Model DC-295C

SMD Disk Controller
Technical Manual

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REVISION HISTORY

ECO No.	Date	Description	Pages
0200	12/23/83	Typo's and Re-Organization	
0241	12/21/83	Obsolete 295A, Replaced with 295C	
0328	6/28/84	New ZETACO Cover	
0336	7/2/84	Per ECO	
0386	9/24/84	Per ECO	
0418	12/10/84	Per ECO	
0553	2/7/86	Add disk characteristics	
0579	2/28/86	Replace disk characteristics	
0523	3/4/86	New Cover	
0631	6/24/86	Change Table 3.1	3-11

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1.0 INTRODUCTION

The Custom Systems, Inc. 295C Storage Module Disk Controller provides a full emulation integration of Data General Nova/Eclipse Minicomputers, SMD Interface Disk Drives and RDOS/AOS/MP/AOS Operating Systems. It is fully compatible with Data General and Data General emulating minicomputers.

Advantages:

.Cost Savings to 60%

.Faster Systems throughput

.Increased Reliability

.Increased Capacity

.Hardware or Software Correctable ECC

.Full Two Year Warranty

1.1 FEATURES

.Emulation of Data General 6060, 6061, 6067, 6122, 6160, 6161 Disk Subsystem

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

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

.Mix Drives of differing capacities and transfer rates

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

.High speed Microprocessor design supports maximum transfer rates

.On-Board SELFTEST with error reporting and LED display

.Capable of Three Sector Buffering

.Sector Interleaving

.Switch Selectable DMA Throttle Control

.Support Overlap Seeks

.Offset Positioning for Data Error Recovery

.Data Strobe Early/Late for Data Error Recovery

.Two Methods of Power Fail Detection

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

.Disk Drive Power Sequencing

.Delayed Power on Pick

.Mix different Drive Formats

.Extended Unit Select Address

.Header CRC Auto Re-try

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2.0 SPECIFICATIONS

2.1 INTERFACE

2.1.1 DRIVE

Electrical: Standard SMD Interface

Driver/Receiver: Differential

Cabling: One 60 Pin Ribbon Cable ("A" Cable) for the
first Disk Drive (Daisy Chained),

One 26 Pin Ribbon Cable ("B" Cable) for the
first Disk Drive (Radial).

NOTE: Both Cables connect to connectors on the board edge.

Multiple Drives: Up to four Drives (CMD counts as two)
per controller. The 60 Pin "A" Cable,
Daisy Chains from Drive to Drive, with
the last Drive in the chain receiving
an "A" Cable terminator. The 26 Pin
"B" Cable connects radially to each
Drive. (No Terminators required).
Reference Figure 3.8.

Performance:

2.1.2 COMPUTER

The controller is compatible with any Model DG Nova

or Eclipse computer interface. Data transfer occurs

over the standard or high-speed data channel.

2.2   POWER

+5 VDC @ 6.6 Amps

-5 VDC @ 0.7 Amps

2.3   PHYSICAL

Dimensions: 15 inches by 15 inches by 1/2 inch

Shipping Weight: 10 Pounds (3.7 kg.) includes cables,
                   diagnostics and documentation.

Cables: 60 Pin Ribbon "A" Cable - 15 feet

          26 Pin Ribbon "B" Cable - 15 feet

2.4   ENVIRONMENTAL

Operating Temperature: 0 to 55 degrees C

Relative Humidity: 10% to 90% (non-condensing)

Exceeds all Nova/Eclipse temperature and humidity

specifications.

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3.0   INSTALLATION

It is suggested that the Disk Drive Manufacturer's
Manual be referenced for correct switch settings of the
Disk Drive. Please read the following 295C Installation
Section carefully.

3.1   UNPACKING AND INSPECTION

All parts comprising of the Model 295C are shipped in
one container consisting of:

a)   Controller

b)   Controller to Disk Drive Cabling (Optional)

c)   Diagnostic Software

d)   Technical Manual

On receipt of the Model 295C 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.

Custom Systems' warranty does not cover shipping damage.

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

3.2   CONFIGURING THE 295C CONTROLLER

The configuration of the 295C is eased by having all options switch selectable. This section discusses each option switch and the meaning of each Switch's On and Off position. At the completion of Section 3.2 the configuration of the 295C will be completed. Refer to Figure 3.1 for the location of all referenced Switches and Port Connector Assignments. Insure the Disk Drive you are installing has the Index and Sectoring signals on the A Cable. If these signals are on the B Cable only, the controller board will not install correctly.

3.2.1   SWITCH LOCATION F2 (REFERENCE FIGURE 3.2)

Switch Positions 1 thru 6 control the Device Code selection of the controller. Any of the 77 (octal) possible Device Codes are selectable with the standard Device Codes being 27 (octal) Primary and 67 (octal) Secondary. Establish the desired Device Code.

Switch Position 7 is used to control looping on the controller's Selftest Feature. With the switch in the On position the Selftest feature will operate continuously. With the switch in the Off position the Selftest will occur once on Power Up. This switch must be in the OFF position.
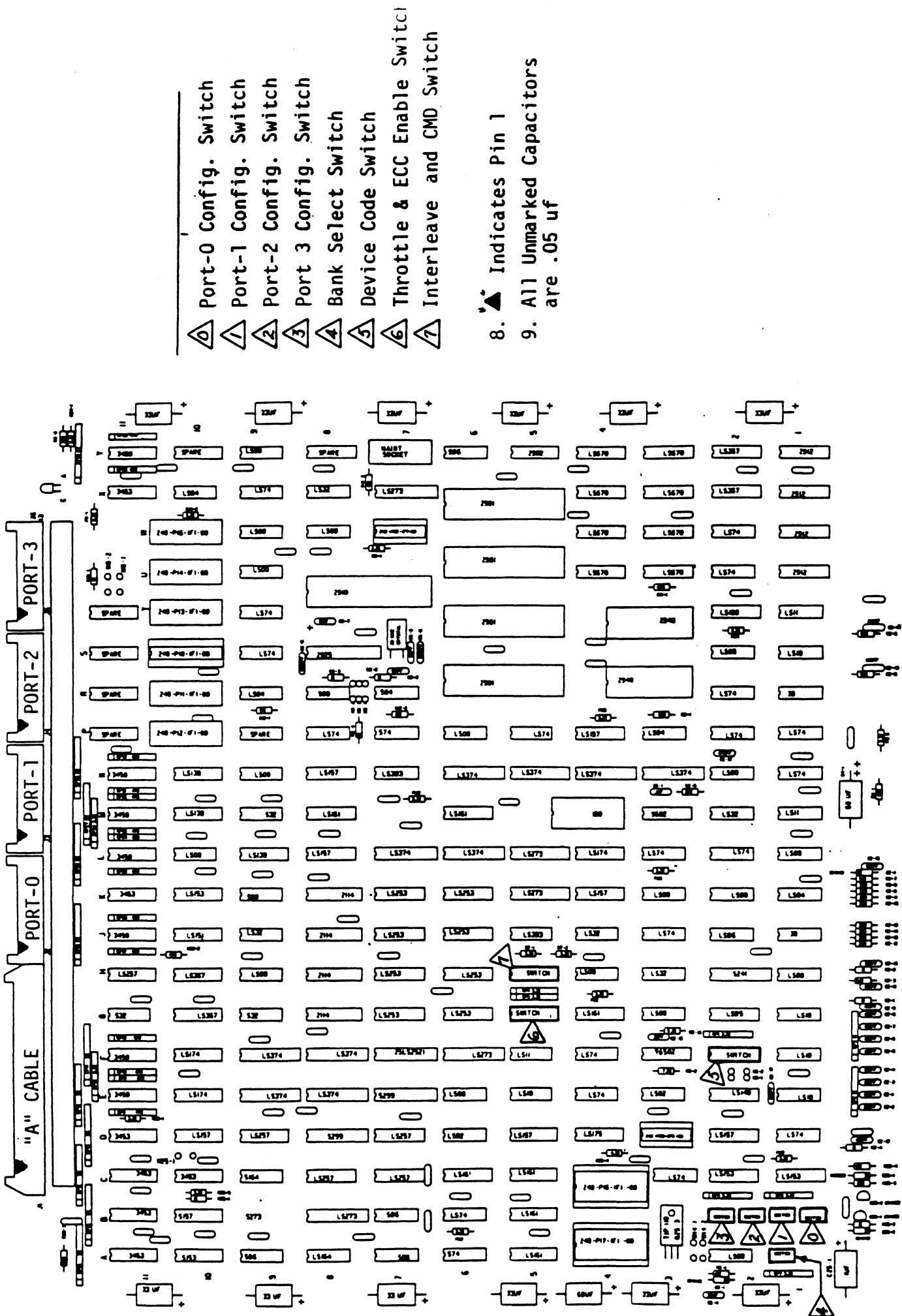
△0	Port-0 Config. Switch
△1	Port-1 Config. Switch
△2	Port-2 Config. Switch
△3	Port 3 Config. Switch
△4	Bank Select Switch
△5	Device Code Switch
△6	Throttle & ECC Enable Switch
△7	Interleave and CMD Switch

8. "▲" Indicates Pin 1
9. All Unmarked Capacitors are .05 uf

BOARD LAYOUT
Figure 3.1

3-3

Make certain the 2 arrows
match (Pin 1 to Pin 1) to
insure correct Disk Drive
operation.

CPU CHASSIS

295C

PORT 1
"B" CABLE

PORT 0
"B" CABLE

CABLE "A"
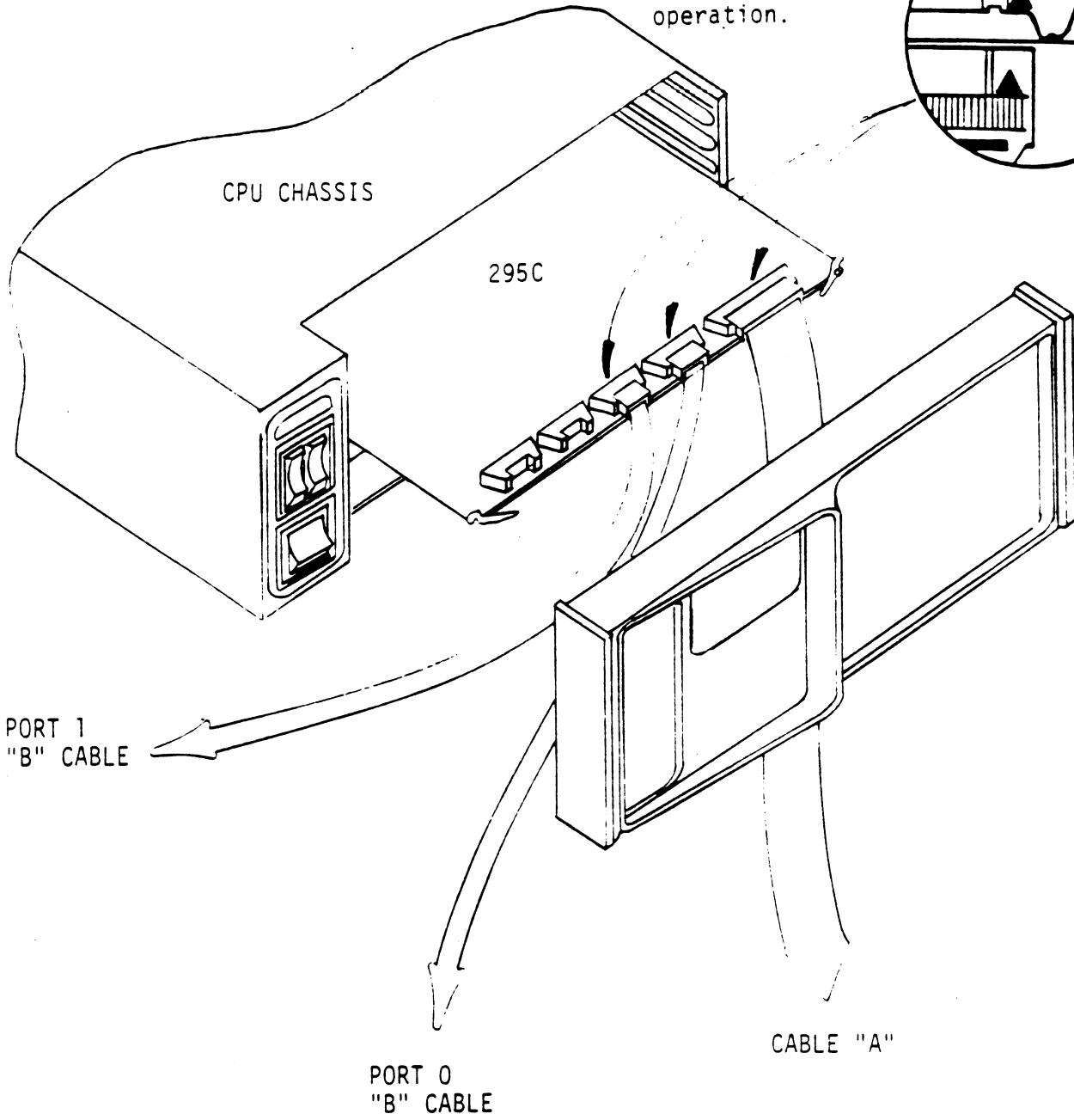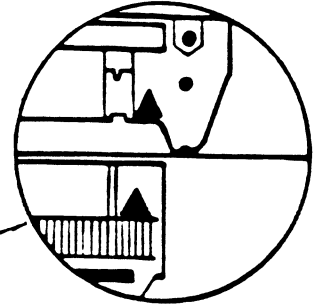
BOARD DIAGRAM

FIGURE 3.1.1

Switch Position 8 controls the Mixed Drive Format feature.
When Switch 8 is ON (Alternate Format Disabled) all four
Ports will use the same disk format (reference Figure 3.2).
Normally Switch 8 is ON. With Switch 8 ON, when set to
Bank 1-5, (reference Tables 3.1/3.2) you receive CSI
format on all 4 Ports (0-3). A Port indicates a connection
point (B Cable) for the Disk Drive. With Switch 8 ON,
when set to Bank 6, you receive DG format on all 4 Ports
(0-3). With Switch 8 ON, when set to Bank 7, you receive
Alternate 1 format for all 4 Ports (0-3). In each case
all 4 Ports (0-3) are the same format. If a disk format
is required on Ports 0 and 1 and a different disk format
is required on Ports 2 and 3, set Switch 8 to the OFF
position. When Switch 8 is OFF you enable the Alternate
format. Refer to Tables 3.1/3.2 for Alternate Format
Bank Selection. For a detailed description of the Disk
formats reference Section 3.8 and 6.5. Remember Switch 8
is normally ON.

DEV SEL 0 (MSB)
DEV SEL 1
DEV SEL 2
DEV SEL 3
DEV SEL 4
DEV SEL 5 (LSB)
Maintenance Switch (OFF=Disabled)
Alternate Format (ON=Disabled)
Refer to Section 3.2.1

SLIDE SWITCH

Location F2
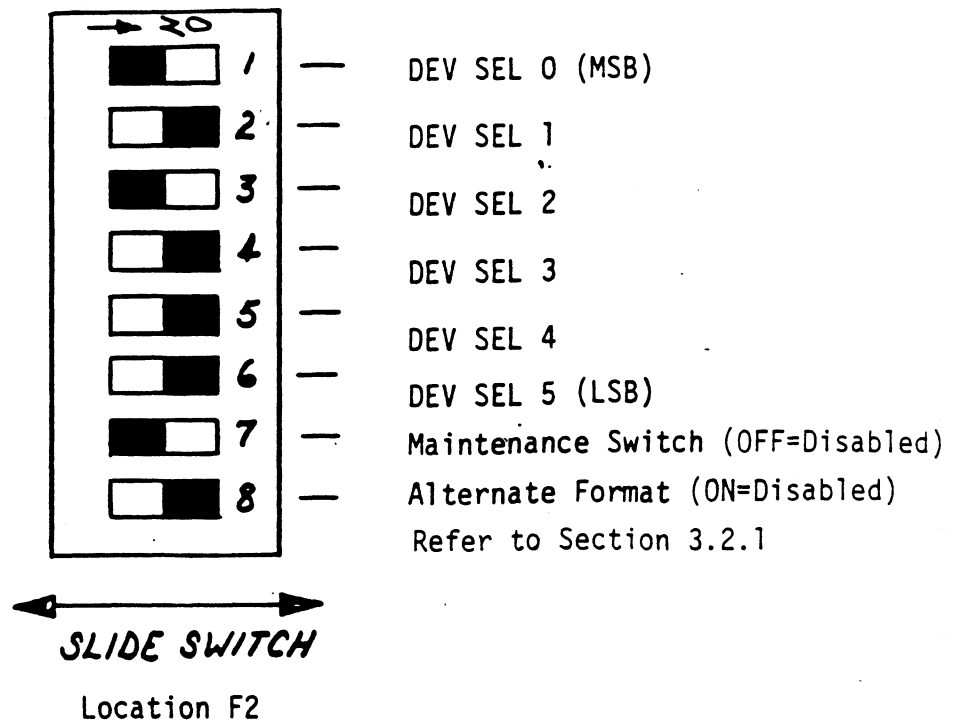
Figure shows Device Code 27_8,
Maintenance Switch Off,
Alternate Format Disabled.

| Device Code	S1	S2	S3	S4	S5	S6
0X	OFF	OFF	OFF			
1X	OFF	OFF	ON			
2X	OFF	ON	OFF			
3X	OFF	ON	ON			
4X	ON	OFF	OFF			
5X	ON	OFF	ON			
6X	ON	ON	OFF			
7X	ON	ON	ON			
X0				OFF	OFF	OFF
X1				OFF	OFF	ON
X2				OFF	ON	OFF
X3				OFF	ON	ON
X4				ON	OFF	OFF
X5				ON	OFF	ON
X6				ON	ON	OFF
X7				ON	ON	ON

DEVICE CODE SELECT SWITCH
Figure 3.2

3.2.2   SWITCH LOCATION A1 - BANK SELECT (REFERENCE FIGURE 3.3)

Switch Position 1 is reserved and must be in the ON position. Switch Position 2 thru 4 select one of the seven possible Bank Selects (reference Tables 3.1/3.2). Two Tables reference to Bank and Port Configuration. Table 3.1 is the Single DOC Mode (see Section 6.2.3 for DOC explanation) for 6060, 6061 and 6067 emulations of 32 sectors or less. When you have RDOS 6.7 or less you must choose Table 3.1. When Dual Volumes of 32 sectors or less are needed use the Single DOC Mode. Table 3.2 is the Double DOC Mode for 6160, 6161 and 6122 emulations of more than 32 sectors. Dual 35 sectoring requires Double DOC. In Tables 3.1/3.2 the Bank Select numbers are on the horizontal (X) axis and the Select Configuration numbers are on the vertical (Y) axis. First decide which format will be used (CSI, DG or ALT 1). The CSI format has an extra Sync Bit for error checks.

NOTE: Refer to Section 3.2.1 for the correct position
         of Switch 8 at Location F2. This switch affects
         the format.

Under each Bank Select is a list of Disk Drives. Locate which drives will be used, insuring they all come from within the same Bank. When this process is done the Bank Select can be made. Remember, only one Bank can be chosen.

SLIDE SWITCH

1 — Reserved (Normally ON)
2 — Bank SEL 2
3 — Bank SEL 1
4 — Bank SEL 0
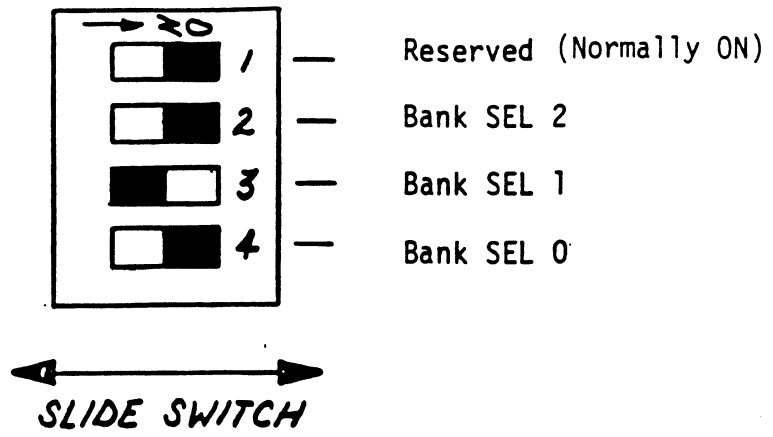
Location Al

Figure shows bank two selected.

SW2	SW3	SW4	BANK SELECTED
ON	ON	ON	0
ON	ON	OFF	1
ON	OFF	ON	2
ON	OFF	OFF	3
OFF	ON	ON	4
OFF	ON	OFF	5
OFF	OFF	ON	6
OFF	OFF	OFF	7

BANK SELECT SWITCH
Figure 3.3

3.2.3 PORT CONFIGURATION SWITCH SELECTION

Switch Locations   B1A - Port 0 (Reference
                                                Figure 3.4)

(Select Configuration)   B1B - Port 1

                                    B2A - Port 2

                                    B2B - Port 3

Referencing back to Section 3.2.2, a Disk Format was

chosen as well as what Disk Drives would be attached.

Decide which Disk type will be attached to a respective

Port. Set each Switch Bay in Figure 3.4 to the Select

Configuration number that corresponds to the Drive type

that will be attached to that particular port. Refer to

Tables 3.1/3.2 first and Figure 3.4 second.

For example, it is desired to have CSI format on all

Ports and the following Disk Drives connected to -

$$\text{BANK 1} \begin{cases} \text{Port 0 = CDC 9762 (Select Configuration 0)} \\ \text{Port 1 = CDC 9766 (Select Configuration 1)} \\ \text{Port 2 = Ampex Capricorn 330 (Select Configuration 7)} \end{cases}$$

Tables 3.1/3.2 indicates that these drives are all under

Bank Select 1. Therefore, set the Bank Select Switch

(location A1) to Bank 1 (see Figure 3.3). Set Port 0

Switch (location B1A) to Select Configuration 0, Port 1

to Select Configuration 1 and Port 2 to Select

Configuration 7 (see Figure 3.4).
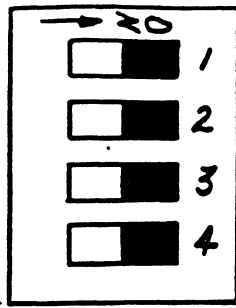
SLIDE SWITCH

Location B1A - Port 0
Location B1B - Port 1
Location B2A - Port 2
Location B2B - Port 3

Select Configuration 0 shown.

SW1	SW2	SW3	SW4	Select Configuration
ON	ON	ON	ON	0
ON	ON	ON	OFF	1
ON	ON	OFF	ON	2
ON	ON	OFF	OFF	3
ON	OFF	ON	ON	4
ON	OFF	ON	OFF	5
ON	OFF	OFF	ON	6
ON	OFF	OFF	OFF	7
OFF	ON	ON	ON	8
OFF	ON	ON	OFF	9
OFF	ON	OFF	ON	10
OFF	ON	OFF	OFF	11
OFF	OFF	ON	ON	12
OFF	OFF	ON	OFF	13
OFF	OFF	OFF	ON	14
OFF	OFF	OFF	OFF	15

PORT CONFIGURATION SWITCHES
Figure 3.4

SLIDE SWITCH

Location B1A - Port 0
Location B1B - Port 1
Location B2A - Port 2
Location B2B - Port 3

Configuration 0 shown.

SW1	SW2	SW3	SW4	PORT CONFIGURATION SELECT
ON	ON	ON	ON	0
ON	ON	ON	OFF	1
ON	ON	OFF	ON	2
ON	ON	OFF	OFF	3
ON	OFF	ON	ON	4
ON	OFF	ON	OFF	5
ON	OFF	OFF	ON	6
ON	OFF	OFF	OFF	7
OFF	ON	ON	ON	8
OFF	ON	ON	OFF	9
OFF	ON	OFF	ON	10
OFF	ON	OFF	OFF	11
OFF	OFF	ON	ON	12
OFF	OFF	ON	OFF	13
OFF	OFF	OFF	ON	14
OFF	OFF	OFF	OFF	15

PORT CONFIGURATION SWITCHES
Figure 3.4

BANK SELECT →

PORT CONFIGURATION SELECT ↓

	1 — CSI PORT 0-3 ALT 1 PORT 2,3	2 — CSI PORT 0-3 ALT 1 PORT 2,3	3 — CSI PORT 0-3 ALT 1 PORT 2,3
0	·CDC 9762, RSD, 9730-80·CD T82 ·FUJITSU 2280·KENNEDY 5380,7380 ·AMPEX DM980, SCORPIO-80 ·TECSTOR 85·MEGAVAULT 85 [80MB/32S]	·CDC 9448-32 ·AMPEX DFR 932 (REMOVABLE=0, FIXED=1) [16/16MB/32S]	·NEC 2230 ·KENNEDY 7340 [40MB/32S]
1	·CDC 9766·MEMOREX 677-30 ·CENTURY 315, T306 ·TECSTOR 300 [300M/32S]	·CDC 9448-32 ·AMPEX DFR 932 (REMOVABLE=1, FIXED=0) [16/16MB/32S]	·CDC 9448-64 ·AMPEX DFR-64 (REMOVABLE=0, FIXED=1) [16/48MB/32S]
2	·CDC 9730-160·KENNEDY 53160 ·CDC F30·TECSTOR-165 ·FUJITSU 2284 ·AMPEX CAPRICORN-165 [160MB/32S]	·CDC 9455-16 "LARK" (REMOVABLE=0, FIXED=1) [8/8MB/32S]	·CDC 9448-64 ·AMPEX DFR-64 (REMOVABLE=1, FIXED=0) [16/48MB/32S]
3	·CDC 9448 ·AMPEX DFR 96 (REMOVABLE=0, FIXED=1) [16/80MB/32S]	·CDC 9455-16 "LARK" (REMOVABLE=1, FIXED=0) [8/8MB/32S]	·CDC 9775 2 UNITS [675MB/32S]
4	·CDC 9448 ·AMPEX DFR 96 (REMOVABLE=1, FIXED=0) [16/80MB/32S]	·PRIAM 3450 [34MB/23S]	·AMPEX DM160 [160MB/32S]
5	·CDC 9455-48 "LARK" (REMOVABLE=0, FIXED=1) AMCODYNE 7110 [24/24MB/32S]	·TECSTOR 200 [200MB/32S]	·CDC FSD 108 [340MB/32S]
6	·CDC 9455-48 "LARK" (REMOVABLE=1, FIXED=0) AMCODYNE 7110 [24/24MB/32S]	·MEMOREX 677-70 [206MB/23S]	·NEC 2246 [80MB/35S]
7	·FUJITSU 2294 ·AMPEX CAPRICORN 330 [330MB/32S]	·MEGAVAULT 16 [16MB/32S]	·NEC D2220 [25MB/32S]
8	·CDC 9410-32 "FINCH" [32MB/23S]	·MEGAVAULT 48 ·AMPEX SCORPIO-50 [48MB/32S]	·PRIAM 3350 [34MB/32S]
9	·FUJITSU 2312 ·MEMOREX 214 [84MB/32S]	·MEGAVALT 116 [116MB/32S]	.Priam 7050 70Mb/23S
10	·FUJITSU 2311 ·MEMOREX 213 [48MB/32S]	·CENTURY C2048 (REMOVABLE=0, FIXED=1) [16/32MB/32S]	.Priam 3450 34Mb/23S
11	·PRIAM 6650/67 [62MB/32S]	·CENTURY C2048 (REMOVABLE=1, FIXED=0) [16/32MB/32S]	.CDC WINDSOR 70Mb/32S
12	·PRIAM 15450 ·DISCTRON 3600 [145MB/32S]	·CDC 9410-8 "FINCH" [8MB/23S]	
13	·PRIAM 804 [56MB/32S]	·CDC 9410-24 "FINCH" [24MB/23S]	
14	·AMPEX 660 [660MB/32S]	·CDC 9762, RSD, 9730-80 ·FUJITSU 2280·KENNEDY 5380,7380 ·AMPEX DM980, SCORPIO-80 ·TECSTOR 85·MEGAVAULT 85 [80MB/32S]	
15		·MEGAVAULT 212 [212MB/32S]	

NOTE : BANK 0 RESERVED FOR SELFTEST

PORT CONFIGURATION SELECT ↓

	4	5	6	7
	ALT 1 PORT 0-3 D.G. PORT 2,3	ALT 1 PORT 0-3 D.G. PORT 2,3	D.G. PORT 0-3 CSI PORT 2,3	RESERVED
0	• CDC 9762, 9730-80, RSD · CD T#2 • FUJITSU 2280 · KENNEDY 5380, 7380 • AMPEX DM 980, SCORPIO-80 • TECSTOR 85 · MEGAVAULT 85 80MB/32S	• CDC 9448-32 • AMPEX DFR 932 (REMOVABLE =0, FIXED =1) 16/16 MB/32S	• CDC 9762, RSD, 9730-80 · CD T#2 • FUJITSU 2280 · KENNEDY 5380, 7380 • AMPEX DM 980, SCORPIO-80 • TECSTOR 85 · MEGAVAULT 85 (DOWNSIZED TO ZEBRA) 50 MB/24S	
1	• CDC 9766 · MEMOREX 677-30 • CENTURY 315, T306 • TECSTOR 300 300M/32S	• CDC 9448-32 • AMPEX DFR 932 (REMOVABLE =1, FIXED =0) 16/16 MB/32S	• CDC 9766 · MEMOREX 677-30 • CENTURY 315, T306 • TECSTOR 300 (DOWNSIZED TO ZEBRA) 192 MB/24S	
2	• CDC 9730-160 · TECSTOR 165 • CDC FSD · FUJITSU 2284 • AMPEX CAPRICORN 165 • KENNEDY 53160 160 MB/32S	• CDC 9455-16 "LARK" (REMOVABLE =0, FIXED =1) 8/8 MB/32S	• CDC 9762, RSD, 9730 · CD T#2 • FUJITSU 2280 · KENNEDY 5380, 7380 • AMPEX DM 980, SCORPIO-80 • TECSTOR 85 · MEGAVAULT 85 80MB/32S	
3	• CDC 9448 • AMPEX DFR 96 (REMOVABLE =0, FIXED =1) 16/80MB/32S	• CDC 9455-16 "LARK" (REMOVABLE =1, FIXED =0) 8/8 MB/32S	• CDC 9766 · MEMOREX 677-30 • CENTURY 315, T306 • TECSTOR 300 300 MB/32S	
4	• CDC 9448 • AMPEX DFR 96 (REMOVABLE =1, FIXED =0) 16/80MB/32S	• PRIAM 3450 36MB/23S	• CDC 9730-160 · FUJITSU 2284 • CDC FSD · TECSTOR 165 • AMPEX CAPRICORN 165 • KENNEDY 53160 160MB/32S	
5	• CDC 9455-48 "LARK" (REMOVABLE =0, FIXED =1) AMCODYNE 7110 24/24MB/32S	• TECSTOR 200 200 MB/32S	• CDC 9455-16 "LARK" (REMOVABLE =0, FIXED =1) 8/8MB/32S	
6	• CDC 9455-48 "LARK" (REMOVABLE =1, FIXED =0) AMCODYNE 7110 24/24MB/32S	• MEMOREX 677-70 206 MB/23S	• CDC 9455-16 "LARK" (REMOVABLE =1, FIXED =0 8/8MB/32S	
7	• FUJITSU 2294 • AMPEX CAPRICORN 330 330MB/32S	• MEGAVAULT 16 16 MB/32S		
8	• CDC 9410-32 "FINCH" 32 MB/23S	• MEGAVAULT 48 • AMPEX SCORPIO-50 48MB/32S		
9	• FUJITSU 2312 • MEMOREX 214 86 MB/32S	• MEGAVAULT 116 116 MB/32S		
10	• FUJITSU 2311 • MEMOREX 213 48 MB/32S	• CENTURY C2048 (REMOVABLE =0, FIXED =1) 16/32MB/32S		
11	• PRIAM 6650/67 62 MB/32S	• CENTURY C2048 (REMOVABLE =1, FIXED =0) 16/32MB/32S		
12	• PRIAM 15450 • D SCT#06 D.600 145 MB/32S	• CDC 9410-8 "FINCH" 8MB/23S		
13	• PRIAM 804 60 MB/32S	• CDC 9410-24 "FINCH" 24MB/23S		
14	• AMPEX 660 60.J MB/32S	• CDC 9762, 9730-80, RSD • FUJITSU 2280 · KENNEDY 5380, 7380 • AMPEX DM 980, SCORPIO-80 • TECSTOR 85 · MEGAVAULT 85 80MB/32S		
15	· CDC FSD 9715 340Mb/32S	• MEGAVAULT 212 212 MB/32S		

NOTE: BANK 0 RESERVED FOR SELFTEST

Location G5

Throttle Setting of 16, Maintenance Switch
Off, and ECC Enabled Shown.

THROTTLE SETTINGS

SW1	SW2	SW3	NUMBER OF WORDS
ON	ON	ON	2
OFF	ON	ON	4
ON	OFF	ON	8
OFF	OFF	ON	16
ON	ON	OFF	32
OFF	ON	OFF	64
ON	OFF	OFF	128
OFF	OFF	OFF	256

DATA CHANNEL THROTTLE SWITCH
Figure 3.5

BANK & PORT CONFIGURATION
TABLE 3:1   60XX EMULATION
SINGLE DCC MODE

BANK SELECT → 1   2   3   4

SELECT CONFIGURATION (PORT) ↓	CSI PORT 0-3 / DG PORT 2,3	CSI PORT 0-3 / DG PORT 2,3	CSI PORT 0-3 / DG PORT 2,3	CSI E PORT 0-3 (HIGH SPEED) / CSI PORT 2,3
0				
1				
2		CDC 9455-16 (REMOVABLE=0, FIXED=1) * 6.7/6.7 MB / 32S		
3		CDC 9455-16 (REMOVABLE=1, FIXED=0) * 6.7/6.7 MB 32S		
4		PRIAM 3450 30 MB / 23S		
5	AMCODYNE 7110 · CDC 9457 (REMOVABLE=0, FIXED=1) * 20/20 MB / 32S			
6	AMCODYNE 7110 CDC 9457 (REMOVABLE=1, FIXED=0) * 20/20 MB 32S	MEMOREX 677·70 152 MB / 23S		FUJITSU 2351 (AOS) DUAL 6061 *★ 380MB 24/24S
7				FUJITSU 2351 (RDOS) DUAL** 414MB 24/24S
8	CDC 9410-32 28MB / 23S	CDC 9410-32 28MB 21S		
9		CDC 9410-40 35 MB 21S		
10		CENTURY DATA C2048 (REMOVABLE=0, FIXED=1) * 4 28MB / 32S		
11		CENTURY DATA C2048 (REMOVABLE=1, FIXED=0) * 14/28MB / 32S	CENTURY DATA AMS 513 (AOS) DUAL 6061* 380MB 24/24S	
12		CDC 9410-8 7MB / 23S		AMS 4830-404 (RDOS) 4835-404 DUAL *★ 324MB / 32/32S
13		CDC 9410-24 21MB / 23S	PRIAM 7050 61MB / 23S	
14			PRIAM 3450 30 MB / 23S	
15			CDC·9412 63 MB / 32S	

ASSOCIATED BLOCKS INDICATE FORMATTED CAPACITY
IN MEGABYTES (MB) & NUMBER OF SYSTEM SECTORS (S)

* CMD (REFER TO SECTION 3.2.5)
** CONFIGURABLE IN SINGLE OR DOUBLE UNITS (SEE SECTION 3.2.5 FOR EXPLANATION)

BANK & PORT CONFIGURATION
TABLE 3.1 60XX EMULATION
SINGLE DOC MODE

BANK SELECT →

SELECT CONFIGURATION (PORT)	5 — CSI PORT 0-3 / DG PORT 2,3	6 — DG PORT 0-3 / CSI PORT 2,3	7 — ALT 1 PORT 0-3 / CSI PORT 2,3
0	AMPEX DM 80, 30 · CENTURY DATA T82 · CDC 9710, 9730-80, 9762 · FUJITSU 2290 · KENNEDY 5380, 7380 · MEGAVALT 83 · TECSTOR 85 67MB / 325	AMPEX DM 80, 30 · CENTURY DATA T82 · CDC 9710, 9730-80, 9762 · FUJITSU 2290 · KENNEDY 5380, 7380 · MEGAVALT 83 · TECSTOR 85 67MB / 325	AMPEX DM 80, 30 · CENTURY DATA T82 · CDC 9710, 9730-80, 9762 · FUJITSU 2290 · KENNEDY 5380, 7380 · MEGAVALT 83 · TECSTOR 85 67MB / 325
1	CENTURY DATA 300, T306, 315 · CDC 9766 · MEMOREX 677-30 · TECSTOR 300 256 MB / 325	CENTURY DATA 300, T306, 315 · CDC 9766 · MEMOREX 677-30 · TECSTOR 300 256 MB / 325	CENTURY DATA 300, T306, 315 · CDC 9766 · MEMOREX 677-30 · TECSTOR 300 256 MB / 325
2	AMPEX 165 · CDC 9715, 9730-160 · FUJITSU 2284 · KENNEDY 53160 · TECSTOR 165 134 MB / 325	AMPEX 165 · CDC 9715, 9730-160 · FUJITSU 2284 · KENNEDY 53160 · TECSTOR 165 134 MB / 325	AMPEX 165 · CDC 9715, 9730-160 · FUJITSU 2284 · KENNEDY 53160 · TECSTOR 165 134 MB / 325
3	CDC 9448-96 (REMOVABLE = UNIT 0 or 2, FIXED = UNIT 1 or 3) * 13/67 MB / 325	CDC 9448-96 (REMOVABLE = UNIT 0 or 2, FIXED = UNIT 1 or 3) * 13/67 MB / 325	CDC 9448-96 (REMOVABLE = UNIT 0 or 2, FIXED = UNIT 1 or 3) * 13/67 MB / 325
4	CDC 9448-96 (REMOVABLE = UNIT 1 or 3, FIXED = UNIT 0 or 2) * 13/67 MB / 325	CDC 9448-96 (REMOVABLE = UNIT 1 or 3, FIXED = UNIT 0 or 2) * 13/67 MB / 325	CDC 9448-96 (REMOVABLE = UNIT 1 or 3, FIXED = UNIT 0 or 2) * 13/67 MB / 325
5	6061 EMULATION 190 MB 245		6061 EMULATION 190 MB 245
6	6067 EMULATION 50 MB 245		6067 EMULATION 50 MB 245
7	CENTURY DATA T32 67 MB / 325		
8			
9	TECSTOR 200 162 MB / 325		AMPEX 330 268 MB / 325
10		6061 EMULATION 190 MB / 245	
11		6067 EMULATION 50 MB 245	
12			
13			
14			
15			

ASSOCIATED BLOCKS INDICATE FORMATTED CAPACITY IN MEGABYTES (MB) & NUMBER OF SYSTEM SECTORS (S)

* CMD (REFER TO SECTION 3.2.5)

** CONFIGURABLE IN SINGLE OR DOUBLE UNITS (SEE SECTION 3.2.5 FOR EXPLANATION)

BANK & PORT CONFIGURATION
TABLE 3:2   61XX EMULATION
DOUBLE DDC MODE

BANK SELECT →

SELECT CONFIGURATION (PORT) ↓

	1 — CSI PORT 0-3 DG PORT 2,3	2 — CSI PORT 0-3 DG PORT 2,3	3 — CSI PORT 0-3 DG PORT 2,3
0	AMPEX DM 980, 80 · CENTURY DATA T82 · CDC 9710, 9730-80, 9762 · FUJITSU 2280 · KENNEDY 5380, 7380 · MEGAVALT 83 · TECSTOR 85 73MB / 355	AMPEX DFR 932 · CDC 9448-32 (REMOVABLE=0, FIXED=1) ✶ 14/14 MB / 355	NEC 2230 KENNEDY 7340 37MB / 355
1	CENTURY DATA 300 · T306, 315 · CDC 9766 · MEMOREX 677-30 · TECSTOR 300 280MB / 355	AMPEX DFR 932 (REMOVABLE=1, FIXED=0) ✶ 14/14 MB / 355	AMPEX DFR-64 · CDC 9448-64 (REMOVABLE=0, FIXED=1) ✶ 14/44 MB / 355
2	AMPEX 165 · CDC 7715, 7730-160 · FUJITSU 2284 · KENNEDY 53160 · TECSTOR 165 147MB / 355		AMPEX DFR-64 · CDC 9448-64 (REMOVABLE=1, FIXED=1) ✶ 14/44 MB / 355
3	AMPEX DFR 96 · CDC 9448-96 (REMOVABLE=0, FIXED=1) ✶ 14/73 MB / 355		CDC 7775 RDOS VIRTUAL 675MB
4	AMPEX DFR 96 · CDC 9448-96 (REMOVABLE=1, FIXED=0) ✶ 14/73 MB / 355		AMPEX DM 160 147MB / 355
5		TECSTOR 200 176 MB / 355	CDC 9715-340 306 MB / 355
6			✶ NEC 2266 74 MB / 355
7	· AMPEX 330 · FUJITSU 2294 294 MB / 355	MEGAVALT 16 14.7 MB / 355	6122 EMULATION
8			NEC D2220 22 MB / 355
9	· FUJITSU 2312 MEMOREX 214 73MB / 355		PRIAM 3950 30 MB / 355
10	FUJITSU 2311 MEMOREX 213 42 MB / 355		CENTURY DATA AMS 513 (RDOS) 452 MB / 555
11	PRIAM 6650/67 55 MB / 355		
12	· PRIAM 15450 DATA PERIPHERAL C1600 139 MB / 355		DUAL 6161 EMULATION ✶✶ 294 MB / 355
13	PRIAM 804 140 MB / 355		
14	AMPEX 660 587 MB / 355	AMPEX DM 980, 80 · CENTURY DATA T82 · CDC 9710, 9730-80, 9762 · FUJITSU 2280 · KENNEDY 5380, 7380 · MEGAVALT 83 · TECSTOR 85 73MB / 355	
15	CENTURY DATA AMS 380 333 MB / 555	MEGAVALT 212 14 MB / 355	

ASSOCIATED BLOCKS INDICATE FORMATTED CAPACITY IN MEGABYTES (MB) & NUMBER OF SYSTEM SECTORS (S)

✶ CMD   (REFER TO SECTION 3.2.5)

✶✶ CONFIGURABLE IN SINGLE OR DOUBLE UNITS / SEE

BANK SELECT →

BANK & PORT CONFIGURATION
TABLE 3:2 61XX EMULATION
DOUBLE DOC MODE

SELECT
CONFIGURATION
(RT)

	4 CSI PORT 0-3 (HIGH SPEED) CSI PORT 2,3	5 CSI PORT 0-3 DG PORT 2,3	6 DG PORT 0-3 CSI PORT 2,3	7 ALT 1 PORT 0-3 CSI PORT 2,3
0	FUJITSU 2351 (ROOS) (YOU MUST INTERLEAVE HERE) 405 MB / 17S			
1	FUJITSU 2312 MEMOREX 214 73 MB / 35S			
2	FUJITSU 2294 294 MB / 35S			
3	FUJITSU 2280 73 MB / 35S			
4	FUJITSU 2284 147 MB / 35S			
5	FUJITSU 2311 MEMOREX 213 42 MB / 35S		6160 EMULATION 73 MB / 35S	
6			CENTURY DATA 300 - 305, 315 CDC 9766 MEMOREX 677-30 TECSTOR 300 280 MB / 35S	
7			6161 EMULATION 147 MB / 35S	
8	FUJITSU 2351 SLIP 370 MB / 43S	CENTURY DATA T82 73 MB / 35S	CDC 2148-96 (REMOVABLE = UNIT 0 & 2 FIXED = UNIT 1 & 3) ★ 14/73 MB / 35S	
9	6122 EMULATION 277 MB / 35S		CDC 2148-96 (REMOVABLE = UNIT 1 & 3 FIXED = UNIT 0 & 2) ★ 14/73 MB / 35S	
10	DUAL 6122 EMULATION APS 4865 (AOS) ★★ 554 MB / 35/35S			
11	★★ APS 4830-404, 4835-404, 1830-337, 4835-337 (AOS) DUAL 6161 294 MB / 35/35 S			
12			RESERVED	
13	APS 4830-404, 4835-404 (ROOS) ★★ 354 MB / 35/35S		6122 EMULATION 277 MB / 35S	
14	APS 4865 (ROOS) ★★ DUAL 560 MB / 35/35S			
15				

ASSOCIATED BLOCKS INDICATE FORMATTED CAPACITY IN MEGABYTES
(MB) & NUMBER OF SYSTEM SECTORS (S)

★ CMD   (REFER TO SECTION 3.2.5)
★★ CONFIGURABLE IN SINGLE OR DOUBLE UNITS (SEE SECTION 3.2.5
FOR FURTHER EXPLANATION)

3.2.4   SWITCH LOCATION G5 (REFERENCE FIGURE 3.5)

Switch Positions 1, 2 and 3 control the DMA Throttle
Setting (i.e. the number of words that will be transferred
per a Data Channel Access). 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.
Set the desired throttle setting (normally set to 16).

Switch Positions 4, 5, 6 and 7 are used for identification
bits to inform the system of subsystem type under AOS.
(See Figure 3.6).

NOTE: These switches do not apply to RDOS. For RDOS
Switch Positions 4, 5, 6 and 7 should be ON. (See
Figure 3.6).

Switch Position 8 is the ECC Enable Switch. When the ECC
switch is On, on-board error correction and Data Strobe
Early/Late is enabled. 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 the switch Off, ECC corrections must be
handled by the software. The hardware switch overrides
the software enabled/disabled command. (To use the
software commands, the switch must be in the On position.)
When changing the switch from an Off to an On position,
IORESET Switch or Power Off/On must be depressed.
Switch 8 is normally ON.
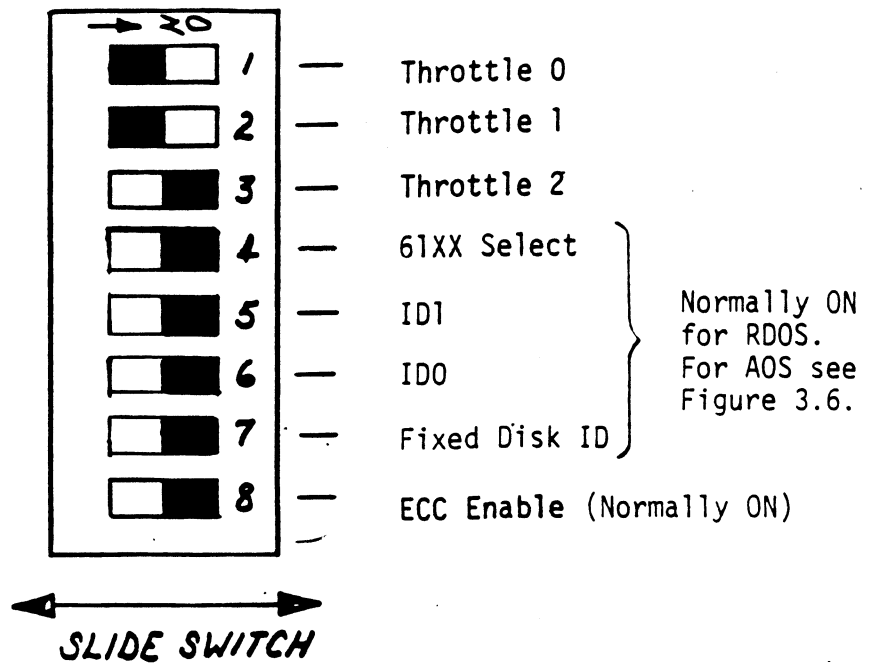
Location G5

Throttle Setting of 16,
RDOS ON, ECC Enabled

THROTTLE SETTINGS

SW1	SW2	SW3	NUMBER OF WORDS
ON	ON	ON	2
OFF	ON	ON	4
ON	OFF	ON	8
OFF	OFF	ON	16
ON	ON	OFF	32
OFF	ON	OFF	64
ON	OFF	OFF	128
OFF	OFF	OFF	256

DATA CHANNEL THROTTLE SWITCH
Figure 3.5

3.2.5   SWITCH LOCATION H5 (REFERENCE FIGURE 3.7)

Switch Position 1 and 2 should be ON in all cases (AOS and RDOS). Switch 3 enables looping on any subsection of selftest that is failing. In the OFF position you receive a short selftest. Switch 3 is normally OFF. With Switch 3 on you receive sector slip (requires special software to be written).

Switch 4 and 5 are used to inform the Microprocessor that the Dual Unit* is attached (Dual Unit* indicates two volumes, fixed and removable). Examples of two Unit Drives are the Lark I (9455-16), Lark II (9457), Amcodyne 7110 and CDC CMD (9448 Series). Dual units* (fixed/removable) are marked on Tables 3.1 and 3.2 with one asterisk (*).

If a Dual Unit is to be connected, the Drive(s) unit number plug must be an even number. A Dual Unit is treated as two logical units, so a maximum of two Dual Units; or one Dual Unit and two other Drives can be connected. The Sector Switch Setting within the Disk Drive is shown·in the System Sector Block in the lower right hand corner of Tables 3.1/3.2. See Section 3.8.2 for special considerations for the CDC 9457 Lark II.

The terms "Dual"** and "Virtual" are used in Tables 3.1 and 3.2. "Dual"** is identified with two asterisks (**) on Tables 3.1 and 3.2. These terms refer to the way a disk drive sectors are accessed to make more efficent use of particular disk drives under AOS and RDOS. A dual select configuration port splits a disk drive's physical number of sectors in half and either doubles the units seen by the system or doubles the number of cylinders seen by the system. As an illustration, let C = number of physical cylinders, S = number of physical sectors, H = number of physical heads, and U = number of physical units of the characteristics of a disk drive. If the CMD switch (H5 SW.4 or 5) is on then the system will see number of cylinders = C, number of sectors = (1/2)S, number of heads = H, and number of units = 2U. If the CMD switch is off then the system will see number of cylinders = 2C, number of sectors = (1/2)S, number of heads = H, and number of units = U.

A dual configuration is exemplified by the Fujitsu 2351 (Reference to table 3.1 Bank Select 4, Configuration Select 7). The 2351's physical characteristics are 842 cylinders, 48 sectors, 20 heads. Under the dual configuration the 2351 could be seen in two ways by the system. First, if the CMD switch (H5#4 or #5) is on, the system will see two identical units under RDOS each with 842 cylinders, 20 heads, and 24 sectors. Second, if the CMD switch is off, the system will see one unit with 1684 cylinders, 20 heads, and 24 sectors under RDOS. (Use Bank Select 4 Configuration Select 6 for AOS. You may use 2 logical units only for AOS.)

	HDS	CYL	SEC	
Actual Drive Characteristics	20	842	48	"DUAL"
CMD, OFF 1 logical unit	20	1684	24	Sample of Fujitsu 2351 (RDOS)
CMD, ON 2 logical units	20	842	24	
	20	842	24	
Actual Drive Characteristics	40	843	35	"VIRTUAL"
CMD, OFF 1 logical unit	20	1686	35	Configuration CDC 9775 (RDOS only)
CMD, ON 2 logical units	20	843	35	
	20	843	35	

A virtual select configuration port splits a disk drive's physical number of heads in half and either doubles the number of units or doubles the number of cylinders seen by the system depending again on the CMD switch (H5#4 or #5). Referring to Table 3.2, Bank select 3, configuration select 3- presently the CDC 9775 has "virtual" capabilities under RDOS. The 9775 has physical characteristics of 843 cylinders, 40 heads, and 35 sectors. If the CMD switch (H5#4 or #5) is on, then the system will see two identical units each having 843 cylinders, 20 heads, and 35 sectors under RDOS. If the CMD switch (H5#4 or #5) is off, then the system will see one unit having 1686 cylinders, 20 heads, and 35 sectors under RDOS.

NOTE: When the CMD switch is ON you must format 2 units.

ID SWITCH SETTINGS FOR 61XX AND 60XX EMULATIONS UNDER AOS
NOTE: For RDOS all Switches should be ON.
(SWITCH IS LOCATED AT BOARD COORDINATES G5 AND H5)

LOCATION G5   LOCATION H5

Switch Pos.

	7 OFF = FIXED DISK	6 ID 0 OFF=73MB ON=147MB	5 ID 1 OFF=73MB ON=147MB	4 ON = 6214 ON = 616X OFF = 6122		2 IDO ON=6161 OFF=6214	1 ON=6161 OFF=2614
6160	OFF	OFF	OFF	ON		ON	ON
6161	OFF	ON	ON	ON		ON	ON
6122	ON	ON	ON	OFF		ON	ON
6060 6061 6067	ON	ON	ON	ON		ON	ON
RDOS	ON	ON	ON	ON		ON	ON

6160 - 35 Sectors   6060 - 24 Sectors
         5 Heads   19 Heads
       823 Cylinders   411 Cylinders
        73 Mega Bytes Formatted   96 Mega Bytes Formatted

6161 - 35 Sectors   6061 - 24 Sectors
        10 Heads   19 Heads
       823 Cylinders   815 Cylinders
       147 Mega Bytes Formatted   190 Mega Bytes Formatted

6122 - 35 Sectors   6067 - 24 Sectors
        19 Heads   5 Heads
       815 Cylinders   815 Cylinders
       277 Mega Bytes Formatted   50 Mega Bytes Formatted

FIGURE 3.6   3-20
AOS SWITCH SETTINGS

Switch			
1	—	600 ID1 ⎫	Switch 1 and 2 Normally ON for RDC
2	—	600 ID0 ⎬	I.D. Bits for AOS (See Figure 3.6)
3	—		Sector Slip and Maintenance Switch (Normally OFF)
4	—		Dual Volume Unit 0,1
5	—		Dual Volume Unit 2,3
6	—		DOC Mode (See Section 3.2.5) OFF for Double DOC
7	—		Maintenance Switch (Normally ON)
8	—		Interleave (Normally OFF)
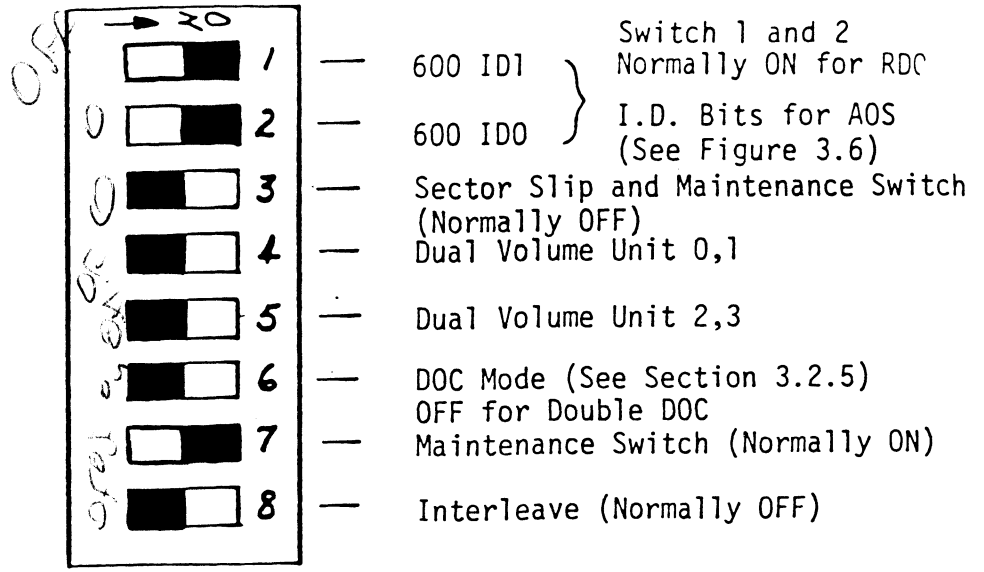
SLIDE SWITCH

Location H5

I.D. Bits, Maintenance Switch OFF, No CMD's, Double DOC
Enabled,   Maintenance Switch ON, Interleave OFF

INTERLEAVE, CMD, SECTOR VERIFY SWITCHES

Figure 3.7

If a Dual Volume Drive has logic plug 0 installed then Switch 4 must be ON and Switch 5 OFF. If a Dual Volume Drive has logic plug 2 installed then Switch 4 must be OFF and Switch 5 ON. If there are not any Dual Volume Drives, then both Switch 4 and 5 must be OFF.

Switch 6 is for the Single DOC or Double DOC Mode. Single DOC applies to 32 sectors or less (when in a single volume). RDOS Revision 6.7 or less is used for Single DOC. Double DOC applies to 33 to 64 sectors. Double DOC Mode requires RDOS Revision 7.0 or greater. The 295C is factory set for Double DOC unless otherwise specified. See Tables 3.1/3.2 to identify your Drive and its DOC Mode setting. Remember when using RDOS 6.7 or less you must choose Single DOC. If this switch is ON then you are in the Single DOC Mode. If this switch is OFF then you are in the Double DOC Mode (see *NOTE).

AOS

Single DOC is 6060, 6061, 6067

Double DOC is 6160, 6161, 6122

*NOTE: Single DOC Mode requires W6-1 and W6-2 be removed.
        Double DOC requires W6-2 be in and W6-1 should
        still be removed. W6-1 and W6-2 are located by
        F2 on the controller board.

Switch 7 controls the run time of Selftest. When the
switch is On, the short verison of the RAM test is run.
When the switch is Off the long version of the RAM test
is run. Normally Switch 7 is ON.

Switch 8 enables the sector interleaving feature. When
Switch 8 is ON it enables sector interleaving by a factor
of 3. See Figure 3.9 for 32 sector example. This
interleave factor eliminates the need for surface spiral
and is restricted to operation with the number of sectors
that meets the following equation:

$$(X + 1)/3 = 0 \text{ Remainder}$$

Where X = The desired number of sectors on the drive.

Interleaving may be desired to fine tune a systems performance.
This is to avoid going a full revolution on the disk
when the CPU cannot respond fast enough to catch the
next sector. Only the drive at Bank 4, Select Configuration
0 utilizes the interleave. Insure Swtich 8 is on when
using Bank 4, Select Configuration 0.

When Switch 8 is in the OFF position the sector inter-
leaving feature is disabled. Normally Switch 8 is OFF.

3.2.6   RELEASE DRIVE COMMAND ENABLE/DISABLE

The "Release Drive" command is used in dual processor
applications to direct the controller to clear the reserved
condition of the specified drive. The standard configuration
of the controller is to ignore this command to maintain
fast response to unit selection for high speed processors.
If the controller is to be used with a dual-port drive in
dual processor applications, the Release function must be
enabled as follows:

To enable Release Drive command:

Locate the IC (74LS367) at coordinates G10 on the PC
board. Locate pin 4 of the IC (Figure 3.7.1). Using a
cutter plier, snip pin 4 of the G10 near the bottom of
the pin and bend it up, disconnecting it from the PC board.
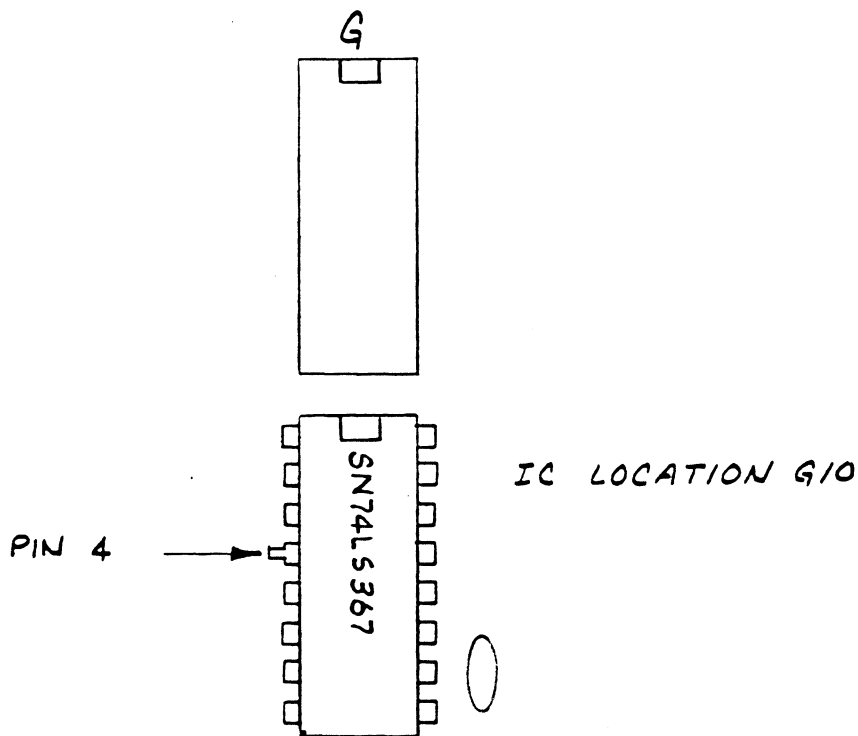
RELEASE DRIVE COMMAND ENABLE

Figure 3.7.1

3.3   BOARD INSERTION

The 295C SMD is to be installed only after inspection
and switch settings are verified. Carefully guide
the controller board into the desired slot by allowing
the edges of the board to follow the guides evenly.
Use the lock tabs on the two outside corners to provide
leverage when the board meets the connector. Use equal
pressure on both lock tabs until the board seats firmly
into the backplane connectors.

3.4   PRIORITY SELECTION

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 in the
vacant slot(s) to obtain priority continuity between
controllers. To jumper across unused slots, connect A93
(data channel priority out) to A94 (data channel priority
in) and A95 (interrupt out) to A96 (interrupt priority
in). Reference your Data General Manual for additional
information if needed.

3.5   POWER FAIL PROTECTION

The 295C Disk Controller contains a double protection power fail scheme. The Data General CPU outputs a signal called "Power Fail" which gives an early warning of power loss. This is used on the 295C to disable the drives write circuitry through the open cable detect line.

To enable this power fail protection connect A47 of the 295C backplane slot to Pin A5 of a Nova 3 CPU backplane slot or A9 on a Nova 4 power supply slot.

In addition, the 295C contains power fail circuitry to further protect drive data integrity in the event the slot where the board is installed loses power.

3.6   CABLING

Reference Figure 3.8 for proper cable connection and Figure 3.1 for Header Orientation.

BE SURE TO OBSERVE THE ARROWS ON THE HEADERS AND PLUGS FOR PROPER ORIENTATION (see Figure 3.1.1). As shown in Figure 3.8, the 60 Pin "A" Cable connects between J1 and the first drive and continues from drive to drive in a daisy chain fashion. The last drive in the chain must have a terminator installed in place of the daisy chain cable.

Each drive must have a 26 Pin "B" Cable connected between the drive and the controller (J2-J5) in a radial fashion.

CPU

295C DISK

CONTROLLER

A	0	1	2	3

Term.

A	A	B
DRIVE

A	A	B
DRIVE

A	A	B
DRIVE

A	A	B
DRIVE
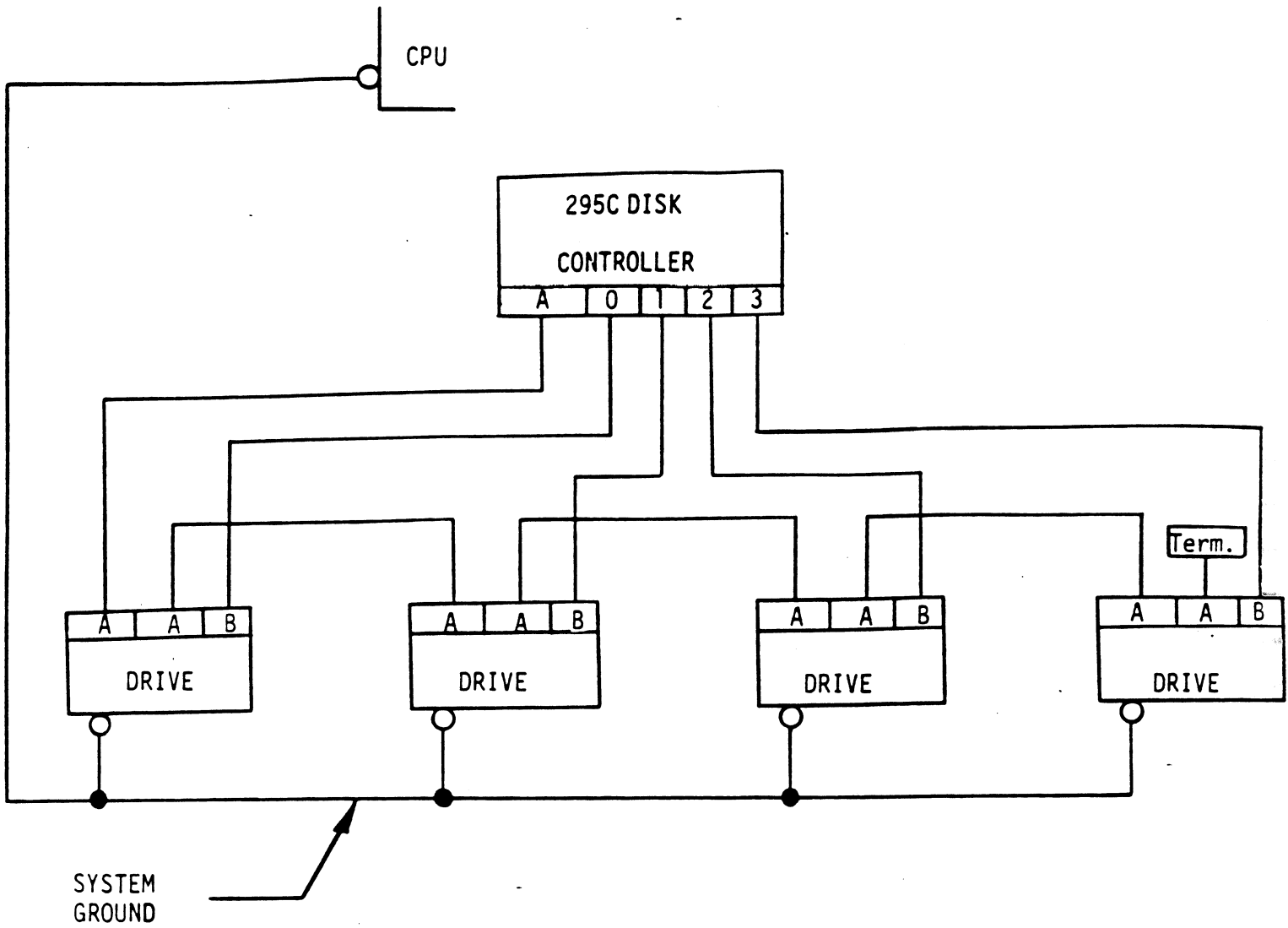
SYSTEM
GROUND

DAISY-CHAINING DRIVES

Figure 3.8

Insure that the port configuration switches match the corresponding drive type plugged into its port.

Refer to the Drive Manufacturer's Manual for proper subsystem grounding if required.

3.6.1   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 drive(s) must be connected to a single-point ground system. 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 component 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 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.

3.7   DRIVE PICK-HOLD

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.

INDEX
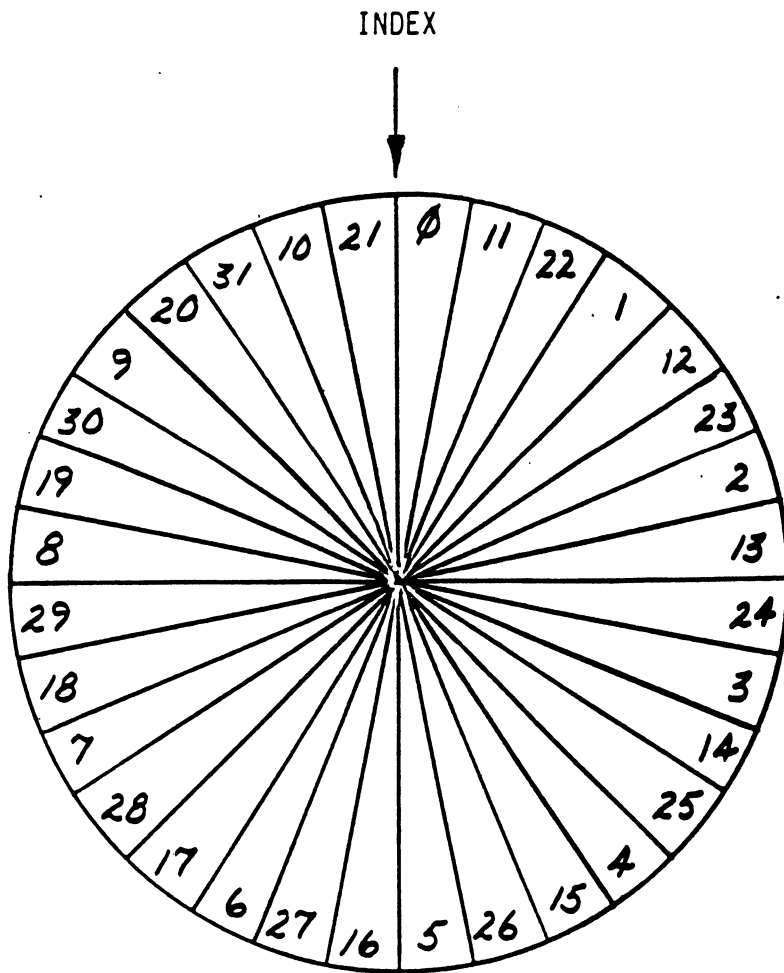
EXAMPLE FOR 32 SECTOR DISK

Figure 3.9

3.8   POWERING UP

Turn System power ON. The 295C will perform an initial "Selftest" by briefly lighting a red LED. A good test is indicated by the LED turning OFF. For more details refer to Section 5.0. Once a good test is indicated, format your Disk. We recommend using the CSI format due to its added features of; more error checks on header, conforms to necessary drive characteristics and does not require patching. For CSI Disk Formatter refer to Section 4.0, 4.2 and Appendix A. For the next installation step (RDOS) we recommend running Disk Reliability in order to exercise and test the disk system. Refer to Section 4.3 and Appendix A. If you are using AOS we recommend you run Diagnostics in addition to Reliability. Under AOS run Diagnostics first and Reliability second. Refer to Diagnostics Section 4.1. The final step involves the use of CSDKINIT for RDOS or DFMTR for AOS. Before you load any RDOS or AOS onto a Model 295C disk you must initialize the disk by running CSDKINIT (RDOS) or DFMTR (AOS). For CSDKINIT refer to Section 4.4. For DFMTR refer to Data General's Manual.

3.8.1 SPECIAL CONSIDERATIONS FOR FUJITSU 2351 SECTOR SELECTION

When setting up the sector switch settings within the Fujitsu 2351 Eagle add one sector to the system sector block in Table 3.1/3.2. For Example, Bank 4, Select Configuration 0 (see Table 3.2) indicates 47 sectors. The sector switch setting within the Fujitsu Eagls should be set to 48. With the Fujitsu Eagle set at 48 your characteristics with the CSI format will indicate 20 heads, 842 cylinders and 47 sectors.

For Bank 4, Select Configuration 6, 7 and 8 you should also have one sector added when configuring the sector setting within the Fujitsu Eagle. Adding one sector is only true for the Fujitsu 2351 Eagle. When setting up the sector switch settings within a Disk Drive use the sector indicated in the small Block in the lower right hand corner of each Bank and Select Configuration (Port) shown on Tables 3.1/3.2. When Dual emulations or Dual volumes are used add the two sectors together. For example, (Table 3.2) Bank 4, Select Configuration 11 the APS sector switch setting would be 70.

3.8.2 SPECIAL CONSIDERATIONS FOR CDC 9457 (LARK II)

Insure options W-4 and W-8 are installed.

3.9   SYSGEN

Listed below is an example of part of the RDOS System Generator.

1. Number of 6060/6061/6067/6122/6160/6161 Disk Controllers (0-2)

2. Device Primary ("0") or Secondary ("1")

3. Controller #1 6160/6161 Type? ("0"=NO, "1"=YES)

4. Number of Devices for Controller #1 (1-4)

5. Number of other types of Moving Head Disk Controllers (0-2)

6. Device Primary ("0") or Secondary ("1")

NOTE: On line 3 answer NO when using RDOS. When you answer NO you allow up to four Disk Drives (6160 or 6161) to be connected to the 295C. If you answer YES you allow only two Disk Drives (6160 or 6161) to be connected.

SUB-TABLE OF CONTENTS

4.0 DIAGNOSTICS AND SOFTWARE

There are three levels of diagnostics; On-board Selftest, System Diagnostics and System Reliability Programs. Included in the 295C package is a Master M248 tape containing these diagnostics and other CSI supplied software.

To load a program from the tape you should:

Mount 400-284-00 tape on drive.

Set console switches to 100022 or 100062.

Press RESET and then LOAD switches.

(See Appendix A for specific Program Load Procedures)

The 400-284-00 tape menu will be displayed:

FILE #	PROGRAM
2	Disk Diagnostic
3	Disk Formatter
4	Disk Reliability
5	CSDKINIT – Disk Initializer
6	CSDSKED – Stand-alone Disk Editor
7	Previous "SV" and "TX" Files in Dump Format
8	ECC Programs in Dump Format: RDOSECC.SV – for RDOS AOSECC.PR – for AOS

File # (CR):

You should enter the file number of the program you wish to execute for files 2, 3, 4, 5 or 6.

To load files from file 7 or 8, use the standard CLI commands:

LOAD/R/V MTO:N   (for RDOS)

X RDOS LOAD/V @MTAO:N +.SV +.PR +.TX/C   (for AOS)

4.1   DISK DIAGNOSTIC

This diagnostic program is provided to find failures
that are related to the basic operations of the
Disk Controller. The ID Bits (AOS) shown in the sample
below will aid in checking the switch settings. Switch
settings for AOS are described in the Installation
Section, Figure 3.6.

Load the program from the tape provided. (See 400-284-00 tape
loading in Section 4.0).

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

C.S.I...DISK 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):

ANY DUAL VOLUME UNITS?   ENTER 1

ENTER UNIT NUMBERS (0,1,2,3) TO RUN: 0,2

SET SWPAK AS PER 8.0, OR HIT (CR) TO CONT.

TESTING UNIT 0

MAX # OF SECTORS/TRACK WITH THIS CONTROLLER IS 64.
--6122 I.D. BIT--
DIB BIT 7 = 0
--6160, 6161 & 6214 I.D. BITS--
ALT1 DIB BIT 1 = 1
ALT1 DIB BIT 2 = 1
ALT1 DIB BIT 3 = 1
ALT1 DIB BIT 6 = 0
ALT1 DIB BIT 7 = 0

UNIT	HDS	CYLS	SEC/TRK	FORMAT
0	5	823	35	C.S.I.

These are the units and characteristics found, do you
want to loop on reading them? Enter 1. See Diagnostic
Text at the end of the Manual for further details.   4-2

4.2   DISK FORMATTER

The Disk Formatter Program is a utility designed program to format and check Disk Packs to be used on the Disk Systems.

The following is a sample dialogue:

C.S.I...DISK 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

CONTROLLER ECC CORRECTION IS ENABLED

DO YOU WANT TO SOFTWARE DISABLE (YES/NO)?   YES

UNIT	TYPE	HDS	CYLS	SEC/TRK	FORMAT
0	0	5	823	32	D.G.
2	1	5	815	24	D.G.

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.

4.3   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.

The following is a sample dialogue:

C.S.I...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

NOVA 3 TOTAL OF 1K'S = 64

START TIME? - MON,DAY,YR HR,MIN

ANY DUAL VOLUME UNITS (YES/NO)?   NO

CONTROLLER ECC CORRECTION IS ENABLED

DO YOU WANT TO SOFTWARE DISABLE (YES/NO)?   NO

UNIT	TYPE	HDS	CYLS	SEC/TRK	FORMAT
0	0	5	823	32	D.G.
2	1	5	815	24	D.G.

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
TESTING UNIT 0,2
See Reliability Text at the end of Manual for further details.

4.4   CSDKINIT - RDOS DISK INITIALIZER

Initializing a Model 295C Disk -

Before you load any RDOS system onto a Model 295C 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 295C 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 295C disk. CSDKINIT can, however, be
used to initialize any DG supported disk.

STEP 1 - LOADING

A) If loading from a M248 tape:

Perform the steps described for loading M248 tape in
Section 4.0.

YOU RESPOND:

     5

B) If loading from disk: (CSDKINIT.SV must have been
                             previously loaded onto the disk.

Mount the disk pack which contains CSDKINT.

Set console switches to correct device code.

Press RESET and LOAD switches.

PROGRAM DISPLAYS:

FILENAME?

YOU RESPOND:

> CSDKINIT or (DIR:CSDKINT, if the program file is
> located in directory, DIR, other than the
> master).

STEP 2 - DISK TYPE

PROGRAM DISPLAYS:

> DISK INITIALIZER - REV. NN.NN/with C.S.I. 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 (CSI 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 - ECC CORRECTION

CSDKINIT will allow you to disable/enable ECC correction
on the controller, if it is currently enabled/disabled
via software. If ECC correction is disabled in the
hardware, this cannot be changed.

For most situations it is recommended that you software
disable ECC correction while running CSDKINIT. This
will allow the initializer to flag those bad blocks which
are potential problems even though they might be
correctable at the time of running CSDKINIT. However,
it is also possible to run with ECC correction enabled
in cases where there is a need for using marginal media.

The three possible dialogues are:

A)   PROGRAM DISPLAYS:

    CONTROLLER ECC CORRECTION IS HARDWARE DISABLED.

    YOU RESPOND:

       NONE

B)   PROGRAM DISPLAYS:

    CONTROLLER ECC CORRECTION IS ENABLED.

    DO YOU WANT TO SOFTWARE DISABLE?   (YES/NO)

    YOU RESPOND:

       YES   To disable ECC correction while running
                     CSDKINIT

       NO   To leave ECC correction enabled while
                     running CSDKINIT

C)   PROGRAM DISPLAYS:

    ECC CORRECTION IS SOFTWARE DISABLE.

    DO YOU WANT TO ENABLE?   (YES/NO)

    YOU RESPOND:

       YES   To enable ECC correction while running
                     CSDKINIT

       NO   To leave ECC correction disabled while
                     running CSDKINIT

STEP 5 - 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.

CSDSKED provides the same functions for the 295C 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

A) If loading from a 400-284-00 Tape:

Perform the steps described for loading 400-284-00 tape in

Section 4.0.

YOU RESPOND:

    5

B) If loading from disk: (CSDSKED.SV must have been
                            previously loaded onto the
                            disk).

Mount the disk pack which contains CSDSKED.

Set console switches to correct device code.

Press RESET and LOAD switches.

PROGRAM DISPLAYS:

    FILENAME?

YOU RESPOND:

    CSDSKED or (DIR:CSDSKED, if the program file is
               located in directory, DIR, other than
               the master).

STEP 2 - DISK TYPE

PROGRAM DISPLAYS:

    DISK EDIT - REV NN.NN WITH C.S.I. 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 (CSI 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 - ECC CORRECTION

CSDSKED will allow you to disable/enable ECC correction
on the controller, if it is currently enabled/disabled
via software. If ECC correction is disabled in the
hardware, this cannot be changed.

The three possible dialogues are:

A) PROGRAM DISPLAYS:

      CONTROLLER EC CORRECTION IS HARDWARE DISABLED

    YOU RESPOND:

      NONE

B) PROGRAM DISPLAYS:

      CONTROLLER ECC CORRECTION IS ENABLED

      DO YOU WANT TO SOFTWARE DISABLE? (YES/NO)

    YOU RESPOND:

      YES   To disable ECC correction while running
              CSDSKED

      NO   To leave ECC correction enabled while
              running CSDSKED

C) PROGRAM DISPLAYS:

      ECC CORRECTION IS SOFTWARE DISABLED

      DO YOU WANT TO ENABLED? (YES/NO)

    YOU RESPOND:

      YES   To enable ECC correction while running
              CSDSKED

      NO   To leave ECC correction disabled while
              running CSDSKED

STEP 5 - 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.

The Model 295C controller maintains a counter of ECC corrections for each 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 CSI supplied ECC program (RDOSECC.SV for RDOS and AOSECC.PR for AOS) allows 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

CUSTOM SYSTEMS - ECC FUNCTIONS

1 - DISPLAY CONTROLLER ECC CORRECTIONS

2 - RESET CONTROLLER ECC CORRECTIONS

3 - STOP

NOTE - SELECT ONLY THOSE DRIVES WITH CSI 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.

SUB-TABLE OF CONTENTS

5.0   TROUBLESHOOTING

Selftest checks out all the internal functions of the controller board once for every time power is applied to the board. If short RAM test is enabled the test takes approximately 300 MS. If long RAM test is selected (See Section 3.4.2 for switch setting) the test takes one minute.

If Selftest passed, the red LED will go out. If a failure was detected, the LED will blink a repetitious code indicating the subtest and corresponding circuit that failed.

Looping on error can be achieved by setting SW1 at H5 (See Section 3.4.2) and depressing the I/O reset switch which causes the microprocessor to loop on that particular subtest.

Looping on Selftest can be achieved by setting SW7 on F2 (See Section 3.2.1) which causes the microprocessor to continuously loop on the entire Selftest unless an error occurs. The LED will pulsate on each pass.

Reference Table 5.1 for Selftest Error Codes.

CODE	TEST	POSSIBLE FAILURE
1	REGISTER TEST	The data in register F did not compare with register Q. 2901 or 2902 may be bad.
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	CONDITION FF, BIT TEST AND 32 BIT SHIFT TEST	The state of the condition flip flops were not correct. Command Full, Busy, Done, Control Full, Overflow (2901), DCHDN (2940) may be bad. The bit testing logic may have failed. The bit shifting mechanism may have failed. (2901)
5	SEQUENCE ERROR TEST	A forced sequence error did not occur within a specified amount of time. Format sequencer may be bad. (No Clock)
6	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.
7	ECC TEST	The generated ECC pattern did not compare with the expected pattern. The shift registers, ECC logic, or multiplexers may be bad.

If the Selftest LED does not blink or go out, then the 2925 clock circuitry or the 2910 might be bad.

SELFTEST ERROR CODES

TABLE 5.1

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
Custom Systems 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 the Custom Systems for repair, please
ask for a "Returned Material Authorization" number. Each
product returned requires a separate RMA number. Use of this
number is 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 Custom Systems,
Inc. 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 character-
istics, and the user system configuration. Checkout results for the
295C SMD Controller should be obtained by performing the following
tests. (Include error program counter numbers and accumulator
contents if applicable).

FUNCTION	TEST	RESULT
SMD	Selftest	
	Diagnostics	
	Reliability	

Other test performed:

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)

SUB-TABLE OF CONTENTS

6.0   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 by switches)

BINARY REPRESENTATION OF AN I/O INSTRUCTION

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	1	1	AC		OP CODE		FUNC		DEVICE CODE						
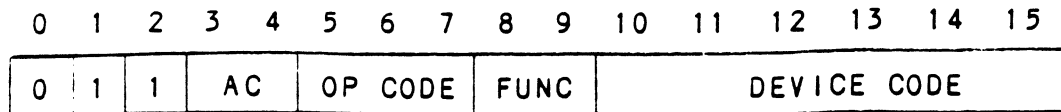
INTERRUPT MASK   BIT 7

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

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

Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R/W DN	CLR SEEK DONE				COMMAND				DRIVE		NOT USED				

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

0000	READ	START
0001	RECALIBRATE	PULSE
0010	SEEK	PULSE
0011	STOP DISC	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

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

Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
MEMORY ADDRESS BITS															
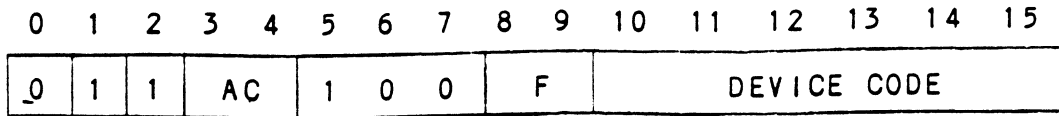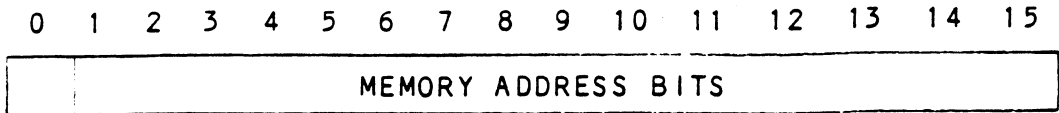
↑— EXTENDED MEMORY ADDRESS BIT

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

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

Accumulator (if previous DOA specified a Seek)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NOT USED						CYLINDER ADDRESS									
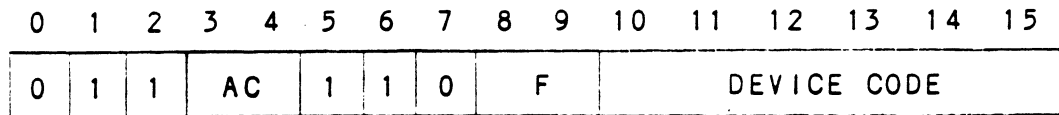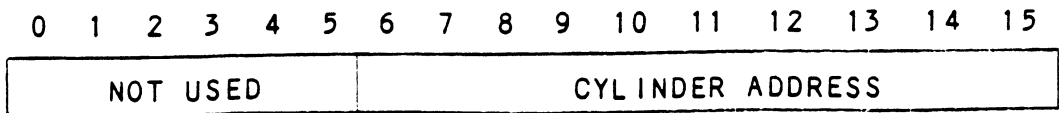
6.2.3.2 DOC - FIRST DOC SPECIFIES EXTENDED SURFACE, SECTOR AND COUNT (DOUBLE DOC MODE ONLY)

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

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				HD MSB	SEC MSB					CNT MSB					
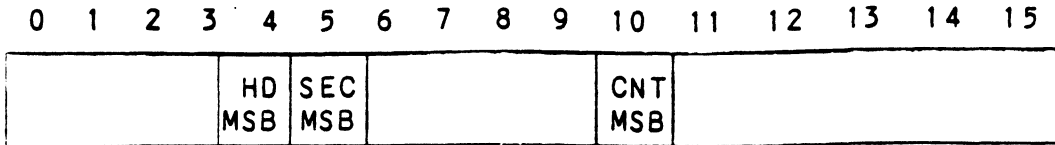
6.2.3.3 DOC - SECOND DOC SPECIFIES LOWER FIVE BITS OF SURFACE, SECTOR AND COUNT (FIRST AND ONLY DOC IF SINGLE DOC MODE)

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	SURFACE ADDR					SECTOR ADDR					COUNT				
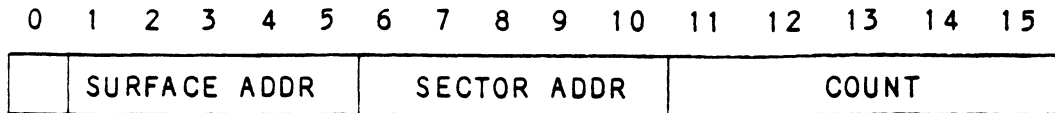
0 -   Not Used

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					
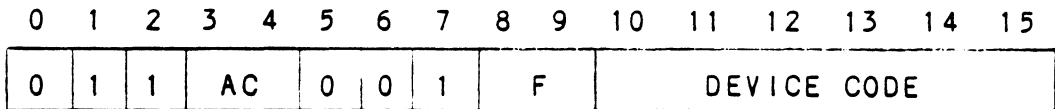
Accumulator

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

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 ed. 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 detailed description.

	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. Check the drive characteristic switches to make sure it agrees with 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 operation 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 switch settings 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 more detailed description.

6.2.4.3 DIC - READ SURFACE, SECTOR AND COUNT

DICF AC, DSKP

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

Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
NU	CURRENT SURFACE ADDR						CURRENT SECTOR ADDR				TWO'S COMPLEMENT OF NUMBER OF SECTORS REMAINING				

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

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EXT	CURRENT MEMORY ADDRESS														
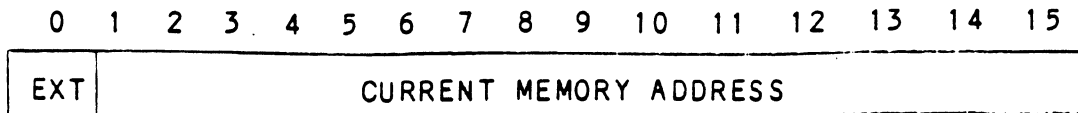
After the execution of this instruction the value of the accumulator will contain the memory address to where the next data word transfer will take place. The memory address counter is incremented by one after each data channel transfer.

6.2.5.2 DIB - READ EXTENDED MEMORY ADDRESS

DIBF AC, DSKP

Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
				HD MSB	SEC MSB					CNT MSB					
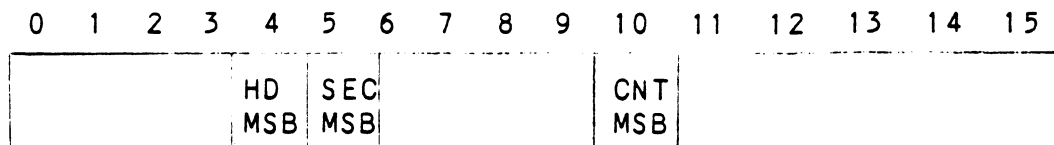
The AC will contain the current most Significant Bits for the Surface (Bit 4), Sector Address (Bit 5) and Two's Complement Count (Bit 10). These Bits will allow the System to reference up to 64 heads or sectors.

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.

	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

6.2.6.1 DIA - READ ECC REMAINDER UPPER

DIAF AC, DSKP

Accumulator

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
31 X	30 X	29 X	28 X	27 X	26 X	25 X	24 X	23 X	22 X	21 X	20 X	19 X	18 X	17 X	16 X

6.2.6.2 DIB - READ ECC REMAINDER LOWER

DIBF AC, DSKP

Accumulator

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

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 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 drives 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 switch was
closed (refer to switch settings), 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 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 proceeded 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 6.2 for format details. Format is also
used to set the bad sector flag.

6.3.1.5 READ BUFFERS

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

6.3.2   DRIVE COMMANDS

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

6.3.2.1 RECALIBRATE

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

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

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

6.3.2.2 SEEK

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

See the SMD specification for the Seek Timing.

6.3.2.3 OFFSET FORWARD

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

6.3.2.4 OFFSET REVERSE

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

When enabled, this command clears the reserved condition of the specified drive which the processor had previously reserved. When disabled, the controller ignores this command, thereby allowing the controller to be used with very high speed processors requiring fast response to unit selection.

If dual processor operation is required, this command must be enabled per the instructions in Section 3.2.6.

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 timout 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 295C controllers memory. This command must be proceeded by a DOC containing the address of the desired RAM location.

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. Features that may be considered in the future.

DETAILED DESCRIPTIONS OF USER RAM LOCATIONS

OCTAL ADDRESS	NAME	DESCRIPTION
1422	DISABLE CORRECTION	The least significant bit is used to indicate if controller self corrections are permitted. This bit will be initialized on a power on or an IORESET switch. If the ECC switch (G5 SW Position 8) is on it will be initialized to a zero, if it is off it will be initialized to a one. If one is written into this bit, correction will be software disabled. Correction cannot be software enabled if the ECC Enable switch is off.
1460-1462	SELECTED DRIVE CHARACTERISTICS	These locations will be updated whenever 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	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

1776-8 EPROM REVISION LEVEL

DIC ACCUMULATOR

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

EXAMPLE: Revision Level 6 EPROMS

Location 1776-8 = 000006-8

1777-8 PROM ID/REV

DIC ACCUMULATOR

0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0	R E S	IDENTIFICATION						REVISION LEVEL							

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.

256 — Reserved for future Drives

DRIVE
CHARACTERISTICS

DRIVE TYPE 2
DRIVE TYPE 1
DRIVE TYPE 0

128 —

FORMAT

ALT FORMAT

READ/WRITE

64 —

FORMAT

MAIN FORMAT

READ/WRITE

0000 —

BANK 1
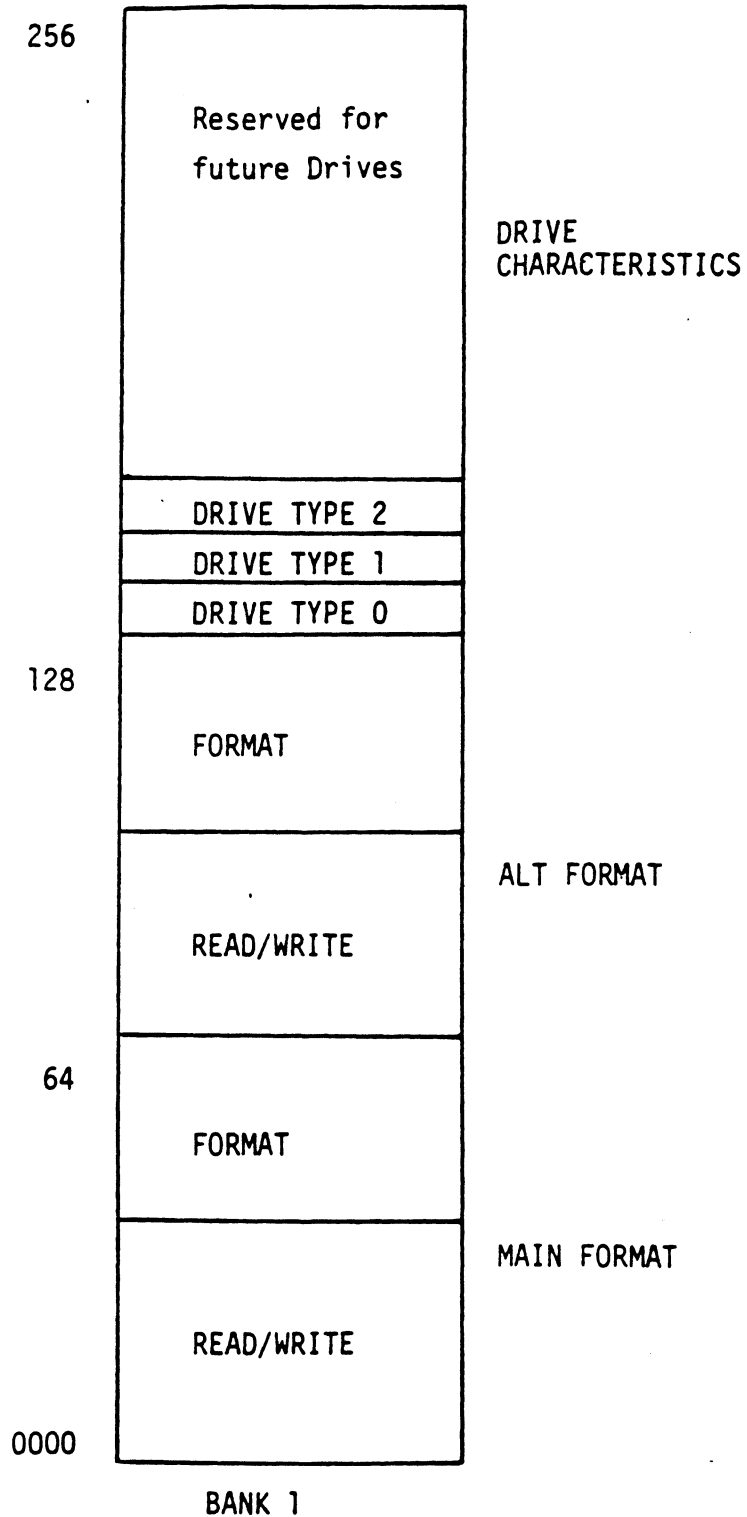
FORMAT SEQUENCER EPROM MAP

Figure 6.1
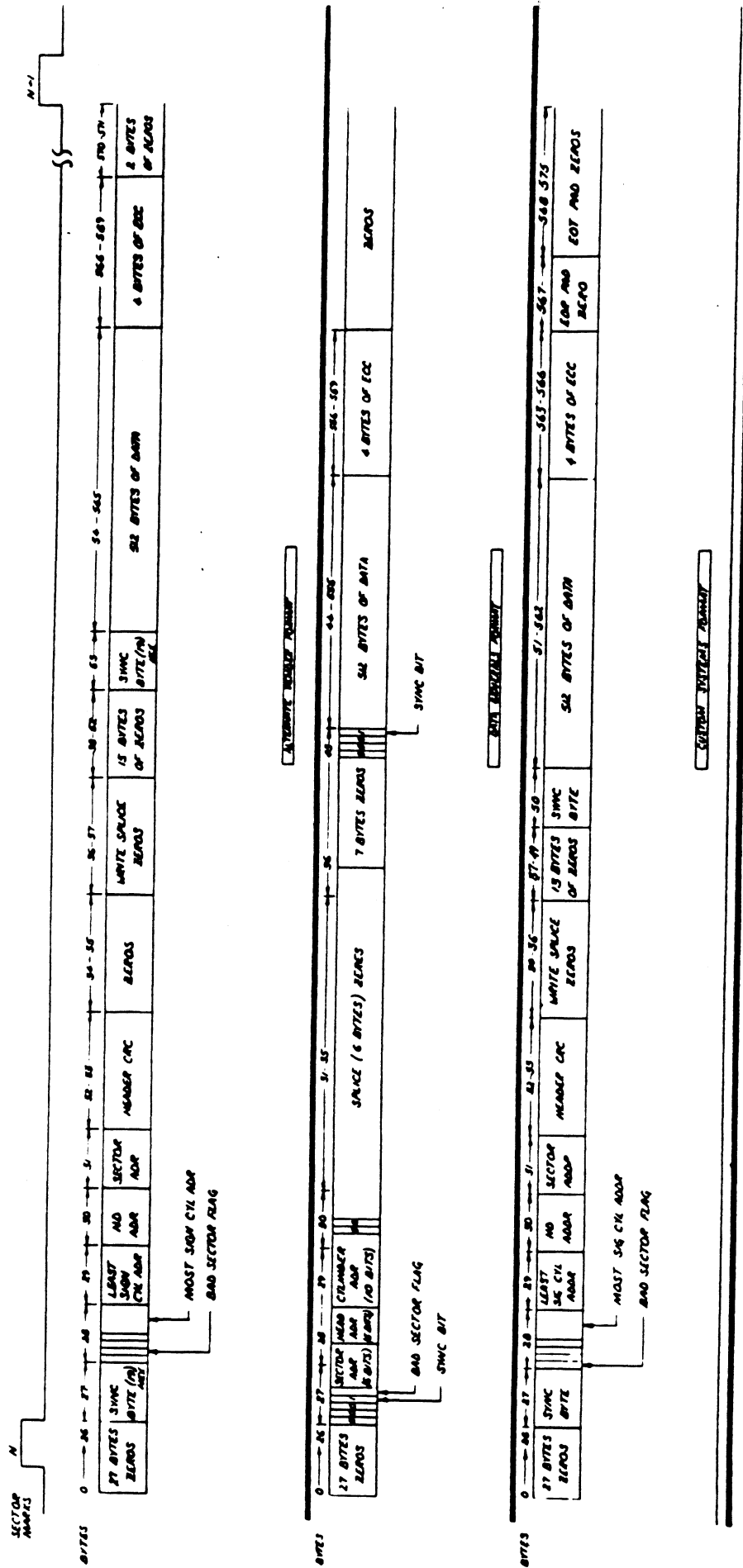
HEADER FORMATS

Figure 6.2

6.5   FORMAT SEQUENCER

The 295C Disk Controller features a format sequencer which controls the disk side of the controller. The firmware which controls this sequencer is contained in 2716 EPROMS allowing disk format changes to take place in the EPROMS instead of the microprocessor firmware.

The format sequencer firmware is arranged in eight banks of 256 words each and is switch selectable for the format bank desired. Each bank consists of half READ/WRITE/ FORMAT CODE and the other half drive characteristics. See Figure 6.1.

6.5.1   READ/WRITE FORMATS

The Read/Write/Format section of a given bank contains the format choices (Main or Alternate).

The Alternate Format is selected only on Ports 2 and 3. Therefore, two header format types could operate simultaneously on this controller restricted only by the port locations. See Figure 6.2 for Header Formats supported and Tables 3.1/3.2.

6.5.2   DRIVE CHARACTERISTICS

The drive characteristics section consists of 16 separate blocks of drive characteristics configurable for each port.

The following is information necessary to format size and communicate precisely with a given disk drive.

1) Maximum Surface, Sector and Cylinder Address

2) Two Volume (CMD, Lark, etc.) and Dual Volume

3) Sync Byte

APPENDIX A

DIAGNOSTIC SUPPORT PACKAGE
GENERAL INFORMATION

Booting Diagnostics from Magnetic Tape.

Step 1   Mount the tape on the Tape Drive and put the Drive
         On-line. Be sure that your BPI. setting matches the
         tape you received.

Step 2   Program Load - The method of program load varies for
         different processors. Some of the possibilities are
         described here.

         If your system does not have a program load option,
         consult your processor manual.

         If your system has front panel switches, set them to
         100022 for the Primary Tape Drive, or 100062 for the
         Secondary Drive. Then press program load switch.

         For the S140 virtual console, set 11A to 100022 for
         the Primary Tape Drive, or 100062 for the Secondary
         Drive. Then enter 100022L (or 100062L).

         For the S120 virtual console, enter 22H for the
         Primary Tape Drive or 62H for the Secondary Drive.

         For the Point 4 virtual console, enter P22 for the
         Primary Tape Drive or P62 for the Secondary Drive.

LOADING DIAGNOSTICS FROM TAPE TO YOUR SYSTEM DISK

The last file on the DSP Tape (reference menu for number)

is a DUMP Format copy of the previous files. This allows

a User to load (use RDOS load command) the files onto a disk.

Step 1   While the System is running, mount the tape and put the
         Drive On-line. Be sure that you have correct BPI setting.

Step 2   For an RDOS System enter the commands:

         INIT MT0
         LOAD/R/V MT0:X
         RELEASE MT0

         For an AOS System enter the commands:

         SUPERUSER ON
         DIR :
         X RDOS LOAD/V @MTA0:X
         REWIND @MTA0
         SUPERUSER OFF

The files can now be booted from disk (enter file name in

response to filename? or pathname?).

ZETA ⚙

Please give us your comments.

Please use this form to send us your comments regarding
this Technical Manual. Your input is greatly appreciated!
Problems will be promptly addressed and action taken as
necessary. If you wish a written reply, please furnish
your name and mailing address. Thank you.

Date_____

Name_____Title_____

Firm_____

Address_____

City/State/Zip_____

TECHNICAL MANUAL TITLE_____

DOCUMENT NUMBER_____REVISION_____

ERRORS IN MANUAL:

SUGGESTIONS FOR IMPROVING EITHER THE MANUAL OR THE PRODUCT:

Business Reply Mail

FIRST CLASS   PERMIT NO. 939   HOPKINS, MN 55343

POSTAGE WILL BE PAID BY ADDRESSEE

ZETA ⊙

6850 Shady Oak Road
Eden Prairie, MN 55344
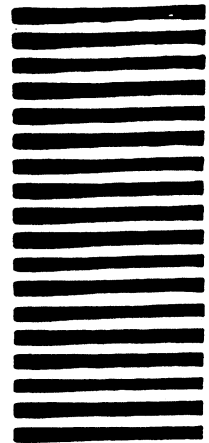
```
01      ;
02      ;
03      ;
04      ;*****************************************************************
05      ;
06      ;
07      ; DESCRIPTION: ZETACO SMD DISK CONTROLLER DIAGNOSTIC
08      ;
09      ;
10      ; PRODUCT OF ZETACO, 1984
11      ;*****************************************************************
              .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, AS 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
```

```
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      ;       - 3 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
```

```
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
```

```
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-
```

```
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         ;         CHECK 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 3 = 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                   0?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-F5 ALTER THE FORMAT ON
59         ;         CYL 0, HD 0, SEC 0 FOR PURPOSES OF
60         ;         CHECKING THE FORMAT LOGIC AND BAD SECTOR LOGIC.
```

```
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.
```

```
01        ;
02        ;
03        ;
04        ;*************************************************************
05        ;
06        ;
47        ; 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 (4001S)
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, IDF1
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)
```

```
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   ;        3 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 C 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
```

```
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.
```

```
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      ;       SSWFD   0
17      ;
18      ;8.1    SWITCH OPTIONS
19      ;       DIFFERENT BITS AND THEIR INTERPRETATION AT LOCATION
20      ;       "SSWFD" 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.     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 7.8,8A)
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
```

```
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
```

```
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 100  DATA ERRORS (HARD OR SOFT) ARE LOGGED
29      ;11.0   DEBUG HELP:
30      ;       ;GOTO   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      ;12.1   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.
```

```
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
```

```
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).
```

```
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
```

```
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        ;     SIWPO   3
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
```

```
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 9.3)
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 5)
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
```

```
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.06W.2 AND H.06R.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
```

```
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
```

```
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
```

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0010  DISKR
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
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```
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              0?0TD   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 90
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
```

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