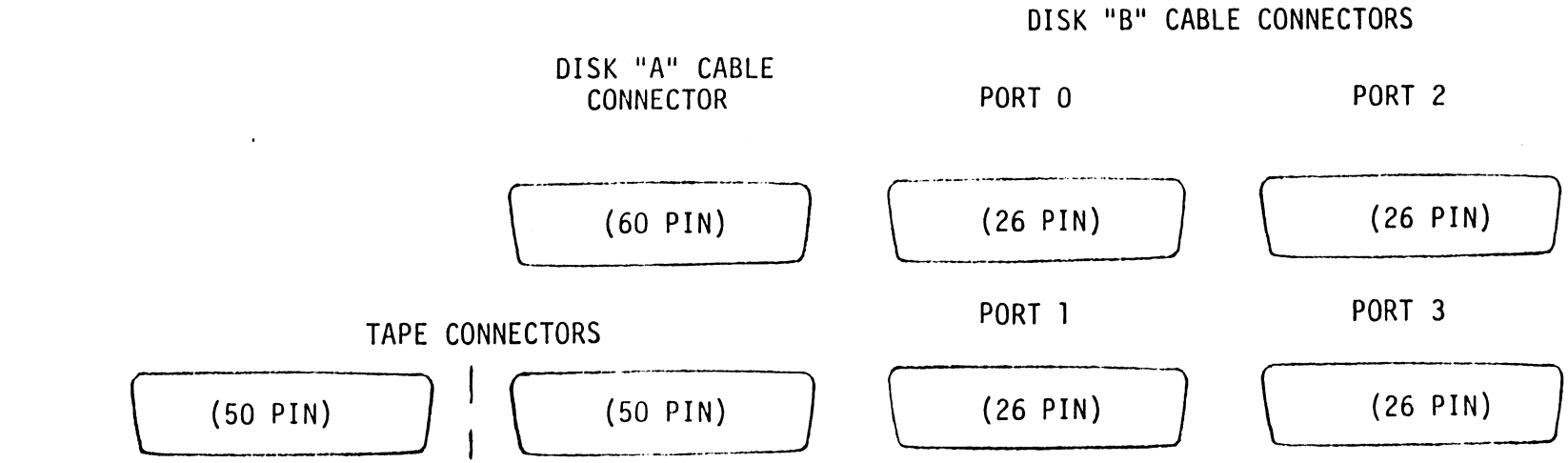
Locate the two rows of pins on the "A" side of the backpanel for the slot containing the ZDF-1 controller. Check to see that no pins are bent, and position the "A" paddle-board block connector over all 100 pins with components facing up. (For vertical-board machines, components should face left.) Press the connector securely over the pins, making sure all pins insert and do not bend, until block is flush with backpanel.

CAUTION: Component damage may occur if paddle board is mis-aligned. Make sure block is not shifted right or left by checking for non-inserted pins on both ends. Also, doublecheck that the block is positioned over the correct two rows of pins, and not between slots. It may be necessary to count pairs of rows to determine correct positioning.

Repeat procedure for mounting the "B" paddle board on the "B" side of the backpanel.

3.5.1.2 MOUNTING "D" CONNECTORS (ROUND, SHIELDED CABLING ONLY)

Figure 3.3 depicts the computer I/O connector panel, viewed from the back. To mount the connectors, remove the covers from the desired mounting holes on the connector panel. With the mounting hardware removed from the "D" connectors, insert the connectors into the panel and insert the hex bolts from the outside of the panel. 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

*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 500395-000

CONNECTOR PANEL EXAMPLE LAYOUT
FIGURE 3.3

3.5.2 EXTERNAL DISK CABLING

Round, shielded cabling:

The disk "A" cable (P/N 300013-000) mounts to the I/O connector panel and is terminated with a 60-pin connector which attaches to the first disk drive. The disk "B" cable (P/N 300011-000) mounts to the panel and is terminated with a 26-pin connector which attaches to the disk drive. One daisy chain "A" cable (P/N 100915-000) is required for every additional "B" cable.

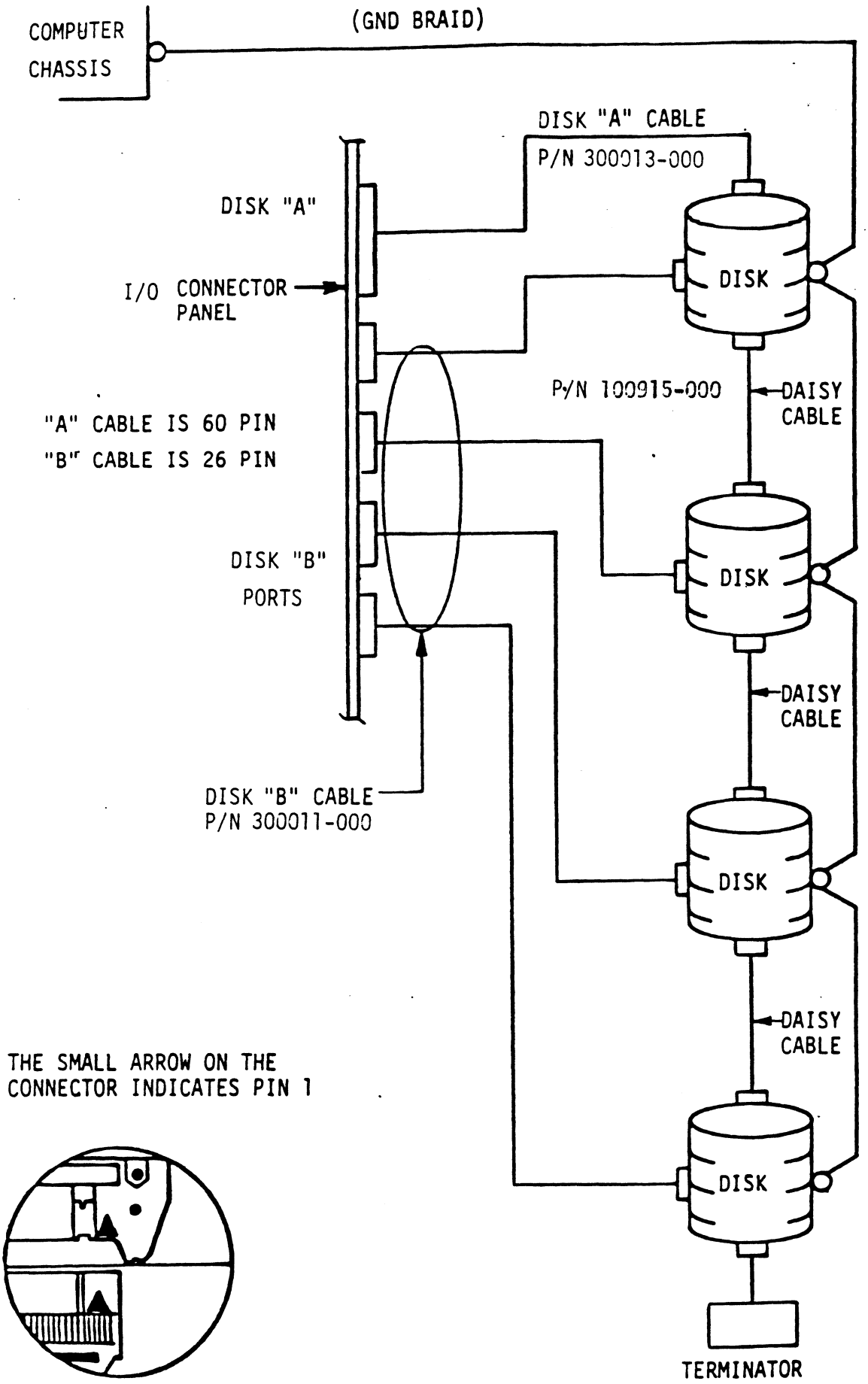
Flat ribbon cabling:

The disk "A" cable (P/N 100911-002) is 60 conductor, twisted pair with 60 pin connectors on each end. The disk "B" cable (P/N 100916-002) is 26 conductor with 26 pin connectors on each end. An additional "A" cable is required for each additional "B"cable. Be sure to observe arrow for proper connection to internal cable headers.

Attach the disk "A" cable to the appropriate header or panel connector labeled disk "A". Attach the other end to the appropriate header on the first disk drive, observing the arrows on header and connector align. For additional drives, remove the terminator and connect the cables from drive to drive in a daisy chain fashion, as shown in Figure 3.4. Ensure that a terminator is installed in the open header of the last drive in the chain.

Next, connect the "B" cable(s) to the appropriate header or panel connector and the other ends to each disk drive.

It is important to note that a drive's unit number setting does not dictate the "B" connector it must attach to. The controller allows any unit to be attached to any of the four "B" ports and assigns individual drive characteristics on a port-by-port basis. Therefore, it must be noted which connector each drive is attached to (PORT 0-PORT 3, labeled on internal connectors), so that proper drive characteristics are assigned to each port when the Configurator program is run.



DISK DRIVE CABLING
FIGURE 3.4

3.5.3 EXTERNAL TAPE CABLING

For shielded round cables, two cables (P/N 300001-001) connect the I/O connector panel to the tape unit. For flat ribbon cables (P/N 100914-001), each cable is terminated with a 50 pin 2-row connector on one end. Cables are terminated with 50-pad edge connectors which fit on the tape unit's formatter board.

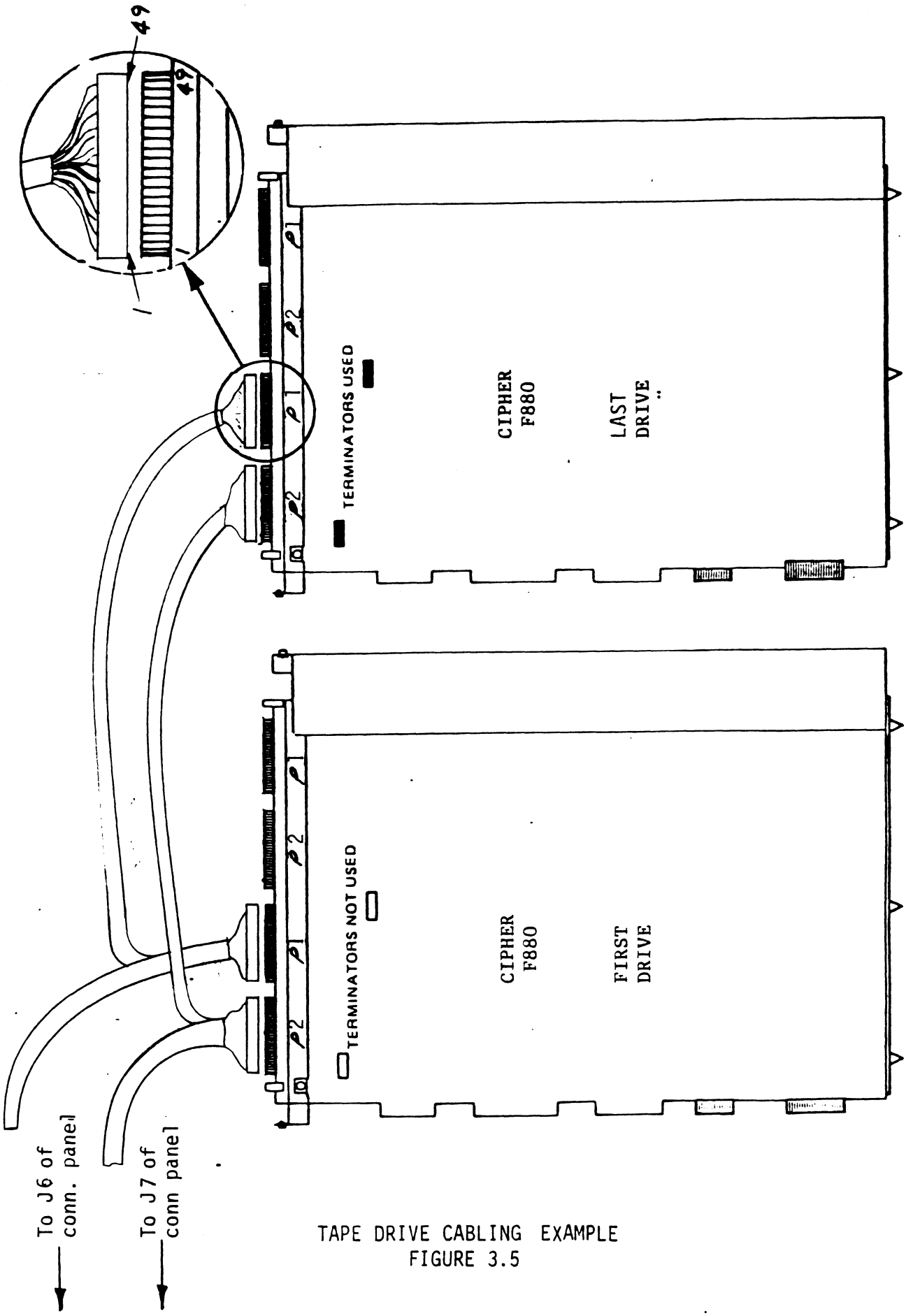
Attach the two cables to the headers or panel connectors labeled J6 and J7. For ribbon cabling, be sure to observe arrows on header and connector.

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 models' 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.

TAPE DRIVE	COMPUTER CONN. PANEL "B" SIDE J6*	"A" SIDE 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

*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 500395-000

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

3.5.3.1 MULTIPLE TAPE DRIVES

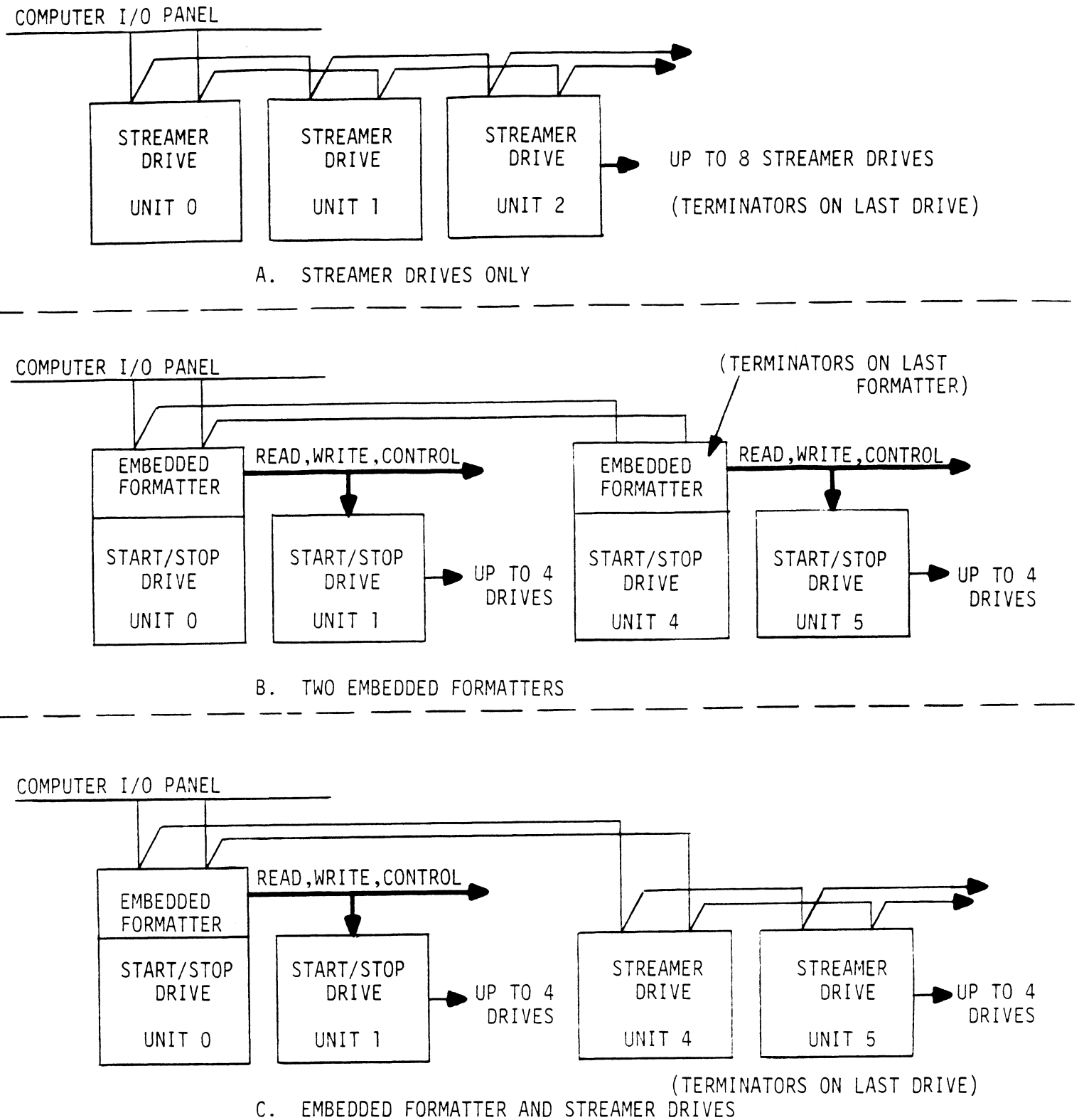
Figure 3.6 shows 3 multiple-drive cabling schemes. The coupler may address up to 8 tape units. These may be all drives with individual formatters, as shown in Figure A, or they may be drives which share a common formatter as in Figure B, or a combination of both as in Figure C. In Figure A, the drives 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 300012-001). 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.

3.5.4 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.



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 switch in the drive or by changing lens caps on the front. For two or more drives, unit numbers assigned are usually consecutive, with unit "0" being the primary unit. 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.

Insure 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 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 11) AND CDC 9455 (LARK)

Insure 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 M294 software tape shipped with the controller is 1600 BPI unless indicated.

3.8 INITIAL DEVICE CODES

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. 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.

If the secondary device codes cannot be used during initial configuration, the controller may be forced to the primary disk (27) and tape (22) device codes by cutting the Device Code Default jumper. Refer to section 3.2.1.

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 M294 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. However, 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. However, the primary is 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. If the device code default jumper was cut to force the disk primary value, it must be wired in after configuration if any other value is specified.

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 (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

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 4035 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). However, the primary is 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. If the device code default jumper was cut to force the primary value, it must be wired in after configuration if any other value is specified.

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 or AOS/VS (both MTC). RDOS does not support 6125 emulation.

3.10.2.3 READ LOOK-AHEAD ENABLE

Read Look-Ahead is a feature which helps avoid drive re-positioning during multiple record reads on basic streamer type drives. We recommend it be ENABLED for these drives. We recommend this feature be DISABLED for GCR or cache streamer drives, or 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 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 or AOS/VS 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 M294 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 CSDKINIT. (included on the M294 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 M294 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 CSDKINIT 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 M294 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 M294 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. M294 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      CSDKINIT -DISK INITIALIZER       CSDKINIT.SV
           (RDOS SYSTEMS ONLY)
 10      CSDSKED -DISK EDITOR             CSDSKED.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 M294 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 9.0

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 M294 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 factory set to the secondary value of 67 octal to avoid conflict if another disk subsystem exists. Enter this value if the disk device code has not been forced to primary using the device code default jumper.

- If the disk device code was forced (section 3.2.1), then respond with the primary value of 27.

If the program returns on error after the device code is entered, refer to section 3.2.1 to force the disk to the primary value. Turn the computer off, then on to re-initialize the controller, then re-boot the Configurator.

4.2.2 CONFIGURATOR OPERATION

The ZDF-1 Configurator includes two "HELP" commands - one for OPERATIONAL questions and one which suggests WHAT you might want to do. 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 M294 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 M294 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 M294 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 M294 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 M294 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 M294 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 CSDKINIT, per the instructions in section 4.6.1.

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

4.6.1 CSDKINIT - RDOS DISK INITIALIZER

Before you load any RDOS system onto a Model ZDF-1 disk, YOU MUST INITIALIZE THE DISK BY RUNNING CSDKINIT. 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 CSDKINIT 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 CSDKINIT. Data General's DKINIT cannot be run on a Model ZDF-1 disk. CSDKINIT can, however, be used to initialize any DG supported disk.

STEP 1 - LOADING

Boot the CSDKINIT program from tape M294 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
          99       99           999     Megabytes if disk
                                        >4000 blks.  Blocks
                                        if disk <4000 blks.
STEP 4-COMMANDS AND SUBSEQUENT OUTPUT
The commands which can be selected are identical to those
of DKINIT.
From this point on CSDKINIT will perform exactly as DKINIT.
```

4.7 CSDSKED - RDOS STANDALONE DISK EDITOR

CSDSKED 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 CSDSKED.

```
STEP 1 - LOADING
Boot the CSDSKED program from tape M294 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	# SEC/TRK	# CYLINDERS	MBG/BLK
99	99	999	Megabytes if disk >4000 blks. Blocks if disk <4000 blks.

STEP 4 - COMMANDS AND SUBSEQUENT OUTPUT
The commands which can be selected are identical to those of DSKED. From this point on CSDSKED 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 M294 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, or whatever.

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, DDOS, DTOS).

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.

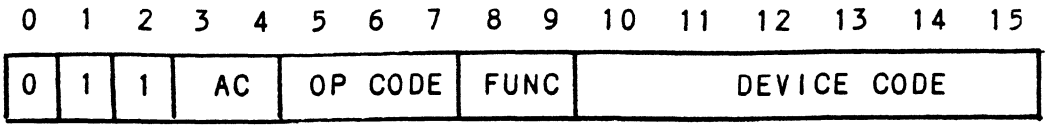
AC = Accumulator: 0, 1, 2 or 3.

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.

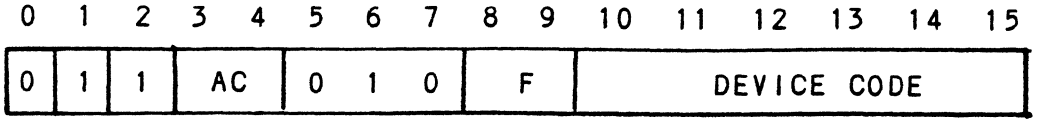
SKPDZ DSKP - SKIP IF DONE FLIP-FLOP IS CLEAR.

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

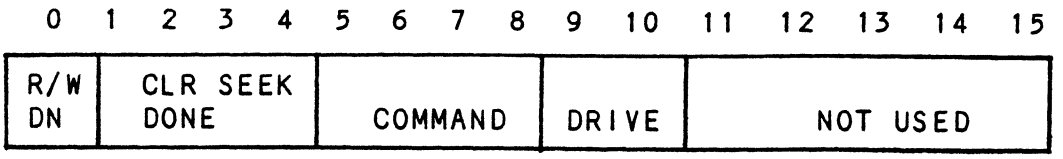
6.2 ACCUMULATOR FORMATS

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

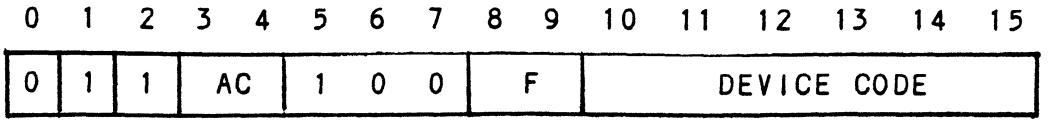
DOA will reserve a previously unreserved drive.

Bit Position 9 is not used if 616X.

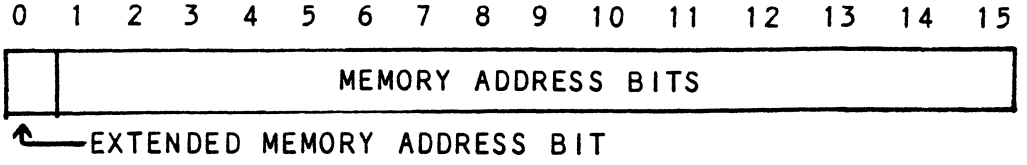
11-15 Reserved for future consideration

6.2.2 DOB - LOAD STARTING MEMORY ADDRESS

DOBF AC, DSKP



Accumulator

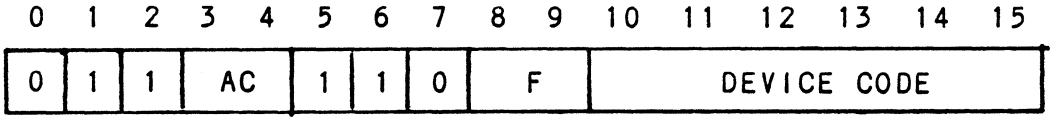


Execution of this instruction will load the controllers address counter with the contents of the specified accumulator and will be used as the starting memory address for a command that requires a data channel transfer operation.

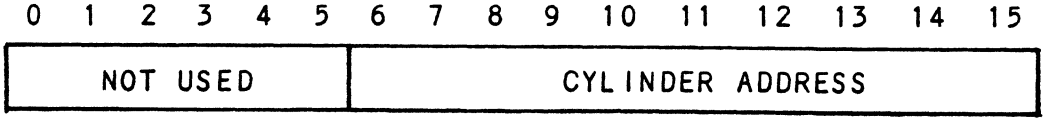
6.2.3 DOC - LOAD DRIVE ADDRESS

6.2.3.1 DOC - SPECIFY CYLINDER

DOCF AC, DSKP

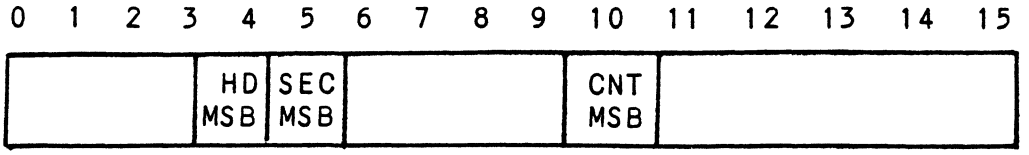


Accumulator (if previous DOA specified a Seek)

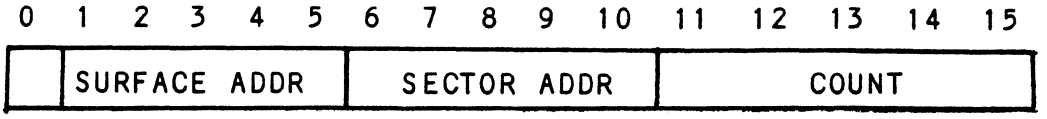


6.2.3.2 DOC - FIRST DOC SPECIFIES EXTENDED SURFACE, SECTOR AND COUNT (DOUBLE DOC MODE ONLY)

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

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

Accumulator

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

*0 - Invalid Status

*1 - Drive Reserved

*2 - Trespassed

3 - Ready

4 - Busy

*5 - Positioner Offset

6 - Write Disabled

*7 - ID

*8 - Ill Sur/Cyl Addr

*9 - Illegal Command

*10 - DC Voltage Fault

*11 - Pack Unsafe

12 - Positioner Fault

*13 - Servo Clock Fault

*14 - Write Fault

15 - Drive Fault

*These Bits are 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.

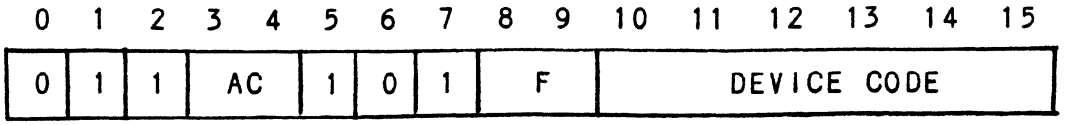
	STATUS BIT POSITION	CONTROLLER ACTION	ERROR RECOVERY	DRIVE ACTION
ILLEGAL SURFACE	8	Command is rejected and Done is set immediately,	New Command	None
ILLEGAL CYLINDER	8	Seek Command is rejected,	New Seek or Recal Command	None
ILLEGAL COMMAND	9	Command is rejected and Done is set immediately.	New Command	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)

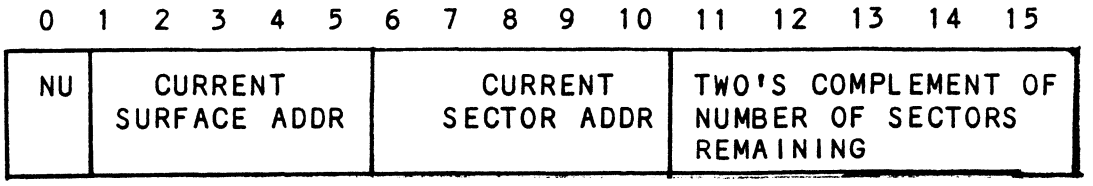
TABLE 6.2

6.2.4.3 DIC - READ SURFACE, SECTOR AND COUNT

DICF AC, DSKP



Accumulator



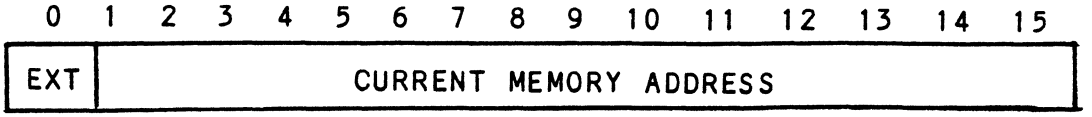
6.2.5 READ STATUS - ALTERNATE MODE ONE

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

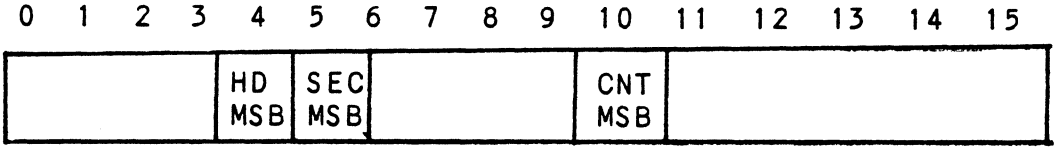


After the execution of this instruction the value of the accumulator will contain the memory address to where the next data word transfer will take place. The memory address counter is incremented by one after each data channel transfer.

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

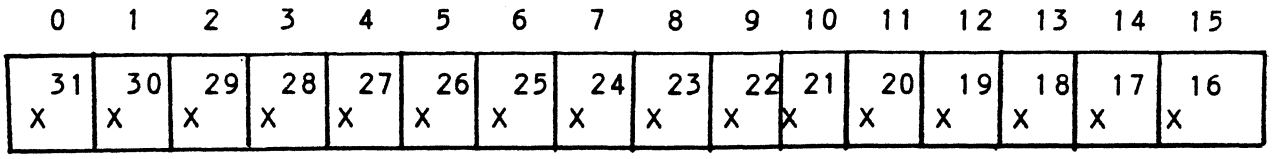
6.2.6 READ STATUS - ALTERNATE MODE TWO

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

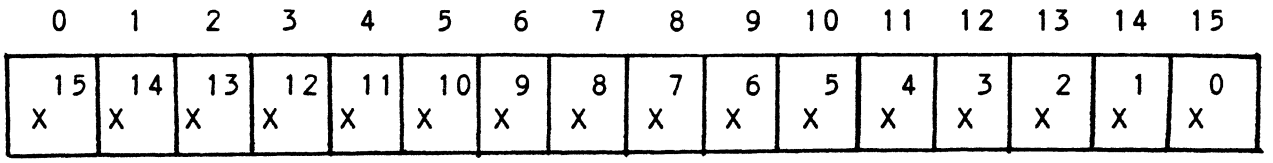
Accumulator



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 6.1 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

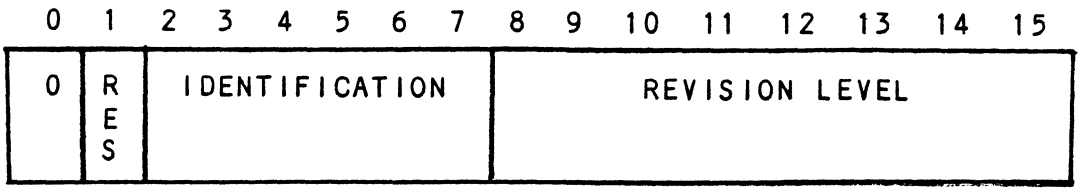
DETAILED RAM DESCRIPTIONS

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

$$X-32 + X-23 + X-21 + X-11 + X-2 + 1$$

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-1 + 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.

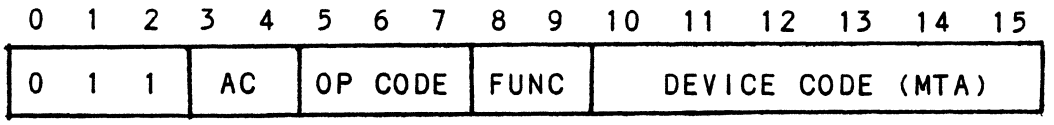
S (START) - Clears all errors except illegal, set busy and clear done. Command that was issued by a DOA will be executed.

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

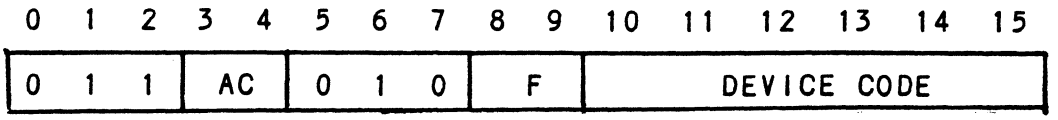
7.1.1 SKIP INSTRUCTIONS

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.

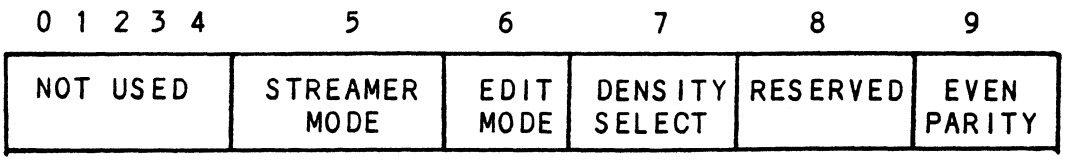
SKPBZ MTA - SKIP IF BUSY FLIP-FLOP IS CLEAR.
SKPBN MTA - SKIP IF BUSY FLIP-FLOP IS SET.
SKPDZ MTA - SKIP IF DONE FLIP-FLOP IS CLEAR.
SKPDN MTA - SKIP IF DONE FLIP-FLOP IS SET.

7.2 DOA - SEND COMMAND

DOAF AC,MTA



AC



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.

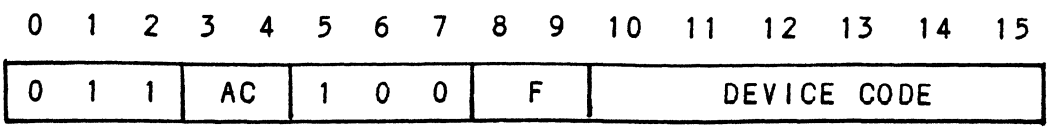
BIT 6	BIT 7	
LIMIT 1	LIMIT 0	LIMIT (MS = MILLISEC.)
0	0	75 MS
0	1	150 MS
1	0	300 MS
1	1	RESERVED

LIMIT TABLE

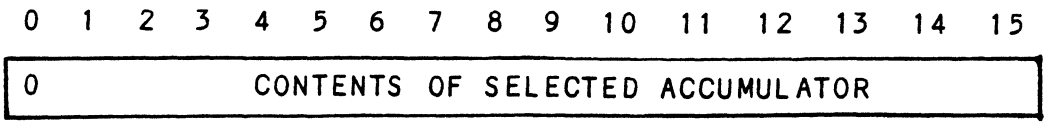
These modes, high speed and dynamic gap, will remain as selected until another DOA with streamer mode select (BIT 5) = 1 is issued again. The default condition is normal gap and low speed. Default is established on power on or IORESET switch depressed.

7.3 DOB - LOAD STARTING MEMORY ADDRESS

DOBF AC,MTA



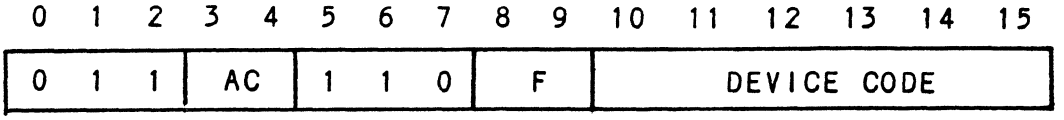
AC



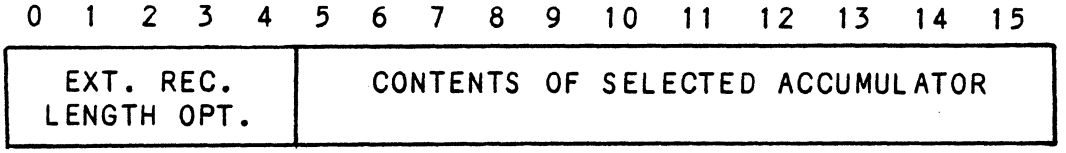
The contents of Selected Accumulator will be loaded into the controllers address counter. This will become the starting address for the next command that requires the data channel (READ or WRITE).

7.4 DOC - LOAD WORD COUNT

DOCF AC,MTA



AC

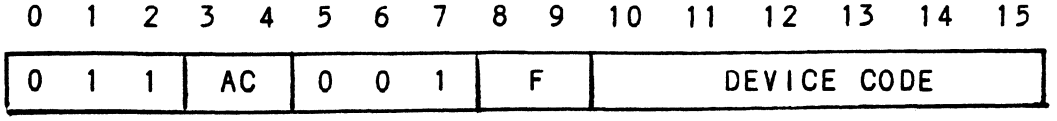


Program must place two's complement of desired word count into selected accumulator before this instruction is executed.

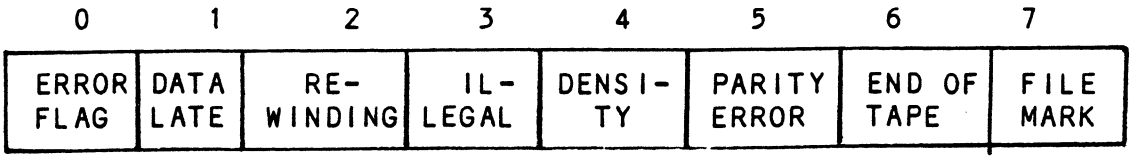
Spacing Forward/Reverse - Place two's complement of the maximum number of records to be spaced.

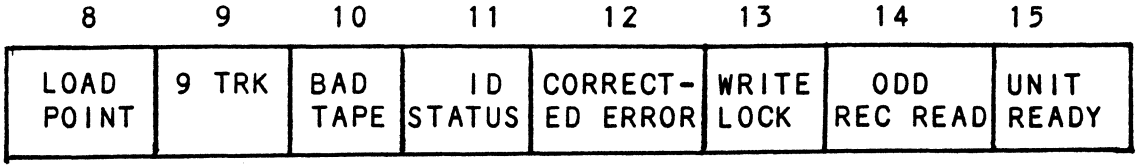
7.5 DIA - READ STATUS

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.

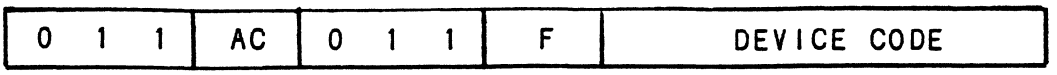
3) Controller is not busy.

4) Ready line from unit must be received.

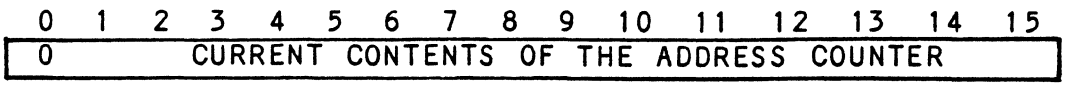
5) Selftest is done.

7.6 DIB - READ CURRENT MEMORY ADDRESS

DIBF AC,MTA



AC



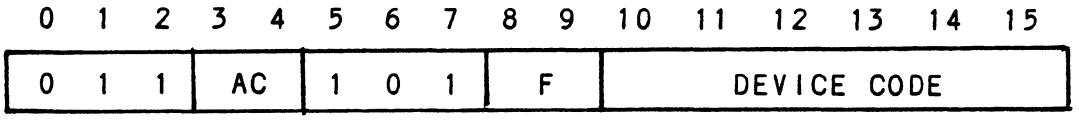
The seleted accumulator will contain the current contents of the address counter after the execution of this instruction.

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.

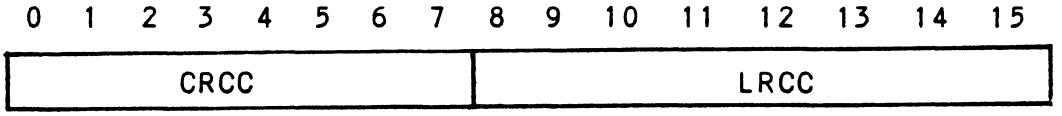
SPACING FORWARD/REVERSE - The address counter becomes a record counter on a space forward or reverse command. The difference between the contents of the counter before and after the space command will indicate the number of records spaced over.

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.

NOTE: READ LOOK AHEAD FEATURE

The probability of one Read record command following another is very high. To take advantage of this likelihood, the ZDF-1, once a Read command is received, will issue a second Read Command to the drive. This feature dramatically increases the amount of time that the minicomputer has to issue the actual Read Command. (The gap length, record postamble and 1024 character buffer is what contributes to the extend time.)

If the next command was not a Read, the coupler will abort the Read Look Ahead and reposition the tape and execute the desired command.

In all cases the Read Look Ahead feature is transparent to the User. It is accomplished automatically by the coupler, and is enabled/disabled at configuration.

7.8.2 WRITE

A Write Command is issued by doing a DOA with a Start Pulse.

Busy sets and the coupler asserts a write forward command to the tape unit. Tape unit ramps up to speed and continues to write bytes of data until the word count limit is reached and the FIFO is empty. Data channel operation is the same as a read except words are read from the mini's memory instead of written after the last byte is written. The tape unit will write its format data (postamble if PE, CRC/LRC is NRZ) and record gap if "ON THE FLY" is not achieved, tape motion will cease.

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

Possible Errors:

1) Same as Read Command.

NOTE: Since, normally, a Read or Write Command will ultimately result in data channel activity, it is imperative that the word counter (DOC) and address counter (DOB) are initialized prior to the start pulse.

7.8.3 WRITE END OF FILE

Start will set busy (illegal and done sets if no write ring) and the tape unit will move forward and write one file mark.

PE FORMAT - A gap approximately 3.5 inches long before the file mark followed by a record gap.

NRZ FORMAT - A single character record with bits in tracks 3, 6 and 7 set for both the data character and the LRCC. The CRC character will contain all zero bits.

Done sets when the command is completed.

7.8.4 REWIND

Start does not set busy, selected tape unit will rewind at high speed. The unit will not be ready until the tape is stopped at the BOT marker. Other units are available for commands while this unit is rewinding. Done does not set when command is completed.

7.8.5 SPACE FORWARD

When start sets busy, forward tape motion starts. When unit reaches a record gap the coupler then makes the decision whether to continue onto the next record gap or to stop tape motion. It will stop under any of the following conditions - word count overflowed, file mark was detected or last record spaced contains EOT marker.

The word counter should be loaded with two's complement of the desired number of records to be spaced prior to start pulse. The maximum number of records to be spaced is 4095 (64K is optional). Done will set after command completion and the file mark status bit will be set if a file mark was encountered. If the drive is a streamer type, high speed will be selected automatically after four records. This greatly increases file access time.

7.8.6 SPACE REVERSE

Start sets busy. If the selected tape unit is at load point, no tape motion will take place. Done and illegal will set. If not at a load point, tape motion will continue until the word count overflows, a file mark is encountered or load point is reached. The word counter is handled the same way as the space forward command. When the command is completed, Done will set. If the coupler is connected to a streamer type of drive, high speed will be selected automatically after ten records.

7.8.7 ERASE

When start sets busy and a write ring is on the reel, the tape unit will erase approximately 3.5 inches of tape. The amount of tape erased varies somewhat with different drive manufacturers. Refer to the drives manual for the actual amount. Done sets when the command is completed.

7.9 DATA CHANNEL OPERATION (RESULTING FROM A READ OR WRITE COMMAND)

Data Channel Operations take place during a read record (providing an end of file is not encountered) or write record. The word counter and address counter must be initialized before a start function (DXX S AC,MTA) is asserted (see 7.3 DOB and 7.4 DOC). If a legal (see DIA Status Bit 3) read or write command was issued prior to a start function, tape motion will commence.

Data transfers will be encountered between the minicomputer and the magnetic tape drive. One data channel request is issued for every word (16 bits) transfers on the drive end. If the mini cannot respond to a request before the next word is transferred by the drive, the coupler will store it in a FIFO buffer until the request is acknowledged. The size of the buffer covers the data channel latency period. But, if for some remote chance the buffer overflows, the coupler will then abort the command and set done, error flag and data late (see 7.5 DIA).

For each word transferred via the data channel, the word and address counter will increase by one data channel. Transfers will continue until the word counter overflows or an end of record is reached on a read command. A maximum word count may be used for a read command if the record size is unknown.

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 M294 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. 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 M294 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 M294 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 M294 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) 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.

```
 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                                    ;.DDIS
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
```

```
 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                                    ;.DOIS
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 LOAD:   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                                    ;.DOIS
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  HNG      AOS 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: HNG.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   HNG
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
```

```
 0001  DISKD    AOS ASSEMBLER REV 04.20        11:55:43 06/22/84
01              ;
02              ;
03              ;
04              ;************************************************************
05              ;
06              ;
07              ; DESCRIPTION: ZETACO SMD DISK CONTROLLER DIAGNOSTIC
08              ;
09              ;
10              ; PRODUCT OF ZETACO, 1984
11              ;************************************************************
                        .TITL   DISKD
13      000001          .DUSR   X=1
14      000001          .NOMAC  X
15              ; 1.0 PROGRAM NAME:     DISKD.SR
16
17              ; 2.0 REVISION HISTORY:
18              ;
19              ;       REV.       DATE
20              ;        00     02/17/83        ;
21              ;        01     09/07/83        ;ANOTHER RDY UNIT WARNING,1 HD ERR C22,
22              ;                               ;AOS BOOTSTRAP(400'S), NO OFFSET TESTS
23              ;                               ;FOR CMD'S
24              ;        02     03/28/84        ;295C,296 AND BMX TESTS
25              ;                               ;DEVICE CODE CHANGE ROUTINE
26              ;        03     06/12/84        ;ZDF1 CHANGES, A5 TESTS 17-76
27              ;
28
29              ; 3.0 MACHINE REQUIREMENTS:
30              ;       NOVA OR ECLIPSE FAMILY CENTRAL PROCESSOR
31              ;       MINIMUM OF 16K READ/WRITE MEMORY
32              ;       ZETACO SMD DISK CONTROLLER
33              ;       0-3 DISK DRIVES
34              ;       TELETYPE OR CRT AND CONTROL
35
36              ; 4.0 TEST REQUIREMENTS:        N/A
37
38              ; 5.0 SUMMARY:
39              ;       THIS PROGRAM IS A HARDWARE DIAGNOSTIC FOR THE
40              ;       ZETACO SMD DISK CONTROLLER AND DRIVES.
41              ;       THE DEVICE CODE MAY BE 20-76 OCTAL WITH THE
42              ;       DEFAULT BEING 27
43
44
45              ; 6.0 RESTRICTIONS:
46              ;       THIS PROGRAM HAS NO RESTRICTIONS AS TO SINGLE OR
47              ;       DUAL PROCESSOR HARDWARE CONFIGURATION. HOWEVER, THE
48              ;       DIAGNOSTIC MAY BE RUN ON ONLY ONE CPU AT A TIME AND
49              ;       MUST BE THE ONLY PROGRAM BEING RUN WITHIN THE DISK
50              ;       SYSTEM.
51
52              ; 7.0 PROGRAM DESCRIPTION/THEORY OF OPERATION:
53
54              ;       7.1 "A" TESTS CHECK:
55
56              ;       - BUSY, DONE, I/O BUS SELECT LOGIC
57              ;       - DISK SELECT LOGIC, CONTROLLER RAM
58
59              ;       7.2 "B" TESTS CHECK:
60
```

```
0002  DISKD
01              ;       - START, BUSY, CLEAR LOGIC
02              ;       - RECALIBRATE, ATTN, INTERRUPT LOGIC
03              ;       - INTERRUPT DISABLE, INTA LOGIC
04              ;       - THAT SEEKS TO CYL'S 0,1/2 CYL MAX,AND CYL MAX CAN AT
05              ;         LEAST BE EXECUTED AND SET DRIVE BUSY.
06              ;       - READY/SELECT LOGIC
07
08              ;       7.3 "C" TESTS CHECK:
09
10              ;       - THAT THE CA REGISTER INCREMENTS PROPERLY
11              ;         VIA DCH  OR BMC REQUESTS
12              ;       - THAT A WRITE CAN BE EXECUTED
13              ;       - SELD, CLEAR LOGIC
14              ;       - THAT SEEK/WRITE OPERATIONS CAN BE EXECUTED
15              ;       - WRITES TO DIFFERENT HDS,SECTORS
16              ;       - MULTI-SECTOR WRITES
17              ;       - THE INCREMENT HEAD LOGIC
18              ;       - ILLEGAL SECTOR, SURFACE, CYLINDER CONDITIONS
19
20              ;       7.4  "E" TESTS CHECK:
21
22              ;       - THAT A READ MAY BE EXECUTED
23              ;       - 8 SECTOR WRITE/READ OPERATIONS (9 DIFFERENT
24              ;         DATA PATTERNS) AT CYL'S 0,1/2 CYL MAX AND CYL MAX WITH FULL
25              ;         CORE COMPARE
26              ;       - DATA VERIFY FUNCTION (NORMAL AND WITH FORCED ERRORS)
27              ;       - OFFSET MODES
28              ;       - ILLEGAL COMMAND TRAPS
29              ;       - WRITE CYL# TO HEAD 0,SECTOR 0 OF ALL CYLINDERS
30              ;       - WRITE HEAD # TO SECTOR 0 OF ALL HEADS ON CYL 0
31              ;       - WRITE SECTOR # TO ALL SECTORS OF HEAD 0,CYL 0
32              ;       - EACH OF THE ABOVE OPERATIONS IS FOLLOWED
33              ;         BY A CORRESPONDING READ/CHECK OPERATION TO VERIFY
34              ;         DISK ADDRESSING LOGIC.
35
36              ;       7.5  "F" TESTS CHECK:
37
38              ;         THE FORMAT LOGIC ON CYL 0,HEAD 0,SECTOR 0,
39              ;         A BAD SET FLAG IS SET AND TESTED
40              ;         THE FORMAT IS SET TO NORMAL AFTER COMPLETION OF
41              ;         THESE TESTS.
42              ;         ## SEE SWPAK 7 OPTION ##
43
44              ;       7.6 "S" TESTS ARE SEEK EXERCISERS
45
46              ;       - PERFORMS RANDOM SEEKING.  EACH SEEK IS FOLLOWED BY A
47              ;         READ TO HEAD 0,SECTOR 0
48
49              ;       - PERFORMS RANDOM OVERLAPPED SEEKING TO TWO DRIVES.
50              ;         EACH SEEK IS FOLLOWED BY A READ TO HEAD 0,SECTOR 0.
51              ;         U1 IS THE THE PRIMARY UNIT UNDER TEST AND U2
52              ;         IS THE NEXT DRIVE FOUND IN A 1,2,3,0 ETC.  SEARCH.
53              ;         IF ONLY 1 DRIVE, TEST IS BYPASSED.  TEST IS ONLY RUN
54              ;         AFTER A PASS IS ACHIEVED ON ALL DRIVES.
55
56              ; 8.0  OPERATING MODES/SWITCH SETTINGS:
57
58              ;8.1    SWITCH SETTINGS
59              ;
60              ;       LOCATION "SWREG" IS USED TO SELECT THE PROGRAM OPTIONS
```

```
 0003  DISKD
01              ;       THIS LOCATION WILL BE SET ACCORDING TO THE ANSWERS
02              ;       SUPPLIED BY THE OPERATOR.  THE OPTIONS CAN BE CHANGED
03              ;       OR VERIFIED BY USING ONE OF THE COMMANDS GIVEN IN SEC.
04              ;       8.3
05              ;
06              ;
07              ;8.2    SWITCH OPTIONS
08              ;       DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION
09              ;       "SWREG" IS AS FOLLOWS:
10              ;
11              ;       BIT     OCTAL   BINARY  INTERPRETATION
12              ;               VALUE   VALUE
13              ;
14              ;       1               0       LOOP ON ERROR
15              ;               40000   1       SKIP LOOPING ON ERROR
16              ;
17              ;       2               0       PRINT TO CONSOLE
18              ;               20000   1       ABORT PRINT OUT TO CONSOLE
19              ;
20              ;       3               0       DO NOT PRINT % FAILURE
21              ;               10000   1       PRINT % FAILURE
22              ;
23              ;       5               0       DO NOT PRINT ON THE LINE PRINTER
24              ;               02000   1       PRINT ON THE LINE PRINTER
25              ;
26              ;       6               0       DO NOT HALT ON ERROR
27              ;               01000   1       HALT ON ERROR
28              ;
29              ;       7               0       N/A
30              ;               00400   1       DISABLE FORMATTING HEAD 0, CYLINDER 0, SECTOR 0
31              ;                               ##SEE 12.2##.
32              ;       8               0       N/A
33              ;               00200   1       RECALIBRATE DURING SCOPE LOOP
34              ;
35              ;       9               0       N/A
36              ;               00100   1       1 SECOND DELAY DURING SCOPE LOOP
37              ;
38              ;       10(A)           0       N/A
39              ;               00040   1       PROGRAM WILL PRINT TEST #'S AND FIRMWARE REVISION
40              ;
41              ;       11(B)           0       N/A
42              ;               00020   1       PROGRAM WILL EXIT TO ODT WHEN
43              ;                               NOT IN TESTS F1- ##SEE 7.5##
44              ;                               SWITCH IS SET TO 0 UPON EXIT
45              ;
46              ;       12(C)           0       SKIP LONG RAM TEST
47              ;               00010   1       LONG CONTROLLER RAM TEST
48              ;
49              ;8.3    SWITCH COMMANDS
50              ;       ONCE THE PROGRAM STARTS EXECUTING THE STATE OF ANY OF
51              ;       THE BITS CAN BE CHANGED BY HITTING KEYS 1-9, A-F.  THE
52              ;       PROGRAM WILL CONTINUE RUNNING AFTER UPDATING THE OPTIONS.
53              ;       EACH KEY WILL COMPLEMENT THE STATE OF THE BIT AFFILIAT-
54              ;       ED WITH IT, THUS BIT 4 CAN BE ALTERED BY HITTING KEY 4.
55              ;       SETTING OF ANY BIT OF LOCATION "SWREG" WILL SET BIT 0.
56              ;       (DEFAULT MODE IS DEFINED AS ALL BITS OF SWREG SET TO 0)
57              ;
58              ;8.4    OTHER COMMANDS  (^ = CONTROL KEY)
59              ;
60              ;       "CR"    A "RETURN" CAN BE TYPED TO CONTINUE THE PROGRAM
```

```
 0004  DISKD
01              ;               AFTER ITS LOCKED IN A SWITCH MODIFICATION MODE
02              ;
03              ;       ^D      THIS COMMAND GIVEN AT ANY TIME WILL RESET "SWREG"
04              ;               TO DEFAULT MODE AND RESTART THE PROGRAM.
05              ;
06              ;       ^R      THIS COMMAND GIVEN AT ANY TIME WILL RESTART THE
07              ;               PROGRAM.  SWITCHES ARE LEFT WITH THE VALUES THEY
08              ;               HAD BEFORE THE COMMAND WAS ISSUED.
09              ;
10              ;       ^O      THIS COMMAND GIVEN AT ANY TIME WILL CAUSE THE
11              ;               PROGRAM CONTROL TO GO TO ODT (NOTE: THIS IS AN
12              ;               OPTIONAL COMMAND AND IS AVAILBLE ONLY IF
13              ;               ODTPK IS PRESENT)
14              ;
15              ;       M       THIS COMMAND GIVEN AT ANY TIME WILL PRINT THE
16              ;               CURRENT OPERATING MODES.
17              ;
18              ;       0       THIS COMMAND GIVEN AT ANY TIME WILL LOCK THE
19              ;               PROGRAM INTO SWITCH MODIFICATION MODE WHERE
20              ;               MORE THAN 1 BIT CAN BE CHANGED.
21              ;
22
23
24              ; 9.0 OPERATING PROCEEDURE/OPERATOR INPUT:
25
26              ;       9.1 LOAD USING THE BINARY LOADER
27
28              ;       9.2 STARTING ADDRESSES
29              ;               200-TO IDENTIFY DISK TYPE (INITIALIZE)
30              ;                  PROGRAM THEN PROCEEDS TO 500.
31              ;               201-ODT DIRECT ENTRY ONLY
32              ;               202-RANDOM SEEK EXERCISERS.  (1 PASS OF DIAG FOR EACH UNIT FIRST)
33              ;                SEEK EXER 1 IS A SINGLE DRIVE EXERCISER
34              ;                SEEK EXER 2 IS TWO DRIVE EXERCISER WITH SEEK OVERLAP
35              ;               500-DIAGNOSTIC (RESTART)
36
37              ;       9.3 THE PROGRAM PRINTS "PASS" FOLLOWING EACH
38              ;          COMPLETE PASS THROUGH THE TESTS.  RANDOM
39              ;          SEEK EXERCISER PERFORMS 1000 SEEKS
40              ;          PER "PASS" MESSAGE.
41
42              ;       9.4 DEVICE CODE OF CONTROLLER IS REQUESTED (27 IS DEFAULT)
43
44              ;       9.5 UNIT NUMBERS TO BE TESTED ARE REQUESTED TO WHICH THE OPERATOR
45              ;           ENTERS THE UNIT NUMBERS TO BE TESTED, SEPARATING
46              ;           THE INDIVIDUAL #'S BY A <,> OR <SPACE>.
47
48              ;       9.6 OPERATOR IS REQUESTED TO ENTER 1, IF UNIT CHARACTERISTICS
49              ;           DISPLAYED ARE INCORRECT, AND WANTS TO LOOP ON READING THEM
50
51              ; 10.  PROGRAM OUTPUT/ERROR DESCRIPTION:
52              ;       WHEN AN ERROR IS DETECTED THE PROGRAM PRINTS THE ERROR
53              ;       PC, AC'S 0,1,AND 2 AT THE POINT OF ERROR, THE PROGRAM THEN
54              ;       GOES INTO A SCOPE LOOP BETWEEN THE ENTRIES TO
55              ;       .SETUP AND .LOOP ALLOWING THE OPERATOR TO SET  SWPAK.
56              ;       IN GENERAL THE ERROR PC WILL POINT TO A CALL ERROR.
57
58              ;       THE PRINTOUT WILL BE OF ONE OF THE FOLLOWING FORMATS:
59
60              ;       A.  STANDALONE CONTROLLER TEST FAILURES-
```

```
 0005  DISKD
01
02              ;       B. STATUS ERRORS
03
04              ;       MODE    UNIT    #       DATA
05              ;       CYL     #       HEAD    #       SECTOR  #
06              ;       AC1(STATUS) SHOULD =AC0
07              ;       DESCRIPTIONS OF FAILING STATUS BITS
08
09              ;       C. MEMORY/DISK ADDRESS ERROR
10
11              ;       MODE    UNIT    #       DATA
12              ;       CYL     #       HEAD    #       SECTOR  #
13              ;       ENDING MEMORY/DISK ADDRESS ERROR
14              ;       AC1(MA/DA) SHOULD =AC0
15
16              ;       C. INTERRUPT TIMEOUT
17
18              ;       MODE    UNIT    #       DATA
19              ;       CYL     #       HEAD    #       SECTOR  #
20              ;       INTERRUPT TIMEOUT
21
22              ;       ADDITIONAL TEST SIGNIFICANCE CAN BE FOUND IN THE PROGRAM
23              ;       LISTING, ALTHOUGH IT IS HOPED THAT A NEED FOR THE
24              ;       LISTING WILL BE MINIMAL.  SWPACK(SWREG) WILL PROVIDE
25              ;       ALL CONTROL OVER TEST LOOP OPTIONS AND PRINTOUTS.
26
27
28              ;       DATA ERRORS WILL RESULT IN THE 1ST 3 GOOD/BAD
29              ;       PAIRS AND THEIR ADDRESSES BEING PRINTED ALONG WITH THE
30              ;       TOTAL COUNT.  IF AN ECC ERROR IS DETECTED, THE CALL
31              ;       EHECC WILL ACKNOWLEDGE THE FACT AND RETURN TO THE
32              ;       MAIN TEST FOR THE DATA COMPARE.  PRINTOUTS RESULT
33              ;       ON THE 1ST ERROR PASS ONLY.  AS THE CHECK ROUTINE
34              ;       CHECKS THE ENTIRE READ BUFFER, ANY ERROR ACCOMPANIED
35              ;       BY AN ECC ERROR,TERMINATING THE READ, MAY CAUSE ALL
36              ;       DATA IN SUCCEEDING SECTORS TO APPEAR BAD.
37
38              ;       TESTS THAT PERFORM A RECALIBRATE HAVE A 2 SEC.
39              ;       DELAY BUILT INTO THE SCOPE LOOP.    SET SWPAK 9 = 1
40              ;       TO INTRODUCE AN ADDITIONAL 1 SECOND DELAY DURING
41              ;       THE SCOPE LOOP.
42
43              ;       IN GENERAL EACH SUCCESSIVE TEST ASSUMES ALL
44              ;       PREVIOUS TESTS WORK.  BYPASSING ERRORS
45              ;       CAN RESULT IN CONFUSING SITUATIONS
46              ;       IN THE SETUP OF MORE COMPLEX TESTS.
47
48              ; 11. DEBUG HELP:
49                      O?DTD   11B
50
51              ; 12. SPECIAL NOTES/SPECIAL FEATURES:
52
53              ;       12.1 IF THE DISK PACK HAS BAD SECTOR FLAGS SET ON CYLINDER
54              ;       0, OR ON THE FIRST 8 SECTORS OF HEAD 0 OF ANY CYLINDER,
55              ;       ERROR PRINTOUTS WILL RESULT WHEN THE FLAGS ARE
56              ;       ENCOUNTERED.
57
58              ;       12.2  TESTS F1-F3 ALTER THE FORMAT ON
59              ;       CYL 0,HD 0,SEC 0 FOR PURPOSES OF
60              ;       CHECKING THE FORMAT LOGIC AND BAD SECTOR LOGIC.
```

```
 0006  DISKD
01              ;       SWPAK7 SHOULD BE SET TO 1 IN ORDER TO STOP PROGRAM
02              ;       FROM EXECUTING THE FORMAT.
03              ;
04              ;       12.3  SOME SCOPE LOOPS WILL REQUIRE A RECALIBRATE
05              ;       TO INITIALIZE THE DISK DRIVE FOLLOWING A FAILURE.
06              ;       SET SWPAK 8 = 1 TO INTRODUCE THE RECALIBRATE TO THE
07              ;       UNIT UNDER TEST.
08              ;
09              ;       12.4  DISK PACKS
10              ;       ONLY USE DISK PACKS FORMATTED BY THE DISKF
11              ;       PACK FORMATTER PROGRAM.  THE DIAGNOSTIC PROGRAM
12              ;       WILL WRITE OVER MOST OF THE DISK SURFACE.
13              ;
14              ; 13. RUN TIME:
15              ;       THE RUN TIME FOR A PASS IS APPROXIMATELY: 3 MIN.
```

```
 0001  DISKF    AOS ASSEMBLER REV 04.20        18:25:35 06/22/84
01              ;
02              ;
03              ;
04              ;*************************************************************
                ;
06              ;
07              ; DESCRIPTION: ZETACO SMD DISK CONTROLLER FORMATTER PROGRAM
08              ;
09              ;
10              ; PRODUCT OF ZETACO, 1984
11              ;*************************************************************
                        .TITL   DISKF
13      000001          .DUSR   X=1
14      000001          .NOMAC  X
15              ;1.0    PROGRAM NAME:   DISKF.SR
16
17              ;2.0    REVISION HISTORY:
18              ;
19              ;       REV.       DATE
20              ;        00     02/09/83        ;
21              ;        01     08/23/83        ;ADUB FOR ALT1 (STTD), AOS BSTRAP (400'S)
22              ;        02     03/28/84        ;DISK PULSE COUNTER, ERROR LOGS, 200.
23              ;                               ;ERRORS, MSB FOR BAD SECTOR LOG
24              ;                               ;DEVICE CODE CHANGE ROUTINE
25              ;        03     05/30/84        ;ECC ON WRITE, ZDF1
26              ;
27
28              ;3.0    MACHINE REQUIREMENTS:
29
30              ;       NOVA/ECLIPSE FAMILY CENTRAL PROCESSOR
31              ;       16K READ/WRITE MEMORY
32              ;       TELETYPE OR CRT DISPLAY
33              ;       ZETACO SMD DISK CONTROLLER
34              ;       0-3 DISK DRIVES
35
36              ;4.0    TEST REQUIREMENTS:      N/A
37
38              ;5.0    SUMMARY:
39
40              ;       THE ZETACO SMD DISK CONTROLLER FORMATTER
41              ;       PROGRAM IS A PROGRAM DESIGNED TO FORMAT AND
42              ;       CHECK DISK PACKS TO BE USED ON DISK SYSTEMS.
43              ;       THE PROGRAM IS !NOT! A MAINTENANCE PROGRAM
44              ;       AND ASSUMES THE HARDWARE TO BE IN WORKING ORDER.
45              ;       THE PROGRAM WILL HALT ON ANY NON-DATA RELATED
46              ;       ERRORS.  ALTHOUGH PRESSING CONTINUE WILL ALLOW
47              ;       THE PROGRAM TO PROCEED, IT IS NOT RECOMMENDED
48              ;       THAT THE PROGRAM BE RUN UNDER THESE CONDITIONS.
49              ;       IT IS ALSO RECOMMENDED THAT ON-BOARD ECC BE
50              ;       SOFTWARE OR CONFIGURED DISABLED WHEN FORMATTING.
51
52
53              ;       THE CONTROL CAN BE ANY DEVICE 20-76 OCTAL
54              ;       THE DEFAULT IS 27  ## SEE 9.
55
56              ;6.0    RESTRICTIONS:   N/A
57
58              ;7.0    PROGRAM DESCRIPTION/THEORY OF OPERATION:
59
60              ;       A.      FORMATTER PROGRAM (STARTING ADDRESS (SA) 500)
```

```
 0002  DISKF
01              ;       THE DISK IS FIRST FORMATTED AFTER WHICH A FORMAT
02              ;       DONE MESSAGE IS PRINTED.  THEN A 55555 PATTERN
03              ;       IS WRITTEN TO THE ENTIRE PACK AND READ BACK 2 TIMES,
04              ;       A RANDOM SEEK TEST IS PERFORMED, AND PASS IS PRINTED.
05              ;       THE DATA PATTERN IS THEN ROTATED
06              ;       1 BIT AND THE WRITE/READ/READ/SEEK PROCESS IS REPEATED.
07              ;       AT THE COMPLETION OF THE NUMBER OF PASSES ENTERED
08              ;       BY THE OPERATOR, A LOG IS PRINTED AND THE DRIVES
09              ;       ARE RELEASED.
10              ;*************************************************************
11              ;       IT IS RECOMMENDED THAT AT LEAST 3 PASSES (W/R/R/S),WITH
12              ;       ON-BOARD ECC SOFTWARE DISABLED, BE ALLOWED TO INSURE PACK
13              ;       QUALITY.  IF TIME PERMITS, LONGER RUNS WILL FURTHER INSURE
14              ;       RELIABILITY.
15              ;*************************************************************
16              ;       ANY HARD DATA OR ADDRESS ERRORS WILL RESULT IN THE
17              ;       BAD SECTOR FLAG BEING SET IN THAT SECTOR.  ANY
18              ;       "SOFT DATA" OR "ADDRESS ERROR" ADDRESS ENCOUNTERED
19              ;       TWICE CAUSE THE BAD SECTOR FLAG TO BE SET.  ANY OTHER
20              ;       ERROR WILL CAUSE THE PROGRAM TO PRINT THE FAILURE TO
21              ;       THE TTY AND THE PROGRAM WILL HALT.  ##THIS PROGRAM IS NOT
22              ;       INTENDED TO BE A RELIABILITY PROGRAM FOR THE DISK SYSTEM
23              ;       AND IN GENERAL ASSUMES THE CONTROL AND DRIVE TO BE IN
24              ;       WORKING ORDER.
25
26              ;       A HARD ADDRESS ERROR IS DEFINED AS SUCH AFTER TWO
27              ;       ATTEMPTS HAVE BEEN MADE BOTH RESULTING IN AN ADDRESS
28              ;       ERROR.  A HARD DATA ERROR IS DEFINED AS SUCH AFTER
29              ;       2 OR MORE OF 10 WRITE/READ RETRY'S HAVE BEEN
30              ;       UNSUCCESSFUL.
31
32              ;       B.      CHECK PROGRAM ONLY (SA 501)
33              ;       SAME AS SA 500 EXCEPT THAT INITIAL PACK FORMAT
34              ;       OPERATION IS BYPASSED.
35
36              ;       C.      STATISTICS
37              ;       TYPE L FOR 1ST 200. DISK ADDRESSES OF BAD SECTORS,
38              ;       DATA AND ADDRESS ERRORS, PLUS A STATISTIC TABLE OF
39              ;       OVERALL ERRORS.
40              ;       **NOTE** ANY CHARACTER TYPED WHILE EXECUTING
41              ;       THIS LOG WILL END IT AT THE NEXT CHANGE OF
42              ;       DATA TYPE.
43
44              ;       D.      LOG RECOVERY (SA 502)
45              ;       USE TO RECOVER LOG IF PROGRAM WAS STOPPED BEFORE
46              ;       LOG PRINTOUT.
47
48              ;       E.      COMMAND STRING INTERPRETER (SA 503)
49              ;       AS A TROUBLE SHOOTING AID THE SERVICE
50              ;       ENGINEER MAY TYPE IN HIS OWN TEST LOOP.
51              ;       AFTER STARTING AT 503, THREE ARGUMENTS
52              ;       MUST BE ENTERED IN RESPONSE TO THREE
53              ;       PROGRAM QUESTIONS; "UNIT", "DATA", AND
54              ;       "COMMAND STRING".  ALL NUMBERS MUST ENTERED
55              ;       IN OCTAL.
56
57              ;       I.      UNIT:   TYPE UNIT # OR CARRIAGE TO
58              ;                       USE THE PREVIOUS ENTRY
59
60              ;       II.     DATA:   RAN=RANDOM
```

```
0003  DISKF
01              ;                       ALO=ALL ONES
02              ;                       ALZ=ALL ZEROS
03              ;                       PAT=110110 PATTERN
04              ;                       FLO=FLOATING ONE PATTERN
05              ;                       FLZ=FLOATING ZERO PATTERN
06              ;                       ADR=ALTERNATING CYLINDER AND
07              ;                       HEAD,SECTOR WORDS
08              ;                       VAR=EXISTING WORDS ENTERED PREVIOUSLY AS
09              ;                       DESCRIBED BELOW
10              ;
11              ;                       ALTERNATIVELY ENTER A STRING OF UP TO 7
12              ;                       OCTAL 16 BIT WORDS TO BE
13              ;                       USED AS DATA.  THE WORDS
14              ;                       ENTERED ARE USED REPEATEDLY
15              ;                       TO MAKE UP A SECTOR BLOCK.
16              ;                       TYPE CARRIAGE TO USE THE
17              ;                       PREVIOUS ENTRY.
18              ;
19              ;       III.    COMMAND STRING:
20              ;
21              ;       OPTIONS 1.      READ HEAD,SECTOR,#SECTORS
22              ;               2.      WRITE SAME
23              ;               3.      SEEK CYLINDER
24              ;               4.      RECALIBRATE
25              ;               5.      LOOP (GO TO BEGINNING OR LR)
26              ;               6.      DELAY N (N=DELAY IN MS)
27              ;               7.      DISABLE (WRITE DISABLE)
28              ;               8.      TRESPASS
29              ;               9.      STOP DISK
30              ;               10.     RELEASE
31              ;               11.     OFF (OFFSET FORWARD)
32              ;               12.     OFR (OFFSET REVERSE)
33              ;               13.     LR  (BEGIN LOOP HERE)
34              ;               14.     VERIFY (WRITE)
35              ;               15.     FORMAT CYL,HD,SECTOR
36              ;               16.     BAD (BAD SECTOR) CYL,HD,SECTOR
37              ;               17.     MEMORY ADDR,DATA(WRITE) (CONTROLLER MEMORY COMMAND)
38              ;               18.     TYPE CARRIAGE RETURN TO USE THE
39              ;                       PREVIOUS COMMAND STRING.
40              ;
41              ;               NOTE THAT EITHER SPACES OR A COMMA
42              ;               MAY BE USED AS AN ARGUMENT DELIMITER.
43              ;               EACH RESPONSE IS TERMINATED BY
44              ;               TYPING CARRIAGE RETURN.  IF MORE
45              ;               ROOM IS NEEDED ON A LINE, TYPE
46              ;               LINE FEED TO SPACE TO THE NEXT LINE.
47              ;               THE WORD "SAME" USED WITH READ, OR WRITE,
48              ;               WILL CAUSE THE PREVIOUS DISK
49              ;               ADDRESS PARAMETERS TO BE USED.
50              ;
51              ;       AN R TYPED WHILE A STRING IS BEING EXECUTED WILL
52              ;       CAUSE THE PROGRAM TO RETURN TO COMMAND STRING START.
53              ;       THE ESCAPE KEY WILL BYPASS UNIT AND DATA PROMPTS TO
54              ;       THE COMMAND STRING PROMPT.
55              ;
56              ;       THE FOLLOWING EXAMPLE WOULD CAUSE UNIT
57              ;       1 TO SEEK CYLINDER 50, THEN REPEATEDLY
58              ;       WRITE SECTORS 2 AND 3 OF HEAD 5,
59              ;       THEN READ IT BACK AND CHECK.  DATA IS SPECIFIED
60              ;       AS ALTERNATE WORDS OF ZEROS THEN ONES.
```

```
 0004  DISKF
01
02              ;       UNIT: 1
03              ;       DATA: 0,177777
04              ;       COMMAND STRING: SEEK 50 LR WRITE 5,2,2 READ SAME LOOP
05
06              ;       THE FOLLOWING EXAMPLE WOULD WRITE ZERO TO
07              ;       CONTROLLER MEMORY LOCATION 1500 (OCTAL)
08
09              ;       UNIT:   1
10              ;       DATA:   N/A
11              ;       COMMAND STRING: MEMORY 101500,0
12              ;       NOTE: UPPER MEMORY BIT = 1 DEFINES A WRITE
13              ;
14              ;
15              ;8.     SWITCH SETTINGS
16              ;       S?WPD   8
17              ;
18              ;8.3    SWITCH OPTIONS
19              ;       DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION
20              ;       "SWREG" IS AS FOLLOWS:
21              ;
22              ;       BIT     OCTAL   BINARY  INTERPRETATION
23              ;               VALUE   VALUE
24              ;
25              ;       1               0       LOOP ON ERROR
26              ;               40000   1       SKIP LOOPING ON ERROR
27              ;
28              ;       2               0       PRINT TO CONSOLE
29              ;               20000   1       ABORT PRINT OUT TO CONSOLE
30              ;
31              ;       5               0       DO NOT PRINT ON THE LINE PRINTER
32              ;               02000   1       PRINT ON THE LINE PRINTER
33              ;
34              ;       11(B)           0       N/A
35              ;               00020   1       ENABLE BAD SECTOR PRINTOUT
36              ;
37
38              ;9.0    OPERATING PROCEEDURE/OPERATOR INPUT:
39
40              ;       A. VERIFY DRIVE (DRIVES) ARE READY ON-LINE
41              ;       B. LOAD PROGRAM USING BINARY LOADER
42              ;       C. TO RUN OTHER THAN TEST 500, ENTER CONTROL "O"
43              ;          AT 9.2, ENTER STARTING ADDRESS FOLLOWED BY AN "R"
44
45              ;       STARTING ADDRESS (SA)
46              ;       200     READ UNIT CHARACTERISTICS AND THEN RUN FORMATTER (500)
47              ;       500     FORMATTER/CHECK PROGRAM
48              ;       501     CHECK PROGRAM ONLY
49              ;       502     ERROR LOG RECOVERY (SEE 7.B,BA)
50              ;       503     COMMAND STRING INTERPRETER
51
52              ;9.1    OPERATOR IS REQUESTED TO ENTER DEVICE CODE OF
53              ;       CONTROLLER (DEFAULT 27)
54              ;9.2    OPERATOR IS REQUESTED TO SET SWPAK FOLLOWED
55              ;       BY A CARRIAGE RETURN (SEE 8.3)
56              ;9.3    MONTH, DAY, YEAR (I.E. 77...), HOUR, & MIN
57              ;       (IF [CR] IS GIVEN THIS ROUTINE IS BYPASSED)
58              ;9.4    ENTER # OF PASSES FOR TEST COMLETION (IF [CR] IS
59              ;       GIVEN THIS ROUTINE IS BYPASSED)
60              ;9.5    OPERATOR IS REQUESTED TO ENTER YES/NO TO CONTROLLER
```

```
0005  DISKF
01              ;       CORRECTION, IF IT IS ENABLED
02              ;9.6    UNIT NUMBERS, TYPES, AND THEIR CHARACTERISTICS
03              ;       ARE THEN DISPLAYED, "PLEASE VERIFY"
04              ;       OPERATOR IS THEN REQUESTED TO ENTER
05              ;       UNIT NUMBERS TO BE TESTED(0-3)
06              ;9.7    OPERATOR IS THEN REQUESTED TO ENTER
07              ;       TYPE OF DISK (USER DEFINED ENTER 10)
08              ;       A.      IF TYPE ENTERED DID NOT MATCH, ENTER 0
09              ;               1 2 OR 3 TO RE-DEFINE A DISK TYPE
10              ;       B.      # OF HEADS FOR NEW TYPE (IN DECIMAL)
11              ;       C.      # OF CYLINDERS FOR NEW TYPE (IN DECIMAL)
12              ;       D.      # OF SECTORS FOR NEW TYPE (IN DECIMAL, CANNOT BE DOWNSIZED)
13              ;       E.      RETURN TO 9.7
14
15              ;       OPERATOR INPUT CONTROLLED PRINTOUTS ARE AS FOLLOWS:
16              ;
17              ;       L       = FIRST 200. BAD SECTORS, DATA, OR ADDRESSES
18              ;               ALSO LISTED IS A COUNT FOR CONTROLLER
19              ;               CORRECTS/UNIT (ON BOARD ECC CORRECTION AND OFFSET CORRECTS)
20
21              ;10.0   PROGRAM OUTPUT/ERROR DESCRIPTION:
22
23              ;       1. ERRORS- ERROR STATUS IS PRINTED
24              ;       WHENEVER ENCOUNTERED.  WHEN DATA ERRORS
25              ;       ARE FOUND ONLY THREE ARE PRINTED PER
26              ;       ENCOUNTER. (SEE PARAGRAPH 10.3)
27
28              ;       2. IF ERRORS ARE ENCOUNTERED MORE THAN ONCE,
29              ;       A COUNT WILL BE RECORDED AND A BAD SECTOR FLAG SET.
30              ;       ALL ADDRESS INFO. WILL BE PRINTED IN OCTAL.
31
32              ;       3. ERROR REPORTING AND RECOVERY
33
34              ;       ALL ERRORS ARE IDENTIFIED, AND THE
35              ;       PROGRAM IS ROUTED VIA BASE TO A CALL TO CKSW.
36              ;       WITH THE EXCEPTION OF ADDRESS AND DATA ERRORS
37              ;       THE PROGRAM WILL THEN LOOP FOR OPERATOR INTERVENTION,
38              ;       ON THE BASIS OF SWPAK (SEE 8.)
39
40              ;       RECALIBRATE - ANY UNUSUAL STATUS IS REPORTED
41              ;       IMMEDIATELY AND AN ERROR RETURN EXECUTED.
42
43              ;       SEEK - POSITIONER FAULT STATUS RESULTS
44              ;       IN STATUS PRINTOUT AND ERROR RETURN.
45
46              ;       WRITE - FOLLOWING "DONE" ON A WRITE, ERRORS ARE
47              ;       CHECKED IN THE SEQUENCE SHOWN BELOW.  ERROR
48              ;       RECOVERY PROCEDURE IS OUTLINED FOR EACH CASE.
49              ;       IF THE ERROR IS NOT PRESENT THE NEXT CHECK IS MADE.
50
51              ;       DRIVE STATUS (DIB) IS CHECKED 1ST FOR BOTH READ AND
52              ;       WRITE BEFORE ANY DIA CHECKS ARE MADE
53
54              ;       4. READ/WRITE TIMEOUTS, DATA LATE, ILLEGAL SECTOR,
55              ;       ECC(DATA OK), OR ANY DRIVE FAULT- PRINT THE ILLEGAL
56              ;       STATUS AND DO AN ERROR RETURN.
57
58              ;       5. ADDRESS ERROR- REPEAT THE WRITE, IF TEST PASSES
59              ;       THE SECOND TIME, DO A NORMAL RETURN; OTHERWISE
60              ;       FLAG AS HARD, SET THE BAD SECTOR FLAG FOR THAT SECTOR
```

```
0006  DISKF
01              ;       AND DO AN ERROR RETURN.
02
03              ;       IF A HARD CYLINDER ADDRESS ERROR OCCURS, A READ
04              ;       ON AN ADJACENT HEAD WILL BE ATTEMPTED TO DETERMINE
05              ;       WHETHER THE FAULT SHOULD BE CLASSED AS A SEEK ERROR
06              ;       OR AN ADDRESS ERROR. THE FIRST 30. HARD ADDRESS
07              ;       ERRORS WILL HAVE THEIR ADDRESSES LOGGED.
08
09              ;       6. ENDING MEMORY ADDRESS -PRINT THE ERROR MESSAGE,
10              ;       CHECK FOR A DISK ADDRESS AND DO AN ERROR RETURN.
11
12              ;       7. ENDING DISK ADDRESS -PRINT THE ERROR MESSAGE AND
13              ;       DO AN ERROR RETURN.
14
15
16              ;       READ - ALL READ ERRORS WITH THE EXCEPTION OF DATA RELATED
17              ;       ERRORS ARE HANDLED THE SAME AS DESCRIBED FOR THE WRITE
18              ;       OPERATIONS
19
20              ;       DATA ERRORS - DATA IS REREAD 9 TIMES.
21              ;       IF DATA IS BAD ON 2 OR MORE OF
22              ;       10 TRIES, A HARD ERROR COUNT IS INCREMENTED,
23              ;       THE BAD SECTOR FLAG IS SET IN THAT SECTOR, AND AN
24              ;       ERROR RETURN IS TAKEN. IF DATA IS GOOD ON ALL RETRIES,
25              ;       THE ERROR IS CONSIDERED SOFT AND A NORMAL RETURN IS
26              ;       TAKEN.
27
28              ;       THE 1ST 200. DATA ERRORS (HARD OR SOFT) ARE LOGGED.
29              ;11.0   DEBUG HELP:
30                      O?DTD   11
31
32
33              ;12.0   SPECIAL NOTES/SPECIAL FEATURES:
34
35              ;       1. THE PROGRAM IS !NOT! A MAINTENANCE PROGRAM
36              ;       AND ASSUMES THE HARDWARE TO BE IN WORKING ORDER.
37              ;       THE PROGRAM WILL HALT ON ANY NON-DATA RELATED
38              ;       ERRORS. ALTHOUGH PRESSING CONTINUE WILL ALLOW
39              ;       THE PROGRAM TO PROCEED, IT IS NOT RECOMMENDED
40              ;       THAT THE PROGRAM BE RUN UNDER THESE CONDITIONS.
41
42              ;       2. IT IS RECOMMENDED THAT AT LEAST 3 PASSES (W/R/R/S)
43              ;       BE ALLOWED (SEE BELOW) TO INSURE PACK QUALITY.
44              ;       IF TIME PERMITS, LONGER RUNS WILL FURTHER
45              ;       INSURE QUALITY.
46
47              ;13.1   PROGRAM RUNTIME:
48
49              ;       PROGRAM RUNTIMES ARE SUBSTANTIALLY REDUCED WITH
50              ;       MEMORIES OF 24K OR LARGER. RUNTIMES ARE ALSO
51              ;       DEPENDANT ON CPU TYPE, DRIVE SIZE AND DRIVE TYPE.
52
53              ;       3 PASSES AFTER FORMAT ARE RECOMMENDED FOR
54              ;       SURFACE VERIFICATION.
55
56              ;       READ, WRITE AND SEEK OPERATIONS ARE TIMED
57              ;       BY SPECIAL ROUTINES. WHEN THE PROGRAM IS
58              ;       FIRST STARTED, THE TIMING ROUTINE WILL TEST
59              ;       FOR THE PRESENCE OF A REAL TIME CLOCK (RTC)
60              ;       TO DERIVE TIMING FROM IT.
```

```
 0001  DISKR    AOS ASSEMBLER REV 04.20        18:25:36 06/22/84
01              ;
02              ;
03              ;
04              ;*************************************************************
05              ;
06              ;
07              ; DESCRIPTION: ZETACO SMD DISK CONTROLLER RELIABILITY PROGRAM
08              ;
09              ;
10              ; PRODUCT OF ZETACO, 1984
11              ;*************************************************************
                        .TITL   DISKR
13      000001          .DUSR   X=1
14      000001          .NOMAC  X
15              ;1.0    PROGRAM NAME:   DISKR.SR
16
17              ;2.0    REVISION HISTORY:
18              ;
19              ;       REV.      DATE
20              ;        00     02/09/83              ;
21              ;        01     09/07/83              ;5120 # SKP TOGETHER, STACK AND
22              ;                                     ;AOS BOOTSTRAP AT 400, NO VERIFY
23              ;                                     ;WITH RANDOM DATA TEST 502 SWT 10
24              ;        02     03/28/84              ;ADD RELEASE COMMAND TO RC
25              ;                                     ;FOR DUAL PORT, DAISY CHAIN
26              ;                                     ;DISK SECTOR PULSE COUNTER
27              ;                                     ;DEVICE CODE CHANGE ROUTINE
28              ;                                     ;502 PAT 24 SECTOR
29              ;        03     05/30/84              ;ZDF1,
30
31              ;3.0    MACHINE REQUIREMENTS:
32
33              ;       NOVA/ECLIPSE FAMILY CENTRAL PROCESSOR
34              ;       16K READ/WRITE MEMORY
35              ;       TELETYPE OR CRT DISPLAY
36              ;       ZETACO SMD DISK CONTROLLER
37              ;       0-3 DISK DRIVES
38
39              ;4.0    TEST REQUIREMENTS:      N/A
40
41              ;5.0    SUMMARY:
42
43              ;       THE ZETACO DISK CONTROLLER RELIABILITY
44              ;       PROGRAM IS A MAINTENANCE PROGRAM DESIGNED TO
45              ;       EXERCISE AND TEST THE ZETACO SMD DISK SUB-SYSTEMS
46              ;       AND 1-4 DISK DRIVES.  THE DISK DRIVES MAY BE
47              ;       SHARED BETWEEN TWO COMPUTERS IN WHICH CASE
48              ;       THE FOLLOWING PROGRAMS MAY BE RUNNING IN EACH
49              ;       COMPUTER:
50
51              ;       STARTING ADRESSES'S (SA) 500,501 RANDOM RELIABILITY
52              ;       SA 503 COMMAND STRING (IF A RELEASE COMMAND IS
53              ;       INCLUDED IN THE COMMAND STRING)
54
55              ;       THE CONTROL CAN BE ANY DEVICE CODE 20-76 OCTAL.
56              ;       THE DEFAULT IS 27 -SEE 9.1 FOR OTHER SETTINGS
57
58              ;6.0    RESTRICTIONS:
59
60              ;       1.  THE DISK DRIVES MAY BE
```

```
0002  DISKR
01              ;       SHARED BETWEEN TWO COMPUTERS IN WHICH CASE
02              ;       THE FOLLOWING PROGRAMS MAY BE RUNNING IN EACH
03              ;       COMPUTER:
04
05              ;       STARTING ADRESSES'S (SA) 500,501 RANDOM RELIABILITY
06              ;       SA 503 COMMAND STRING (IF A RELEASE COMMAND IS
07              ;       INCLUDED IN THE COMMAND STRING)
08
09              ;       IF NO DRIVES ARE TO BE SHARED, THERE ARE NO OTHER
10              ;       RESTRICTIONS AS TO THE RUNNING OF THESE PROGRAMS ON
11              ;       A DUAL PROCESSOR SYSTEM.
12
13              ;       2. ANY COMBINATION OF DRIVES
14              ;       MAY BE TESTED BY THIS PROGRAM AT A SINGLE TIME.
15
16              ;7.0    PROGRAM DESCRIPTION/THEORY OF OPERATION:
17
18              ;       A. RELIABILITY TEST (SA 500)
19
20              ;       A RANDOM NUMBER GENERATOR IS USED TO SELECT A
21              ;       DISK DRIVE,CYLINDER,HEAD,BEGINNING SECTOR,
22              ;       AND NUMBER OF CONSECUTIVE SECTORS.  RANDOM
23              ;       DATA IS THEN GENERATED, WRITTEN, AND READ.
24              ;       THE SEQUENCE IS REPEATED INDEFINITELY.
25              ;       IF RUNNING MULTIPLE UNITS, OVER LAPPED SEEKS ARE
26              ;       EMPLOYED IF THE NEXT RANDOM UNIT IS DIFFERENT FROM
27              ;       THE CURRENT UNIT UNDER I/O EXECUTION.
28
29              ;       B. RELIABILITY TEST (SA 501) WITH OPTIONS
30
31              ;       SAME AS A, EXCEPT THAT OPERATOR IS GIVEN
32              ;       OPTIONS ON DATA PATTERNS (SEE 7D II)
33              ;       AND MAY CHOOSE A CONSTANT CYLINDER,HEAD,SECTOR
34              ;       OR # OF SECTORS. ANY LETTER RESPONSE TO CYL,HEAD ETC.
35              ;       GETS RANDOM FUNCTION FOR THAT VARIABLE. A CARRIAGE
36              ;       RETURN ONLY GETS THE RANDOM FUNCTION FOR ALL VARIABLES.
37
38              ;       THE OPERATOR IS ALSO ASKED TO RESPOND TO
39              ;       JITTER OPTION(YES/NO). IF YES, A RANDOM DELAY(0-40,50MS)
40              ;       IS INSERTED INTO THE BACKGROUND LOOP TO CREATE
41              ;       A MORE ASYNCHRONOUS DISK I/O LOOP.
42
43              ;       C. INCREMENTAL DISK ADDRESS TEST (SA 502)
44
45              ;       OPERATOR IS GIVEN OPTION ON DATA (SEE 7D II)
46              ;       REQUESTED DATA IS FIRST WRITTEN (SEE SWPAK10) OVER
47              ;       THE ENTIRE PACK. THEN THE DATA IS READ FROM
48              ;       ALL SECTORS . THIS INSURES THAT ALL DISK
49              ;       PACK BLOCKS ARE USEABLE AND ARE FORMATTED
50              ;       PROPERLY.  THE TEST IS THEN REPEATED FOR ALL
51              ;       READY DISCS, AND PASS IS PRINTED.  THE
52              ;       SEQUENCE IS REPEATED INDEFINITELY.
53
54
55              ;       #NOTE
56              ;       SWPAK7=1, PROGRAM WAITS AFTER WRITE WITH READ
57              ;       VERIFICATION ALLOWING OPERATOR TO CHANGE PACKS.
58              ;       SWPAK8=1, PUTS PROGRAM INTO READ ONLY MODE
59              ;       ## SA'S 501,502 ONLY.  IF SA 501-DATA MUST !NOT! BE
60              ;       RANDOM (SEE 7D II).
```

```
0003  DISKR
01
02              ;       ALL NUMBERS ENTERED ABOVE MUST BE IN OCTAL.
03              ;       ANY NON-OCTAL INPUT IS TREATED AS A LETTER.
04              ;       ANY LETTER INPUT FOR CYL,HEAD,SECTOR, OR # OF
05              ;       SECTORS GETS RANDOM FUNCTION IN THE RELIABILITY
06              ;       TEST WITH OPTIONS.
07
08
09              ;       D. COMMAND STRING INTERPRETER (SA 503)
10              ;       AS A TROUBLE SHOOTING AID THE SERVICE
11              ;       ENGINEER MAY TYPE IN HIS OWN TEST LOOP.
12              ;       AFTER STARTING AT 503, THREE ARGUMENTS
13              ;       MUST BE ENTERED IN RESPONSE TO THREE
14              ;       PROGRAM QUESTIONS; "UNIT", "DATA", AND
15              ;       "COMMAND STRING". ALL NUMBERS MUST ENTERED
16              ;       IN OCTAL.
17
18              ;       I.      UNIT:   TYPE UNIT # OR CARRIAGE TO
19              ;                       USE THE PREVIOUS ENTRY
20
21              ;       II.     DATA:   RAN=RANDOM
22
23              ;                       ALO=ALL ONES
24              ;                       ALZ=ALL ZEROS
25              ;                       PAT=155555 PATTERN
26              ;                       ROT=155555 PATTERN ROTATED ON
27              ;                       SUCCESSIVE PASSES.
28              ;                       ALT=52525 PATTERN
29              ;                       FLO=FLOATING ONE PATTERN
30              ;                       FLZ=FLOATING ZERO PATTERN
31              ;                       ADR=ALTERNATING CYLINDER AND
32              ;                       HEAD,SECTOR WORDS
33              ;                       VAR=EXISTING WORDS ENTERED PREVIOUSLY AS
34              ;                       DESCRIBED BELOW
35
36              ;                       ALTERNATIVELY ENTER A STRING OF UP TO 7
37              ;                       OCTAL 16 BIT WORDS TO BE
38              ;                       USED AS DATA.  THE WORDS
39              ;                       ENTERED ARE USED REPEATEDLY
40              ;                       TO MAKE UP A SECTOR BLOCK.
41              ;                       TYPE CARRIAGE TO USE THE
42              ;                       PREVIOUS ENTRY.
43
44              ;       III.    COMMAND STRING:
45
46              ;       OPTIONS 1.      READ HEAD,SECTOR,#SECTORS
47              ;               2.      WRITE SAME
48              ;               3.      SEEK CYLINDER
49              ;               4.      RECALIBRATE
50              ;               5.      LOOP (GO TO BEGINNING OR LR)
51              ;               6.      DELAY N (N= DELAY IN MS)
52              ;               7.      DISABLE (WRITE DISABLE)
53              ;               8.      TRESPASS
54              ;               9.      STOP DISK
55              ;               10.     RELEASE
56              ;               11.     OFF (OFFSET FORWARD)
57              ;               12.     OFR (OFFSET REVERSE)
58              ;               13.     LR  (BEGIN LOOP HERE)
59              ;               14.     VERIFY (WRITE)
60              ;               15.     MEMORY ADDR,DATA (WRITE) (CONTROLLER MEMORY COMMAND)
```

```
01              ;               16.     TYPE CARRIAGE RETURN TO USE THE
02              ;                       PREVIOUS COMMAND STRING.
03              ;               NOTE THAT EITHER SPACES OR A COMMA
04              ;               MAY BE USED AS AN ARGUMENT DELIMITER.
05              ;               EACH RESPONSE IS TERMINATED BY
06              ;               TYPING CARRIAGE RETURN.  IF MORE
07              ;               ROOM IS NEEDED ON A LINE, TYPE
08              ;               LINE FEED TO SPACE TO THE NEXT LINE.
09              ;               THE WORD "SAME" USED WITH READ, OR WRITE,
10              ;               WILL CAUSE THE PREVIOUS DISK
11              ;               ADDRESS PARAMETERS TO BE USED.
12
13              ;               AN R TYPED WHILE A STRING IS BEING EXECUTED
14              ;               WILL CAUSE THE PROGRAM TO  RETURN TO THE
15              ;               COMMAND STRING START.  THE ESCAPE KEY WILL
16              ;               BYPASS THE UNIT AND DATA PROMPTS TO THE
17              ;               COMMAND STRING PROMPT.
18
19              ;       THE FOLLOWING EXAMPLE WOULD CAUSE UNIT
20              ;       1 TO SEEK CYLINDER 50, THEN REPEATEDLY
21              ;       WRITE SECTORS 2 AND 3 OF HEAD 5,
22              ;       THEN READ IT BACK AND CHECK.  DATA IS SPECIFIED
23              ;       AS ALTERNATE WORDS OF ZEROS THEN ONES.
24
25              ;       UNIT: 1
26              ;       DATA: 0,177777
27              ;       COMMAND STRING: SEEK 50 LR WRITE 5,2,2 READ SAME LOOP
28
29              ;       THE FOLLOWING EXAMPLE WOULD WRITE ZERO TO
30              ;       CONTROLLER MEMORY LOCATION 1500 (OCTAL)
31
32              ;       UNIT:   1
33              ;       DATA:   N/A
34              ;       COMMAND STRING: MEMORY 101500,0
35              ;       NOTE: UPPER MEMORY BIT = 1 DEFINES A WRITE
36              ;
37              ;       E. QUICKIE FORMATTER (SA 504)
38              ;       FORMATS PACK AND HALTS.  THERE IS NO VERIFY,
39              ;       NO FLAGS ARE SET, AND NO ERROR CHECKING.
40
41              ;       F. RUNALL (SA 505)
42              ;       PROGRAM ALTERNATES BETWEEN THE PROGRAMS DESCRIBED
43              ;       IN 7.B(4 DATA PATTERNS -PAT,RAN,FLZ,FLO) AND
44              ;       7.C(6 DATA PATTERNS -PAT,RAN,ADR,ALT1,ZEROES,ONES)
45              ;       AND 7.H, AND IN THAT ORDER.
46
47              ;       G. SEEK EXERCISER (SA 506)
48              ;       PROGRAM PROVIDES A SEEK SCAN SEQUENCE
49              ;       CONVERGING FROM THE EXTREME OUTERMOST TRACKS INTO THE
50              ;       ADJACENT TRACK IN THE CENTER, THEN DIVERGING AGAIN TO
51              ;       THE EXTREMES.
52
53              ;       H. RANDOM SEEK EXERCISER (SA 507)
54              ;       PROGRAM PROVIDES A RANDOM SEEK SEQUENCE
55
56              ;       ###G,H ALL SEEKS IN G/H ARE FOLLOWED BY A 1 SECTOR READ
57              ;       BUT WITH NO DATA CHECK.  ALL SEEKS ARE TIMED
58              ;       WITH MAX,MIN, AND AVE.  TIMES BEING LOGGED IN MS.
59              ;       SEEK PATHS FOR MAX,MIN VALUES ARE ALSO LOGGED.
60              ;       ###CAUTION -ECC ERRORS WILL RESULT IN SA'S 506,507 IF
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```
0005  DISKR
01              ;       PACK IS NOT 1ST WRITTEN AFTER FORMATTING.
02
03              ;       I.  ERROR COUNT/LOG RECOVERY (SA 510)
04              ;       IN THE EVENT A PROGRAM WAS STOPPED DURING A RUN, THE
05              ;       ERROR LOGS MAY BE RECOVERED AT THIS STARTING ADDRESS.
06              ;       ***MUST BE DONE BEFORE ANY PROGRAM RESTART AS PROGRAM
07              ;       INITIALIZATION ZEROES ALL LOGS.
08              ;
09
10              ;8.     SWITCH SETTINGS
11              ;       S?WPD   8
12              ;8.3    SWITCH OPTIONS
13              ;       DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION
14              ;       "SWREG" IS AS FOLLOWS:
15              ;
16              ;       BIT     OCTAL   BINARY  INTERPRETATION
17              ;               VALUE   VALUE
18              ;
19              ;       1               0       LOOP ON ERROR
20              ;               40000   1       SKIP LOOPING ON ERROR
21              ;
22              ;       2               0       PRINT TO CONSOLE
23              ;               20000   1       ABORT PRINT OUT TO CONSOLE
24              ;
25              ;       4               0       PRINT PASS
26              ;               04000   1       DO NOT PRINT PASS
27              ;
28              ;       5               0       DO NOT PRINT ON THE LINE PRINTER
29              ;               02000   1       PRINT ON THE LINE PRINTER
30              ;
31              ;       6               0       DO NOT EXIT TO ODT ON ERROR
32              ;               01000   1       EXIT TO ODT ON ERROR
33              ;
34              ;       7               0       **** N/A
35              ;               00400   1       BREAK FOR PACK INTERCHANGE
36
37              ;       8               0       **** N/A
38              ;               00200   1       FOR READ ONLY MODE (SA 501,502)
39              ;
40              ;       9               0       N/A
41              ;               00100   1       BYPASS DATA CHECK
42              ;
43              ;       10(A)           0       N/A
44              ;               00040   1       DO VERIFY AFTER WRITE (SA 502 ONLY AND
45              ;                               NOT RANDOM DATA)
46              ;
47              ;       11(B)           0       N/A
48              ;               00020   1       ENABLE BAD SECTOR PRINTOUTS
49
50              ;       12(C)           0       N/A
51              ;               00010   1       HALT ON DRIVE ERROR PRIOR TO
52              ;                               RECOVERY RECALIBRATE OPERATION
53              ;
54              ;       13(D)           0       NO TRACE
55              ;               00004   1       TRACE PRINTOUT ON ERROR
56
57              ;9.0    OPERATING PROCEEDURE/OPERATOR INPUT:
58
59              ;       A. VERIFY DRIVE (DRIVES) ARE READY ON-LINE
60              ;       B. LOAD PROGRAM USING BINARY LOADER
```

```
0006  DISKR
01              ;       C. TO RUN OTHER THAN TEST 505, ENTER CONTROL "O"
02              ;          AT 9.2, ENTER STARTING ADDRESS FOLLOWED BY AN "R"
03
04              ;       STARTING ADDRESS
05              ;       200     READ UNIT CHARACTERISTICS AND THEN RUN ALL TEST (505)
06              ;       500     RELIABILITY TEST, ALL CYLINDERS
07              ;       501     RELIABILITY TEST, (OPTIONS)
08              ;       502     INCREMENTAL DISK ADDRESS TEST
09              ;       503     COMMAND STRING INTERPRETER
10              ;       504     QUICKIE FORMATTER
11              ;       505     RUN ALL
12              ;       506     SEEK EXERCISER (CONVERGING,DIVERGING PATTERN)
13              ;       507     SEEK EXERCISER (RANDOM PATTERN)
14              ;       510     ERROR COUNT/LOG RECOVERY
15
16              ;9.1    OPERATOR IS REQUESTED TO ENTER DEVICE CODE OF
17              ;       CONTROLLER (DEFAULT IS 27)
18              ;9.2    STARTING ADDRESS IS DISPLAYED AND
19              ;       OPERATOR IS REQUESTED TO SET SWPAK FOLLOWED
20              ;       BY A CARRIAGE RETURN (SEE 8.3)
21              ;9.3    OPERATOR IS REQUESTED TO ENTER YES/NO TO
22              ;       EXERCISE MAPS, IF PRESENT
23              ;9.4    DATE -DAY, MONTH, YEAR (I.E. 77...), HOUR, & MINUTE (A [CR]
24              ;       RESPONSE WILL IGNORE THIS ROUTINE)
25              ;9.5    OPERATOR IS REQUESTED TO ENTER YES/NO IF ANY
26              ;       DUAL VOLUME DRIVES (CMD'S)
27              ;9.6    OPERATOR IS REQUESTED TO ENTER YES/NO TO CONTROLLER
28              ;       CORRECTION, IF IT IS ENABLED
29              ;9.7    UNIT NUMBERS, TYPES, AND THEIR CHARACTERISTICS
30              ;       ARE THEN DISPLAYED, "PLEASE VERIFY"
31              ;       OPERATOR IS THEN REQUESTED TO ENTER
32              ;       UNIT NUMBERS TO BE TESTED (0-3)
33              ;9.8    OPERATOR IS THEN REQUESTED TO ENTER
34              ;       TYPE OF DISK (USER DEFINED ENTER 10)
35              ;       A.      IF TYPE ENTERED IS 10, ENTER 0
36              ;               1 2 OR 3 TO RE-DEFINE A DISK TYPE
37              ;       B.      # OF HEADS FOR NEW TYPE (IN DECIMAL)
38              ;       C.      # OF CYLINDERS FOR NEW TYPE (IN DECIMAL)
39              ;       D.      # OF SECTORS FOR NEW TYPE (IN DECIMAL, CANNOT BE DOWNSIZED)
40              ;       E.      RETURN TO 9.7
41
42              ;       ## A [CR] ONLY RESPONSE TO UNIT NUMBERS, WILL LEAVE
43              ;       UNIT INFORMATION IN PREVIOUS STATE.
44
45              ;       ## A [CR] ONLY RESPONSE TO YES/NO WILL
46              ;       DEFAULT TO NO
47
48              ;       OPERATOR INPUT CONTROLLED PRINTOUTS ARE AS FOLLOWS:
49
50              ;       L       = FIRST 100. BAD SECTORS, DATA, OR ADDRESSES
51              ;       S       = SEEK TIMING STATISTICS (506,507 ONLY)
52              ;       W       = SECTORS W/R, ERROR COUNTS, AND ON BOARD ECC AND OFFSET CORRECTS
53              ;       **NOTE** ANY CHARACTER TYPED WILL END PRINTOUTS AT THE
54              ;       NEXT CHANGE OF DATA TYPE.
55
56              ;       D. OPERATING MODES
57
58              ;       1 OF 4 DIFFERENT MEMORY/INTERRUPT MODES MAY BE IN USE
59              ;       IN THIS PROGRAM AND ARE DESCRIBED AS FOLLOWS:
60
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 0007  DISKR
01              ;       1-BACKGROUND ONLY, WAIT ON INTERRUPT.
02              ;       MAX # OF SECTORS = ALL OF AVAILABLE CORE (IE NOT TAKEN
03              ;       BY PROGRAM) OR 32 SECTORS MAX. USED FOR SA'S 503,506,507
04
05              ;       2-BACKGROUND/FOREGROUND MODES, 2 BUFFERS USED FOR
06              ;       BOTH READ AND WRITE PURPOSES. MAX # OF SECTORS
07              ;       = 1/2 OF AVAILABLE CORE OR 32 SECTORS MAX. USED
08              ;       FOR CONSTANT DATA PATTERNS.
09
10              ;       3.-BACKGROUND/FOREGROUND MODES, 4 BUFFERS ( 2 FOR READ
11              ;       AND 2 FOR WRITE). MAX # OF SECTORS =1/3 OF AVAILABLE
12              ;       CORE OR 32. MAX. USED FOR VARIABLE DATA(EXPECT ADR).
13
14              ;       4. -IF THE ECLIPSE OR NOVA-3 MAPS ARE IN THE SYSTEM,
15              ;       AND MAPPING IS REQUESTED, ONE OF TWO MAPPING SCHEMES
16              ;       WILL BE IN EFFECT.
17
18              ;       4.1 THE 1ST N PHYSICAL 1K BLOCKS CONTAINING THE PROGRAM
19              ;       WILL BE MAPPED TO THE 1ST N 1K LOGICAL BLOCKS IN BOTH
20              ;       THE A AND B USER MAPS. THIS MAPPING WILL REMAIN
21              ;       CONSTANT.  A 25. K PHYSICAL BLOCK WITH THE
22              ;       START 1K DESIGNATED BY THE PROGRAM VARIABLE MPB?N
23              ;       WILL BE ALLOCATED TO THE DISK I/O BUFFER AS FOLLOWS:
24
25              ;       THE 25K I/O BUFFER IS DIVIDED INTO 3 NON-CONTIGUOUS
26              ;       BUFFERS, 9K OF COMMON(TO BOTH THE A AND B I/O BLOCKS)
27              ;       WRITE BUFFER(WAB), 8K OF READ BUFFER ALLOCATED TO THE
28              ;       A-I/O BLOCK(RA) VIA THE A USER MAP, AND 8K
29              ;       OF READ BUFFER ALLOCATED TO THE B-I/O BLOCK(RB) VIA
30              ;       THE B USER MAP. THE 1K BLOCKS OF THE 3 BUFFERS ARE
31              ;       INTERLEAVED IN THE PHYSICAL SPACE IN THE FOLLOWING
32              ;       MANNER:
33
34              ;       WAB1,RA1,RB1,WAB2,RA2,RB2,WAB3 ETC.
35
36              ;       4.2 THE 25K PHYSICAL I/O BUFFER IS MAPPED TO THE
37              ;       1ST 25K LOGICAL IN THE DCH MAP. DISPLACEMENT VALUES
38              ;       H.DBW,2 AND H.DBR,2 ARE ADDED TO THE USER LOGICAL
39              ;       ADDRESSES WHEN LOADING THE DCH MEMORY ADDRESS REGISTER.
40
41
42              ;10.0   PROGRAM OUTPUT/ERROR DESCRIPTION:
43
44
45              ;       ALL ERRORS ARE IDENTIFIED, COUNTED, AND THE
46              ;       PROGRAM IS ROUTED VIA BASE TO A CALL TO CKSW.
47              ;       ON THE BASIS OF SWITCH SETTINGS (SEE 8.2) THE
48              ;       PROGRAM WILL GO INTO A SCOPE LOOP, OR PROCEED,
49              ;       DEPENDING ON THE SWPAK SETTINGS.
50
51              ;       UPON LOSS OF READY AND A SINGLE DRIVE, THE PROGRAM
52              ;       WILL PRINT THE APPROPRIATE ERROR MESSAGE AND WILL NOT
53              ;       PROCEED UNTIL READY IS RETURNED. IF MULTIPLE
54              ;       DRIVES EXIST, THE PROGRAM WILL CONTINUE WITH THE
55              ;       REMAINING DRIVES. IF THE DOWN DRIVE IS PLACED BACK
56              ;       ONLINE, THE PROGRAM WILL RESUME TESTING OF
57              ;       THAT DRIVE. THE ABOVE ALSO APPLIES TO THE LOSS
58              ;       OF WRITE ENABLE IF THE PROGRAM IS IN A WRITE MODE.
59
60              ;       RECALIBRATE - ANY UNUSUAL STATUS IS REPORTED
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0000  DISKR
01              ;       IMMEDIATELY AND AN ERROR RETURN EXECUTED.
02
03              ;10.1   SEEK - POSITIONER FAULT STATUS INCREMENTS SEEK
04              ;       ERROR COUNTER.  ANY ERROR STATUS  RESULTS
05              ;       IN STATUS PRINTOUT AND ERROR RETURN.
06              ;       A RECALIBRATE WILL BE PERFORMED BY THE ERROR HANDLER.
07              ;       PROGRAM WILL LOG THE FIRST 20. CYLINDERS
08              ;       TO/FROM ON FINDING SEEK ERRORS
09
10              ;10.2   WRITE - FOLLOWING "DONE" ON A WRITE, ERRORS ARE
11              ;       CHECKED IN THE SEQUENCE SHOWN BELOW.  ERROR
12              ;       RECOVERY PROCEEDURE IS OUTLINED FOR EACH CASE.
13              ;       IF THE ERROR IS NOT PRESENT THE NEXT CHECK IS MADE.
14
15              ;       DRIVE STATUS (DIB) IS CHECKED 1ST FOR BOTH READ AND
16              ;       WRITE BEFORE ANY DIA CHECKS ARE MADE
17
18              ;       1. READ/WRITE TIMEOUTS, DATA LATE, ILLEGAL SECTOR,
19              ;       PARITY,DATA VERIFY, OR ANY DRIVE FAULTS- INCREMENT THE
20              ;       APPROPRIATE ERROR COUNT, PRINT THE ILLEGAL STATUS
21              ;       AND DO AN ERROR RETURN.  ANY DRIVE FAULT WILL CAUSE
22              ;       A RECALIBRATE TO BE PERFORMED BY THE ERROR HANDLER.
23
24              ;       2. ADDRESS ERROR- REPEAT THE WRITE, IF TEST PASSES
25              ;       THE SECOND TIME, INCREMENT THE SOFT ADDRESS ERROR
26              ;       COUNT AND DO A NORMAL RETURN; OTHERWISE INCREMENT
27              ;       THE HARD ADDRESS ERROR COUNT AND DO AN ERROR RETURN
28
29              ;       IF A HARD CYLINDER ADDRESS ERROR OCCURS, A READ
30              ;       ON AN ADJACENT HEAD WILL BE ATTEMPTED TO DETERMINE
31              ;       WHETHER THE FAULT SHOULD BE CLASSED AS A SEEK ERROR
32              ;       OR AN ADDRESS ERROR. THE FIRST 20.  ADDRESS
33              ;       ERRORS WILL HAVE THEIR ADDRESSES LOGGED.
34
35              ;       3. BAD SECTOR- LOG THE DISK ADDRESS (1ST 100.) AND DO
36              ;       A NORMAL RETURN.  NO PRINTOUT WILL RESULT UNLESS SW11=1,
37              ;       ALTHOUGH THE I/O OPERATION WAS PREMATURELY TERMINATED.
38              ;       A "SOFT" ERROR WILL BE RECORDED IF THE SECTOR UNDER
39              ;       TEST PASSES AT LEAST 1 OF 4 RETRYS.  THE LOG DENOTES
40              ;       SOFT ERRORS BY A COUNT GREATER THAN 0, REPRESENTING
41              ;       THE ERROR COUNT TALLIED.
42              ;       ***SEE 10.3A.
43
44              ;       4. ENDING MEMORY ADDRESS - INCREMENT THE MEMORY ADDRESS
45              ;       ERROR COUNT, PRINT THE ERROR MESSAGE, CHECK FOR A
46              ;       DISK ADDRESS ERROR AND DO AN ERROR RETURN
47
48              ;       5. ENDING DISK ADDRESS - INCREMENT THE DISK ADDRESS
49              ;       ERROR COUNT, PRINT THE ERROR MESSAGE, AND
50              ;       DO AN ERROR RETURN
51
52
53              ;10.3   READ - ALL READ ERRORS WITH THE EXCEPTION OF DATA RELATED
54              ;       ERRORS ARE HANDLED THE SAME AS DESCRIBED FOR THE WRITE
55              ;       OPERATIONS
56
57              ;       DATA ERRORS - DATA IS REREAD 3 X (4X IF ECC UNDETECTED)
58              ;       IF PROGRAM IS IN WRITE/READ MODE AND DATA IS BAD ALL
59              ;       4 TRIES, A HARD ERROR COUNT IS INCREMENTED AND AN
60              ;       ERROR RETURN IS TAKEN.  IF DATA IS GOOD ON ANY OF FOUR
```

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 0009  DISKR
01              ;       TRIES, A SOFT ERROR COUNT IS INCREMENTED AND A
02              ;       NORMAL RETURN IS TAKEN
03
04              ;       IF THE PROGRAM IS IN A READ ONLY MODE (IE. READ MODE
05              ;       FOR ANY 502 PROGRAM OR WHEN 505 IS RUNNING A 502
06              ;       PROGRAM), THE DATA WILL BE REREAD AN ADDITIONAL
07              ;       4 TIMES IN BOTH OFFSET FORWARD AND OFFSET REVERSE
08              ;       MODES BEFORE THE PROBLEM IS CLASSED AS A HARD ERROR
09
10              ;       THUS TOTAL RETRIES FOR A HARD ECC DETECTED ERROR IN
11              ;       A READ ONLY MODE IS 12 (13 FOR ECC UNDETECTED), AND
12              ;       4 IF IN A WRITE/READ MODE (5 IF ECC UNDETECTED).
13              ;       ***SEE 10.3A
14
15              ;       ANY SUCCESSFUL REREADS WHILE IN AN OFFSET MODE
16              ;       WILL BE PRINTED AND LOGGED.  THE DISK ADDRESSES
17              ;       OF ALL DATA PROBLEMS WILL BE PRINTED AND THE FIRST
18              ;       100. WILL BE LOGGED.  THE FIRST THREE GOOD/BAD
19              ;       WORD PAIRS AND RESPECTIVE ADDRESSES WILL BE PRINTED.
20
21              ;       IF SWPAK9=1 (BYPASS DATA CHECK) HARD OR SOFT DATA
22              ;       ERRORS WILL BE DETERMINED BY ECC STATUS.
23
24              ;10.3A  ECC (ERROR CORRECTION CODE) ANALYSIS
25
26              ;       ALL READ PASSES INCLUDING RETRIES WILL HAVE THE ECC
27              ;       RESULTS LOGGED AS PER THE FOLLOWING 4 CATEGORIES:
28
29              ;       1.  ECC CORRECTED -THE ECC DETECTED AND SUCCESSFULLY
30              ;       CORRECTED THE DATA ERROR.
31
32              ;       2.  NON-CORRECTABLE ECC -THE ECC DETECTED AND CORRECTLY
33              ;       DIAGNOSED THE ERROR PATTERN AS UNCORRECTABLE.
34
35              ;       3.  ECC UNDETECTED -THE ECC FAILED TO DETECT A DATA ERROR.
36              ;       THIS MAY BE A MALFUNCTION OF THE ECC LOGIC, BUT IT IS
37              ;       MORE LIKELY ONE OF THE FOLLOWING PROBLEMS:
38
39              ;       A FAILURE OF THE DRIVE TO WRITE A SECTOR.
40              ;       ***NOTE- A CHECK SHOULD BE MADE IN THE BAD SECTOR
41              ;       LOG TO SEE WHETHER A WRITE OPERATION MAY HAVE
42              ;       ENCOUNTERED A SOFT OR FAULTY BAD SECTOR INDICATION,
43              ;       WHICH WOULD HAVE TERMINATED THE WRITE.
44
45              ;       A FAILURE IN THE CONTROLLER DATA PATHS.
46              ;       4.  ECC FAILED -TWO CONDITIONS MAY FALL INTO THIS CATEGORY.
47
48              ;       4A.  AN ECC ERROR WAS DETECTED BUT WITH NO ACCOMPANYING
49              ;       DATA ERROR.  A CHECK IS MADE TO SEE WHETHER THE ECC
50              ;       WORDS POINT TO AN ERROR WITHIN THE TWO APPENDED
51              ;       WRITE ECC WORDS.  IF SUCH AN ERROR IS
52              ;       DETERMINED TO BE THE CASE, THE ERROR WILL BE LOGGED AS
53              ;       CORRECTABLE AND NO ECC FAILED MESSAGE WILL RESULT.
54              ;       THIS TYPE OF ERROR SHOULD REPRESENT ONLY A VERY SMALL
55              ;       PERCENTAGE OF THE DATA ERRORS (<1%- LARGE SAMPLE).  IF
56              ;       A SIGNIFICANTLY HIGHER PERCENTAGE OF THIS ERROR RESULTS,
57              ;       THEN AN ECC PROBLEM WOULD BE INDICATED.
58
59              ;       IF THE ECC DOES NOT POINT TO THE TWO APPENDED WRITE ECC
60              ;       WORDS, THEN AN ECC FAILED MESSAGE (1ST PASS ONLY) WILL
```

```
01              ;       RESULT AND THE ACTUAL ECC WORDS READ FROM THE CONTROLLER
02              ;       WILL BE PRINTED.
03              ;
04              ;       4B. AN ECC ERROR WAS DETECTED, BUT THE ECC EITHER FAILED
05              ;       TO CORRECT A CORRECTABLE ERROR, OR TRIED TO CORRECT AN
06              ;       UNCORRECTABLE ERROR.  THESE CONDITIONS (POSSIBLY CAUSED
07              ;       BY PROBLEMS OTHER THAN ECC) WILL RESULT IN A PRINTOUT
08              ;       (1ST PASS ONLY) OF THE SIMULATED WRITE AND SIMULATED
09              ;       READ ECC WORDS PLUS THE ACTUAL READ ECC WORDS AS READ
10              ;       FROM THE CONTROLLER.
11              ;
12              ;       THE SIMULATED WRITE ECC WORDS ARE THE RESULT OF A
13              ;       PROGRAM SIMULATION OF THE ECC LOGIC ON WHAT THE PROGRAM
14              ;       BELIEVES TO BE THE WRITE DATA (A WRITE ERROR WILL CAUSE
15              ;       THIS ASSUMPTION TO BE FALSE), AND REPRESENTS WHAT THE
16              ;       PROGRAM BELIEVES SHOULD HAVE BEEN WRITTEN AS THE ACTUAL
17              ;       TWO WRITE ECC WORDS ON THE DISK.
18              ;
19              ;       THE SIMULATED READ ECC WORDS ARE THE RESULT OF ANOTHER
20              ;       PROGRAM SIMULATION OF THE ECC LOGIC ON THE READ DATA
21              ;       IN MEMORY, AND REPRESENT WHAT THE PROGRAM BELIEVES
22              ;       SHOULD BE READ FROM THE CONTROLLER AS THE TWO ECC
23              ;       WORDS.  THE ACTUAL READ ECC WORDS ARE THOSE TWO WORDS
24              ;       AS READ FORM THE DISK CONTROLLER.
25              ;
26              ;10.4   ERRORS- ERROR STATUS IS PRINTED WHENEVER ENCOUNTERED
27              ;       AS FOLLOWS:
28              ;
29              ;       'MODE' UNIT:   'N'
30              ;       CYL-- 'N'      HEAD 'N'      SECT 'N'   #SECT 'N'
31              ;       DIA/DIB STATUS= 'N'    'DESCRIPTIVE MESSAGE'
32              ;
33              ;       WHERE CYL,HEAD,SECT REFER TO THE FINAL DISK ADDRESS AT
34              ;       THE POINT OF ERROR, AND #SECT REFERS TO THE NUMBER OF
35              ;       SECTORS ALREADY DONE IN THE MULTIPLE SECTOR TRANSFER.
36              ;
37              ;       WHEN DATA ERRORS ARE FOUND, ONLY THREE ARE PRINTED PER
38              ;       ENCOUNTER PLUS THE TOTAL NUMBER OF ERRORS. (SEE PARA 5)
39              ;       IF THE DATA ERROR IS ECC UNDETECTED AND THE SYSTEM IS
40              ;       MAPPED, THE MAP, PHYSICAL 1K ADDRESS, AND THE DCH
41              ;       LOGICAL ADDRESSES ARE ALSO PRINTED.
42              ;
43              ;       WHEN LOOPING IS INVOLVED (RETRIES OR FOR SCOPING)
44              ;       STATUS IS PRINTED ON THE 1ST PASS ONLY.
45              ;
46              ;10.5   STATISTICS - TYPE A W
47              ;       DURING RANDOM TESTING TO GET A REPORT OF THE
48              ;       NUMBER OF SECTORS WRITTEN(AND/OR)READ, PLUS
49              ;       ERROR COUNTS IN DECIMAL.  ALSO LISTED IS A
50              ;       COUNT FOR CONTROLLER CORRECTS/UNIT
51              ;       (ON BOARD ECC CORRECTION AND OFFSET CORRECTS)
52              ;
53              ;       TYPE L FOR FIRST 100. DISK ADDRESSES OF BAD SECTORS AND
54              ;       DATA ERRORS, AND FIRST 20. OF ADDRESS ERRORS AND
55              ;       SEEK ERRORS (SEEK PATH).  IF ERROR ADDRESSES ARE
56              ;       ENCOUNTERED MORE THAN ONCE (1ST PASS), A COUNT OF UP TO
57              ;       32. WILL BE RECORDED IN THE LOG.  ALSO A COUNT OF UP TO
58              ;       15. HARD ERRORS WILL BE RECORDED.  THIS COUNT WILL BE
59              ;       A SUBSET OF THE THE FIRST COUNT.
60
```

```
01              ;       THE ADDRESS INFORMATION WILL BE IN OCTAL WHILE THE
02              ;       COUNTS WILL BE DECIMAL.
03
04              ;       TYPE S FOR SEEK TIMING STATISTICS IF RUNNING
05              ;       EITHER SEEK EXERCISER.
06
07              ;       **** NOTE ****
08              ;       THE PROGRAM WILL ACCOUNT FOR UP TO A MAX.
09              ;       OF 2**31 SECTORS WRITTEN OR READ.  SPECIAL
10              ;       TEST RUNS EXCEEDING THIS FACILITY WILL
11              ;       REQUIRE AN OPERATOR'S TEST LOG TO AUGMENT
12              ;       SOFTWARE ACCOUNTING.  2**31 SECTORS =
13              ;       APPROX.  5.5* 10**11 WORDS.
14              ;11.0   DEBUG HELP:
15                      O?DTD   11
16
17              ;12.0   SPECIAL NOTES/SPECIAL FEATURES:
18
19              ;       1.  A CR ONLY RESPONSE TO UNIT NUMBERS, WILL LEAVE
20              ;       UNIT/CYLINDER INFORMATION IN PREVIOUS STATE.
21
22              ;       2.  THE PROGRAM USES A 10 WORD BUFFER.
23
24              ;       3.  THE PROGRAM WILL ACCOUNT FOR UP TO A MAX.
25              ;       OF 2**31 SECTORS WRITTEN OR READ.  SPECIAL
26              ;       TEST RUNS EXCEEDING THIS FACILITY WILL
27              ;       REQUIRE AN OPERATOR'S TEST LOG TO AUGMENT
28              ;       SOFTWARE ACCOUNTING.  2**31 SECTORS =
29              ;       APPROX.  5.5* 10**11 WORDS.
30
31              ;       4.  SWPAK7=1, PROGRAM HALTS AFTER WRITE WITH READ
32              ;       VERIFICATION ALLOWING OPERATOR TO CHANGE PACKS.
33              ;       SWPAK8=1, PUTS PROGRAM INTO READ ONLY MODE
34              ;       ## SA'S 501,502 ONLY.  IF SA 501-DATA MUST !NOT! BE
35              ;       VARIABLE.  START AT THE ABOVE SELECTED ADDRESS.
36
37              ;       5.  ALL NUMBERS ENTERED IN 7.0 MUST BE IN OCTAL.
38              ;       ANY NON-OCTAL INPUT IS TREATED AS A LETTER.
39              ;       ANY LETTER INPUT FOR CYL,HEAD,SECTOR, OR # OF
40              ;       SECTORS GETS RANDOM FUNCTION IN THE RELIABILITY
41              ;       TEST WITH OPTIONS.
42
43              ;       6.  AT TIMES THE ECC MAY ATTEMPT TO CORRECT A NON-CORRECTABLE
44              ;       DATA ERROR AND THE SIMULATED ECC AND ACTUAL ECC WILL
45              ;       MATCH EVEN THOUGH AN ECC FAILURE WILL HAVE BEEN PRINTED.
46              ;       THIS IS DUE TO A FAILURE OF THE ECC POLYNOMIAL ITSELF TO
47              ;       DISTINGUISH BETWEEN TWO DIFFERENT ERROR PATTERNS, ONE
48              ;       CORRECTABLE AND ONE UNCORRECTABLE.  THIS IS !NOT! A
49              ;       HARDWARE FAILURE.
50
51              ;13.0   PROGRAM RUNTIME:
52
53              ;       PROGRAM RUNTIMES ARE SUBSTANTIALLY REDUCED WITH
54              ;       MEMORIES OF 16K OR LARGER.  PROGRAM CAN USE UP TO
55              ;       24K USING 2 BUFFERS AND UP TO 32K USING 4 BUFFERS
56              ;       IN THE RANDOM RELIABILITY TESTS.  ## SEE 9D
57
58              ;       READ, WRITE AND SEEK OPERATIONS ARE TIMED
59              ;       BY SPECIAL ROUTINES.  WHEN THE PROGRAM IS
60              ;       FIRST STARTED, THE TIMING ROUTINE WILL TEST
```

```
0012  DISKR
01              ;       FOR THE PRESENCE OF A REAL TIME CLOCK (RTC)
02              ;       TO DERIVE TIMING FROM IT.
03
```

```
 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
 2              ;                                      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
 9              ;                                        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.
```

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0003  MTAFD
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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 0005  MTAFD
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
```

```
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 DNWAIT
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.
```

```
!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
```

```
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
```

```
01              ;                       BE IN OCTAL.  IF THE COMMAND STRING
02              ;                       EXCEEDS THE LINE LENGTH, TYPE A
03              ;                       LINEFEED TO CONTINUE ON THE NEXT
04              ;                       LINE.  THE FOLLOWING IS A LIST OF
05              ;                       AVAILABLE SUB-SYSTEM COMMANDS.
06              ;
07              ;                       RD N    READ N RECORDS
08              ;                       RW      REWIND
09              ;                       SB N    SPACE BACK N RECORDS
10              ;                       SF N    SPACE FORWARD N RECORDS
11              ;                       WT N    WRITE N RECORDS
12              ;                       WE      WRITE END OF FILE MARK
13              ;                       ER      ERASE 3" OF TAPE
14              ;                       RE      READ END OF FILE MARK
15              ;                       LOOP    LOOP BACK TO FIRST COMMAND
16              ;                       *       LOOP TO HERE
17              ;                       LOOP *  LOOP TO *
18              ;
19              ;                       SAMPLE COMMAND STRINGS
20              ;
21              ;                       RW WT 10 SB 10 RD 10 LOOP
22              ;
23              ;                       THE ABOVE COMMAND STRING WILL REWIND,
24              ;                       WRITE 8 RECORDS, SPACE BACK 8 RECORDS,
25              ;                       AND READ 8 RECORDS.  THIS TEST WILL
26              ;                       CONTINUE UNTIL STOPPED BY THE OPERATOR.
27              ;
28              ;                       RW,WT 10,WE * RW,SF,10,SB,10,RD,10,RE,
29              ;                       LOOP *
30              ;
31              ;                       THE ABOVE COMMAND STRING WILL REWIND,
32              ;                       WRITE 8 RECORDS, WRITE AN EOF MARK,
33              ;                       AND THEN LOOP ON REWIND, SPACE FORWARD
34              ;                       8 RECORDS, SPACE BACK 8 RECORDS, READ
35              ;                       8 RECORDS AND READ EOF MARK.
36              ;               NOTE:   EITHER A SPACE OR COMMA CAN BE
37              ;                       USED AS AN ARGUEMENT DELIMITER.
38              ;                       IF AN INCORRECT CHARACTER OR
39              ;                       CHARACTERS ARE TYPED, TYPE A RUB-
40              ;                       OUT CHARACTER TO DELETE THE PRE-
41              ;                       VIOUSLY TYPED CHARACTER.  THE DELE-
42              ;                       TED CHARACTER WILL BE PRINTED.
43              ;
44              ;               WHILE THE COMMAND STRING IS BEING EXECUTED,
45              ;               TYPE A 'R' CHARACTER TO CAUSE THE PROGRAM
46              ;               TO RETURN TO THE UNIT PROMPT.  THE ESCAPE
47              ;               KEY WILL CAUSE THE PROGRAM TO RETURN TO THE
48              ;               COMMAND STRING ENTRY POINT.
49              ;
50              ;       7.5     HISTORY RECOVERY (SA 504)
51              ;
52              ;               IF THE PROGRAM HAS STOPPED DURING AN OPERATION,
53              ;               THE ACCUMULATED ERROR AND PASS HISTORY CAN BE
54              ;               RECOVERED BY THIS PROGRAM.  THIS PROGRAM MUST
55              ;               BE RUN BEFORE ANY OTHER PROGRAM IS RESTARTED.
56              ;
57              ;               TO RETRIEVE THE ACCUMULATED ERROR AND PASS
58              ;               HISTORY WHILE THE RELIABILITY TEST IS RUNNING,
59              ;               TYPE A SPACE.  THIS WILL CAUSE THE ACCUM-
60              ;               ULATED HISTORIES OF ALL TESTED UNITS TO BE
```

```
 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?WPD   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 = ?..."
```

```
0006  UMTR
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              ;
```

```
0007  UMTR
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
```

```
 0008  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                      0?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: MIMIMUM GAP IS ONLY TRUE IF DRIVE IS STREAMING, IF
55              ;              REPOSITIONING OCCURS GAP IS OF NOMINAL LENGTH(NOMINAL IS .6 IN)
```

INDEX

(T)

PARTS LIST
ZETACO

FOR: ZDF-1 "A" PADDLEBOARD ASSEMBLY

ASSEMBLY #: 300027-000
PREV. ASSEMBLY #: 294-B44-3A0
REV. LEVEL: B
SCHEMATIC REV. LEVEL:

ITEM	QTY	PART #	GENERIC DESCRIP.	DESCRIPTION	REFERENCE
1	1	100166-000	IC MC3450	QUAD LINE RECEIVER W/STR	U7
2	4	100167-000	IC MC3453	QUAD LINE DRIVER W/INH	U6,U5,U4,U3
3	1	100200-332	RES 3.3K	1/4W 5%	R1
4	2	100200-471	RES 470	1/4W 5%	R2,R3
5	2	100213-336	CAP 33MF	10V	
6	2	100217-471	SIP 470	RES 8P 4R	RP6,RP7
7	5	100218-056	SIP 56	RES 8P 7R	RP5,RP4,RP1,RP2, RP3
8	1	100218-332	SIP 3.3K	RES 8P 7R	RP8
9	2	100221-003	DIP	RES 220/330	U1,U2
10	1	100475-000	SIP 56	RES 10P 9R	RP9
11	4	100636-000	CAP .047MF	50V	
12	1	100671-000	PCB PADDLE	294-A11 "A" REV 1	
13	18	100931-000	CABLE	TAPE, INTERNAL REV A	J7
14	2	100947-000	CONN EDGE	BERG 67659-066 24P	
15	1	100948-000	CONN EDGE	BERG 67659-078 52P	
16	18	200004-000	CABLE	DISK, INT "A" ASSY REV A	J1

PARTS LIST
ZETACO

FOR: ZDF-1 "B" PADDLEBOARD ASSEMBLY

ASSEMBLY #: 300028-000
PREV. ASSEMBLY #: 294-B45-3A1
REV. LEVEL: C
SCHEMATIC REV. LEVEL:

ITEM	QTY	PART #	GENERIC DESCRIP.	DESCRIPTION	REFERENCE
1	4	100166-000	IC MC3450	QUAD LINE RECEIVER W/STR	U2,U3,U5,U7
2	2	100167-000	IC MC3453	QUAD LINE DRIVER W/INH	U4,U6
3	2	100213-336	CAP 33MF	10V	
4	8	100217-471	SIP 470	RES 8P 4R	RP3,RP2,RP9,RP8, RP5,RP6,RP13, RP12
5	1	100218-332	SIP 3.3K	RES 8P 7R	RP15
6	1	100221-003	DIP	RES 220/330	U1
7	1	100474-000	SIP 82	RES 10P 9R	RP4
8	3	100636-000	CAP .047MF	50V	
9	1	100672-000	PCB PADDLE	294-A14 "B" REV 1	REV 1
10	5	100681-000	SIP 82	RES 8P 7R	RP7,RP11,RP1, RP10,RP14
11	18	100931-000	CABLE	TAPE, INTERNAL REV A	J6
12	72	100932-000	CABLE	DISK, INTERNAL "B" REV A	J2,J3,J4,J5
13	2	100947-000	CONN EDGE	BERG 67659-066 24P	
14	1	100948-000	CONN EDGE	BERG 67659-078 52P	

PARTS LIST
ZETACO

FOR: ZDF-1 DISK "A" PADDLEBD ASSY (FCC)

ASSEMBLY #: 300029-000
PREV. ASSEMBLY #: 294-B13-3A1
REV. LEVEL: C
SCHEMATIC REV. LEVEL:

ITEM	QTY	PART #	GENERIC DESCRIP.	DESCRIPTION	REFERENCE
1	1	100166-000	IC MC3450	QUAD LINE RECEIVER W/STR	U7
2	4	100167-000	IC MC3453	QUAD LINE DRIVER W/INH	U6,U5,U4,U3
3	1	100200-332	RES 3.3K	1/4W 5%	R1
4	2	100200-471	RES 470	1/4W 5%	R2,R3
5	2	100213-336	CAP 33MF	10V	
6	2	100217-471	SIP 470	RES 8P 4R	RP6,RP7
7	5	100218-056	SIP 56	RES 8P 7R	RP5,RP4,RP1,RP2, RP3
8	1	100218-332	SIP 3.3K	RES 8P 7R	RP8
9	2	100221-003	DIP	RES 220/330	U1,U2
10	1	100475-000	SIP 56	RES 10P 9R	RP9
11	4	100636-000	CAP .047MF	50V	
12	1	100671-000	PCB PADDLE	294-A11 "A" REV 1	
13	2	100947-000	CONN EDGE	BERG 67659-066 24P	
14	1	100948-000	CONN EDGE	BERG 67659-078 52P	
15	36	200002-000	CABLE	DISK,INT "A" ASSY FCC A	J1
16	36	200022-002	CABLE	INT RBN CABLE ASSY (36")	J7

PARTS LIST
ZETACO

FOR: ZDF-1 DISK "B" PDL BD ASSY (FCC)

ASSEMBLY #: 300031-000
PREV. ASSEMBLY #: 294-B16-3A2
REV. LEVEL: D
SCHEMATIC REV. LEVEL:

ITEM	QTY	PART #	GENERIC DESCRIP.	DESCRIPTION	REFERENCE
1	4	100166-000	IC MC3450	QUAD LINE RECEIVER W/STR	U2,U3,U5,U7
2	2	100167-000	IC MC3453	QUAD LINE DRIVER W/INH	U4,U6
3	2	100213-336	CAP 33MF	10V	
4	8	100217-471	SIP 470	RES 8P 4R	RP3,RP2,RP9,RP8, RP5,RP6,RP13, RP12
5	1	100218-332	SIP 3.3K	RES 8P 7R	RP15
6	1	100221-003	DIP	RES 220/330	U1
7	1	100474-000	SIP 82	RES 10P 9R	RP4
8	3	100636-000	CAP .047MF	50V	
9	1	100672-000	PCB PADDLE	294-A14 "B" REV 1	REV 1
10	5	100681-000	SIP 82	RES 8P 7R	RP7,RP11,RP1, RP10,RP14
11	2	100947-000	CONN EDGE	BERG 67659-066 24P	
12	1	100948-000	CONN EDGE	BERG 67659-078 52P	
13	72	200003-000	CABLE	ZDF-1 DISK INT B FCC ASSY	J2,J3,J4,J5
14	18	200022-001	CABLE	INT. RBN ASSY 18" REV A	J6