DISTRIBUTED LOGIC CORPORATION

MODEL DU256

DISK CONTROLLER

INSTALLATION AND OPERATION MANUAL

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Revision H

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SECTION 1

DESCRIPTION

This manual describes the installation and operation of Distributed Logic Corporation (DILOG) Model DU256 Disk Controller. The controller interfaces up to four SMD/ESMD disk drives with DEC* VAX or PDP-11 Unibus based computer systems. Transfer rates of the system are up to 3.0 Mbytes per second (24 MHz).

The controller is software compatible with DU drivers (MSCP) in MUMPS, RT-11, RSX-11M+, RSTS/E, VMS, ULTRIX, UNIX, and DMS operating systems. The number of words to be transferred per DMA request is jumper selectable.

Figure 1-1 is a simplified diagram of a disk system.

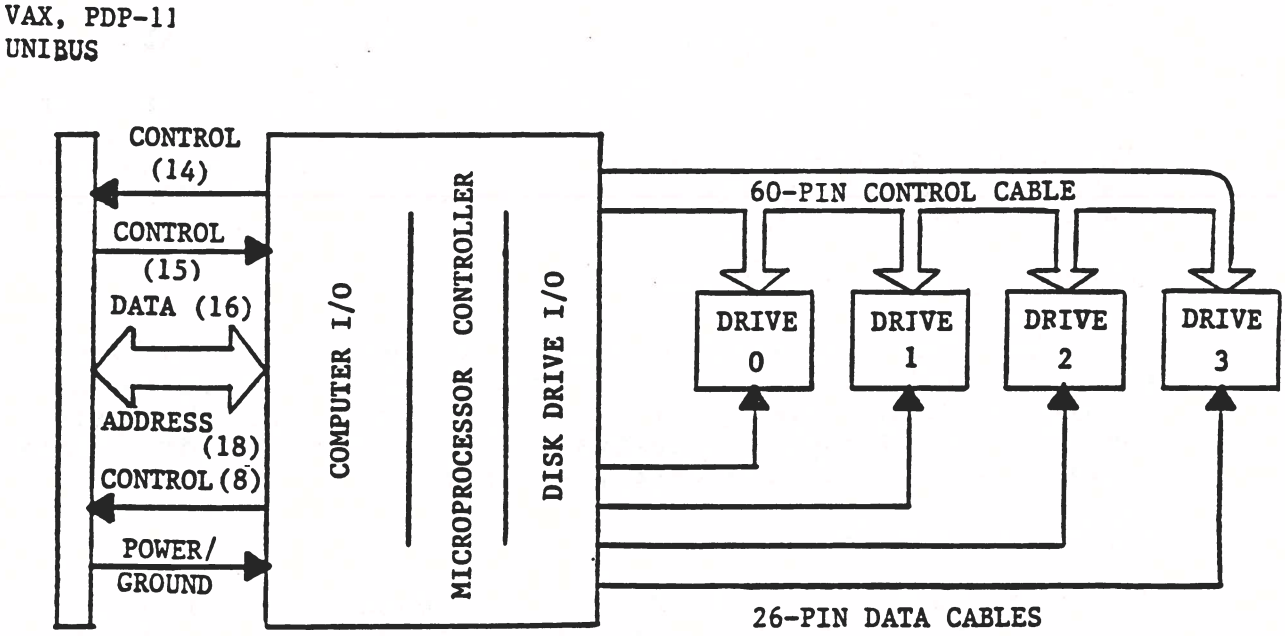

Figure 1-1. Disk System, Simplified Diagram

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* DEC PDP-11, VAX, RT-11, RSX, RSTS/E, VMS, and DU Driver, and MSCP are registered trademarks of Digital Equipment Corporation.

UNIVERSAL FORMATTING is a trademark of Distributed Logic Corporation.

CHARACTERISTICS

- ELEVATOR SEEK ORDERING ALGORITHM

  The controller uses the elevator seek ordering algorithm to determine the execution order for commands stored in the command buffer. This feature reduces drive seek latencies.

- MAPPING MULTIPLE LOGICAL UNITS

  The controller can map each physical drive attached to the controller into one or more logical units. This feature increases the usage of the formated disk capacity by the operating system.

- DILOG'S UNIVERSAL FORMATTING

  UNIVERSAL FORMATTING permits the attachment of drives that have the same or different characteristics, such as number of cylinders, heads, sectors, capacities, and transfer rates, without the need for drive configuration components on the controller. This feature removes all requirements for drive specific configuration components on the controller.

- SUPPORTS DRIVE TRANSFER RATES TO 3.0 MBYTES PER SECOND

  The controller supports these drive transfer rates with a 1:1 sector interleave and a 32 Kbyte (64 sector) data buffer. The controller supports drives from the following manufacturers: CONTROL DATA CORP., CENTURY DATA, FUJITSU, HATACHI, NEC, PRIAM, and NORTHERN TELECOM.

- ONBOARD MULTIPLE PATTERN FORMATTING

  The controller contains a multiple pattern formatter which allows a more effective detection of disk flaws. The formatter is accessible through the system console or optional Diagnostic Access Port. This feature eliminates the need for shipping format programs on user-specified distribution media.

- AUTOMATIC SELF TEST

  The controller is supplied with an automatic self test function that is initiated each time power is applied. The controller performs additional tests each time it is brought online. A green card-edge LED is lit and remains lit after each successful completion. Should self test fail, the controller isolates the disk drive from the system and the LED is extinguished.

- HARDWARE BOOTSTRAP

  The controller contains an onboard bootstrap support for RL01/02, RP02/03, RM02, RM05, RM80, RK06/07, RX02, TS11, TSV05, TM11, TMSCP, and MSCP devices. The controller contains switches for selecting bootstrap addresses, in addition to enabling/disabling this bootstrap feature. When the onboard bootstrap is disabled, the controller will boot from a standard DEC module.

o DILOG'S DYNAMIC TRANSFER SEGMENTATION

Three-dimensional RPS (Rotational Position Sensing)

Dilog's three-dimensional RPS (Rotational Position Sensing) determines the rotational position of each drive attached to the controller and initiates a transfer on the disk whose heads are positioned within or closest to the desired data transfer portion of the disk. The third dimension of RPS is achieved by looking down through the platters (heads) to see if the requested data is ready for transfer. This is implemented every time the controller is waiting for data to come under the initiated request. This feature reduces the rotational latency time associated with the total transfer time.

Data Transfer Fragmentation

Data transfer fragmentation allows the controller to start transferring any immediately accessible sector that is part of an active request to the host. The sectors that are part of the request are transferred to the host as they are encountered, rather than waiting for the first sector of the request to come under the read/write head. This feature reduces the rotational latency associated with the total transfer time.

Segmented Data Transfers Crossing Cylinder Boundaries

In transfers that cross cylinder boundaries, this featue will suspend the request after the last sector of a cylinder is read by the controller. At this time the controller will initiate another transfer on the same cylinder or start the drive seeking and initiate a transfer from another drive. When the second transfer is complete, the controller will proceed with the original request. This feature reduces the seek time associated with the total transfer time.

o MEDIA FLAW COMPENSATION

The following four functions are used to compensate for media defects:

FIRST - at format time one sector per track is reserved as a spare. The controller has the ability to reassign spare sectors for defective sectors.

SECOND - if an error is encountered after the drive is formatted, a sequence of read operations is performed with ECC disabled.

THIRD - if the error still exists, ECC is used to recover the data. The ECC polynomial used is 48 bits in length. Error log packets are generated by the controller every time an error recovery operation is performed.

FOURTH - After the drive is formatted, reassignment of defective sectors is accomplished through a dynamic block replacement scheme controlled by the host software.

- SUPPORTS 1:1 INTERLEAVE

  The controller utilizes a 1:1 interleave along with a 32 KB data buffer (64 sectors) to couple high performance SMD/ESMD disk drives to the Unibus in the most efficient way.

- COMMAND QUEUE BUFFER

  The controller can buffer up to 21 commands. For multiple drive applications, commands for all drives are received until the buffer is full. Priority for command execution is based on the elevator seek algorithm. In multiple drive applications, additional definition of priority is: a drive whose heads are positioned on the proper starting cylinder, or a drive whose heads are positioned closest to the starting cylinder and the required seek is of the proper direction based on the commands stored in the queue for that drive.

- OPTIONS

  Options for the controller are: disk drive I/O cables, maintenance manual, and factory integration of customer-supplied drives. Dual porting is also an option of the controller.

- PDP-11 UNIBUS INTERFACE

  Commands, data and status transfers between the controller and the computer are executed via the parallel I/O bus (Unibus) of the computer. Data transfers are direct to memory via the DMA facility of the Unibus; commands and status are under programmed I/O. Controller/Unibus interface lines are listed in Table 1-1.

Table 1-1. Controller/Unibus Interface Lines

BUS PIN	MNEMONIC	DESCRIPTION
CA1	NPG IN	Non-Processor Grant In — Generated by the processor in response to NPR whenever the processor is not using the bus. NPG is daisy-chained through the devices connected to the bus and is received and regenerated by each device until it reaches the requested device.
CB1	NPG OUT	Non-Processor Grant Out
CD2	D15L	Data Line Bit 15 — These 16 lines DXXL, are used to transfer data and register control/status information to and from the controller.
CE2	D14L	Data Line Bit 14
CF2	D13L	Data Line Bit 13
CH2	D12L	Data Line Bit 12
CH1	D11L	Data Line Bit 11
CJ2	D10L	Data Line Bit 10
CK2	D09L	Data Line Bit 9
CL2	D08L	Data Line Bit 8
CM2	D07L	Data Line Bit 7
CN1	DCLO	DC Power Low
CN2	D04L	Data Line Bit 4
CP2	D05L	Data Line Bit 5
CR2	D01L	Data Line Bit 1
CS1	PB	Bus Parity Bit
CS2	D00L	Data Line Bit 0
CT2	D03L	Data Line Bit 3
CU2	D02L	Data Line Bit 2
CV2	D06L	Data Line Bit 6
DD2	BR7L	Bus Request 7 — One of these lines BRXL, will be asserted by the controller to request control of the bus for the purpose of transferring data.
DE2	BR6L	Bus Request 6
DF2	BR5L	Bus Request 5
DH2	BR4L	Bus Request 4
DK2	BGI7	Bus Grant Bit 7 In — These daisy-chained Bus Grant lines are asserted by the processor after completing the instruction in progress. Issued in response to the corresponding Bus Request line, the Bus Grant will be generated by each device until it reaches the requested device.
DL1	INITL	INITIALIZE — This signal is asserted by the processor to initialize or clear all devices connected to the bus.
DL2	BGO7	Bus Grant Bit 7 Out
DM2	BGI6	Bus Grant Bit 6 In
DN2	BGO6	Bus Grant Bit 6 Out
DP2	BGI5	Bus Grant Bit 5 In
DR2	BGO5	Bus Grant Bit 5 Out
DS2	BGI4	Bus Grant Bit 4 In
DT2	BGO4	Bus Grant Bit 4 Out
DW2	BGIN	Bus Grant In
DV2	BGOUT	Bus Grant Out
EC1	A12L	Address Bit 12 — These lines are the 18-bit address bus over which memory and peripheral register address information is communicated. Address information is placed on the bus by the bus master device and received and decoded by the selected slave device. The master device then either receives input data from, or outputs data to the address slave device (memory) over the data bus lines.

Table 1-1. Controller/Unibus Interface Lines (Continued)

BUS PIN	MNEMONIC	DESCRIPTION
ED1	A17L	Address Bit 17
ED2	A15L	Address Bit 15
EE1	MSYNL	Master Sync — This control signal is issued by the master device to indicate that Address and Control information is present on the Bus.
EE2	A16L	Address Bit 16
EF1	A02L	Address Bit 2
EH1	A01L	Address Bit 1
EH2	A00L	Address Bit 0
EJ1	SSYNL	Slave Sync — This control signal is issued by the slave device in response to the signals (MSYN or INTR) generated by the master device.
EK1	A14L	Address Bit 14
EK2	A13L	Address Bit 13
EL1	A11L	Address Bit 11
EN2	A08L	Address Bit 8
EP1	A10L	Address Bit 10
EP2	A07L	Address Bit 7
ER1	A09L	Address Bit 9
EU1	A06L	Address Bit 6
EU2	A04L	Address Bit 4
EV1	A05L	Address Bit 5
EV2	A03	Address Bit 3
EJ2	COL	Control Bit Zero — These two control lines are coded by the master device to describe the type of transfer: C1 C0 OPERATION 0 0 DATI — Data In (to master) 1 1 DATO — Data Out (from master) 1 1 DATOB — Data Out, Byte (from master)
EF2	C1L	Control Bit One
FD1	BBSY	Bus Busy — This signal is asserted by the bus master to indicate the bus is in use. When BBSY goes false, control of the bus is passed to the new bus master..
FJ1	NPR	Non-Processor Request — This signal is asserted by the controller to request control of the bus for the purpose of transferring disk data directly to or from memory.
FF1	IDO5	Interrupt Vector Bit 5 — These bits specify the Interrupt Vector address. The address is jumper selectable on the controller.
FF2	IDO6	Interrupt Vector Bit 6
FH1	IDO7	Interrupt Vector Bit 7
FK1	IDO8	Interrupt Vector Bit 8
FM1	INTR	Interrupt Request — The controller asserts this signal after becoming bus master to indicate that the desired Interrupt Vector information is present on the bus.
FT2	SACK	Selection Acknowledge — This signal is asserted by the controller in response to the processor's NPG or Bus Grant signal, indicating that control of the bus will pass to the controller when the current bus master completes its operation.

DISK INTERFACE

The controller interfaces up to four disk drives through 60- and 26-pin cables. If two drives are used, the 60-pin control cable ("A" cable) is daisy chained to the drives. The 26-pin cables ("B" cables) are connected separately from the controller to each drive. The maximum length of the 60-pin cable is 100 feet. The maximum length of the 26-pin cable is 50 feet. Table 1-2 lists the 60-pin interface signals, and Table 1-3 lists the 26-pin interface signals.

Table 1-2. Controller To Drive I/O Interface— "A" Cable

Signal Name	Pin Polarity (Active)		Source
	−	+	
DEVICE SELECT 0	23	53	Controller
DEVICE SELECT 1	24	54	Controller
DEVICE SELECT 2	26	56	Controller
DEVICE SELECT 3	27	57	Controller
SELECT ENABLE	22	52	Controller
SET CYLINDER TAG	1	31	Controller
SET HEAD TAG	2	32	Controller
CONTROL SELECT	3	33	Controller
BUS OUT 0	4	34	Controller
BUS OUT 1	5	35	Controller
BUS OUT 2	6	36	Controller
BUS OUT 3	7	37	Controller
BUS OUT 4	8	38	Controller
BUS OUT 5	9	39	Controller
BUS OUT 6	10	40	Controller
BUS OUT 7	11	41	Controller
BUS OUT 8	12	42	Controller
BUS OUT 9	13	43	Controller
BUS OUT 10	30	60	Controller
DEVICE ENABLE	14	44	Controller
INDEX	18	48	Drive
SECTOR MARK	25	55	Drive
FAULT	15	45	Drive
SEEK ERROR	16	46	Drive
ON CYLINDER	17	47	Drive
UNIT READY	19	49	Drive
WRITE PROTECTED	28	58	Drive
ADDRESS MARK	20	50	Drive
BUS-DUAL-PORT ONLY	21	51	Drive
SEQUENCE IN	29		Controller
HOLD	59		Controller

Table 1-3. Controller To Drive I/O Interface— "B" Cable

Signal	Pin Polarity (Active)			Source
	−	+	Ground	
Ground			1	
Servo Clock	2	14		Drive
Ground			15	
Read Data	3	16		Drive
Ground			4	
Read Clock	5	17		Drive
Ground			18	
Write Clock	6	19		Controller
Ground			7	
Write Data	8	20		Controller
Ground			21	
Unit Selected	22	9		Drive
Seek End	10	23		Drive
Ground			11	
Reserved for Index	12	24		
Ground			25	
Reserved for Sector	13	26		

CONTROLLER SPECIFICATIONS *

MECHANICAL

The controller is completely contained on a quad-height module 26.4 cm (10.44 in.) wide by 22.8 cm (8.88 in.) deep and plugs into one standard Unibus quad slot.

BASE ADDRESS - 8 choices, switch selectable

IP-772150 SA-772152	IP-760334 SA-760336	IP-760340 SA-760342
IP-760344 SA-760346	IP-760354 SA-760356	IP-760360 SA-760362
IP-760374 SA-760376	IP-760400 SA-760402	

INTERRUPT VECTOR ADDRESS

Programmable by software, priority BR5 in etch; BR4, 6, and 7 by jumpers.

DMA BURST SIZE

1, 2, 4, 8, or 15 words

DISK TRANSFER RATES

Up to 3.0 Mbytes per second

DISK I/O

One 60-pin and four each 26-pin conductor flat ribbon cables

POWER

+5 volts at 4.7 amps

ENVIRONMENT

Operating temperature 50 degrees F. (10 degrees C.) to 104 degrees F. (40 degrees C.), Humidity 10-90% non-condensing

SHIPPING WEIGHT

5 pounds, including documentation and cables

MTTR

Less than 0.5 hours.

* SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

SECTION 2

INSTALLATION

The padded shipping carton contains the controller board and, if specified on the sales order, a 60-pin control cable to the drive and four optional 26-pin data cables to the drives. Inspect the controller board and its components and the cables for damage.

NOTE

If damage to the board, components on the board, or cables is noted, do not install. Immediately inform the carrier and Dilog.

Figure 2-1 shows the locations of the switch and jumpers.

Table 2-1 describes the switch and jumper settings. Some jumper connections may be etched or cut on the board.

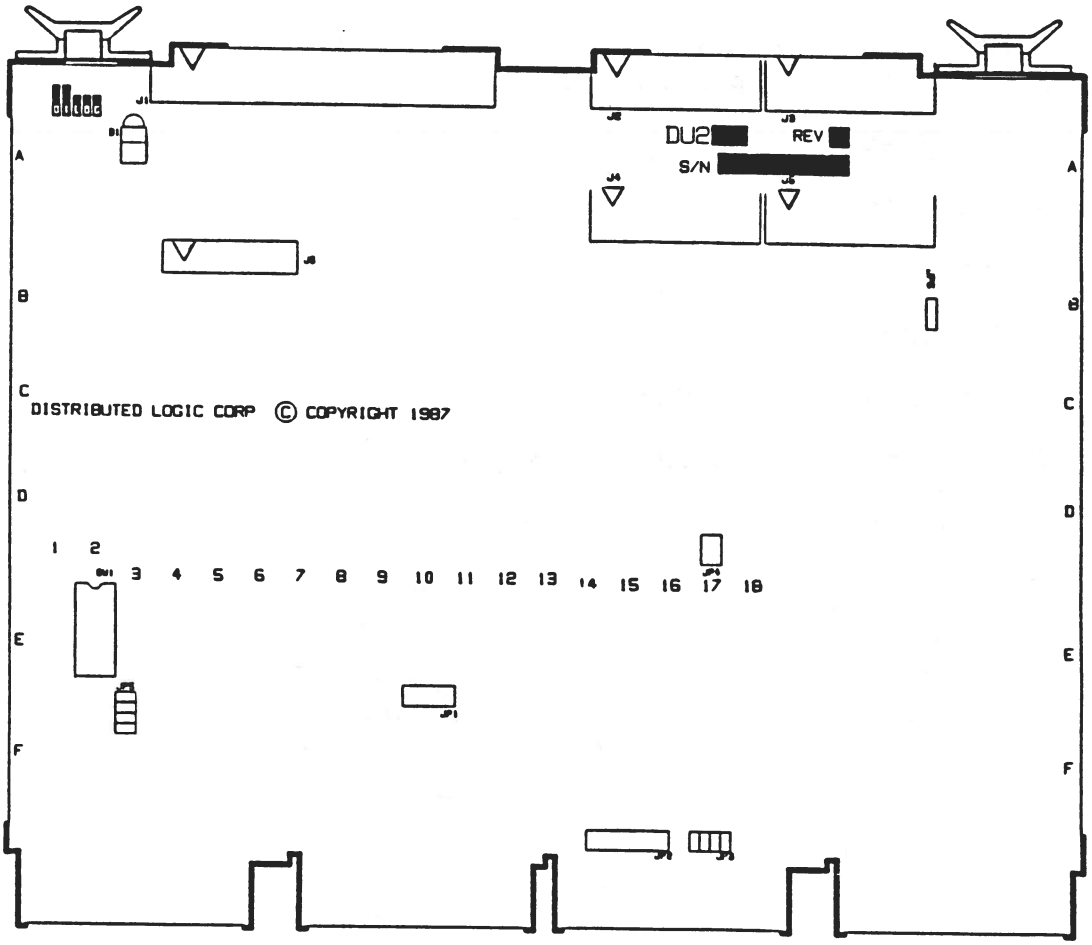


Figure 2-1. Controller Configuration

Table 2-1. Switches and Jumpers

Set and check the switches and jumpers before installing the controller in the backplane.

CAUTION

Ensure power is not applied to the CPU or drive when installing the controller board or cables.

Switch 1
Location 2E

Select Address

SW1-1	SW1-2	SW1-3		Address
OFF	OFF	OFF	=	772150
ON	OFF	OFF	=	760334
OFF	ON	OFF	=	760340
ON	ON	OFF	=	760344
OFF	OFF	ON	=	760354
ON	OFF	ON	=	760360
OFF	ON	ON	=	760374
ON	ON	ON	=	760400

SW1-4 - ON = Bootstrap Enabled = 775000
OFF = Bootstrap Disabled

SW1-5 - Not Used

SW1-6 - Not Used

SW1-7 - Not Used

SW1-8 - Not Used

J6 - Connector - Factory Use Only

JP1 - Burst Size Jumpers (Only one jumper allowed)

Jumper at	Burst Size
JP1 5-6	1 word
JP1 4-7	2 words
JP1 3-8	4 words
JP1 2-9	8 words
JP1 1-10	15 words

JP2, JP3 - Unibus Priority Jumpers (Factory set at BR5 in etch)

For Priority	Install Jumpers
BR4*	JP2 15-16, JP2-14-13 JP2 12-11, JP2 10-7 JP2 9-8, JP3 4-5
BR5	JP2 15-16, JP2 14-13 JP2 12-5, JP2 11-6 JP2 10-9, JP3 3-6
BR6*	JP2 15-16, JP2 14-3 JP2 13-4, JP2 12-11 JP2 10-9, JP3 2-7
BR7*	JP2 16-1, JP2 15-2 JP2 14-13, JP2 12-11 JP2 10-9, JP3 1-8

* Since the jumpers for Priority Level 5 are in etch. the etch must be cut between unused jumpers if a level other than 5 is desired.

JP4 - Factory Use Only

JP5 - Dwell Time Jumpers (Time Between DMAs)

1 us	JP5 4-5
2 us	JP5 3-6
4 us	JP5 2-7
8 us	JP5 1-8

JP6 - Factory Use Only

INSTALLATION

After the jumpers have been positioned and the switches set, install the controller as follows:

CAUTION

Ensure all power is off before installing the controller or cables.

Damage to the backplane assembly will occur if the controller is plugged in backwards.

1. Select the backplane Small Peripheral Controller (SPC) location into which the controller is to be inserted. SPC locations are connectors C, D, E, and F of a UNIBUS backplane assembly.

   To use the DMA (NPR) facility required with the controller, the backplane wiring of the SPC slot must be modified. The modification is as follows:

   Remove the wire on the connector C between A1 and B1 of the slot into which the controller is to be plugged. This allows the non-processor grant priority line to be carried through the controller. If the controller is removed, replace this wire.

   Note that any connector rows which do not have a card installed, must have a bus grant jumper card installed in the D slot to continue the bus grants to other devices in the UNIBUS.

2. Install J1 and J2 into the connectors on the controller, and J3.

   J4, and J5, if multiple drives are used. Ensure pin 1 on each cable is matched with the triangle on each connector as indicated on Figure 2-1.

3. Ensure the controller is oriented with the components facing row one, the processor, and gently press both handles until the module connectors are firmly seated in the backplane.

4. Connect J1 to the drive or drives if daisy-chained. Ensure the terminator is installed in the last drive. Connect the remaining cables to the appropriate drives.

5. Refer to the disk drive manual for operating instructions, and apply power to the drive(s) and the computer.

6. The system is ready to format the disks as described in Section 3.

DRIVE SWITCHES

The following drive switch settings are recommended for maximum capacity. Special requirements may require different switch settings.

For drives not listed in the following pages, Dilog uses 584 bytes/sector with a 21-byte preamble.

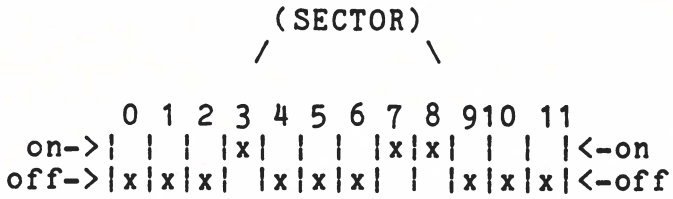
Index and sector pulses are on the A cable.

Display Drive Configuration

```
Drive Name:  9710
Base DU Unit Number:  000
Number of Heads:  005
Number of Sectors Per Track:  034
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00135465
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS

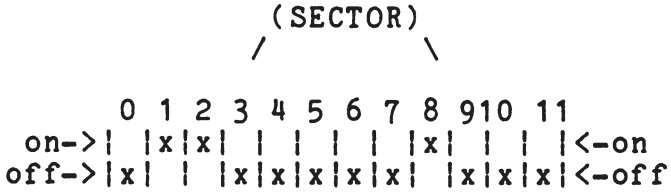


Display Drive Configuration

```
Drive Name:  9715-1515
Base DU Unit Number:  000
Number of Heads:  024
Number of Sectors Per Track:  051
Number of Cylinders:  00711
Number of Logical Units:  001

Logical Unit Size (Blocks):  00850800
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS

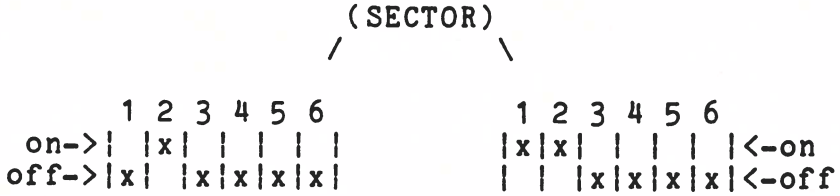


Display Drive Configuration

Drive Name: 9715-1030
Base DU Unit Number: 000
Number of Heads: 026
Number of Sectors Per Track: 070
Number of Cylinders: 00964
Number of Logical Units: 001

Logical Unit Size (Blocks): 01725828 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS



NOTE:

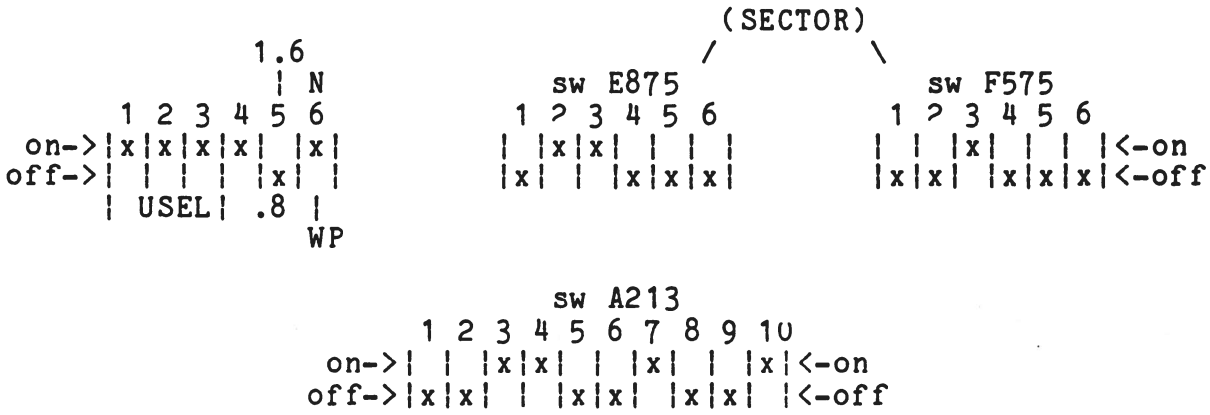
Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

Drive Name: 9720-368
Base DU Unit Number: 000
Number of Heads: 010
Number of Sectors Per Track: 051
Number of Cylinders: 01217
Number of Logical Units: 001

Logical Unit Size (Blocks): 00607500
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS

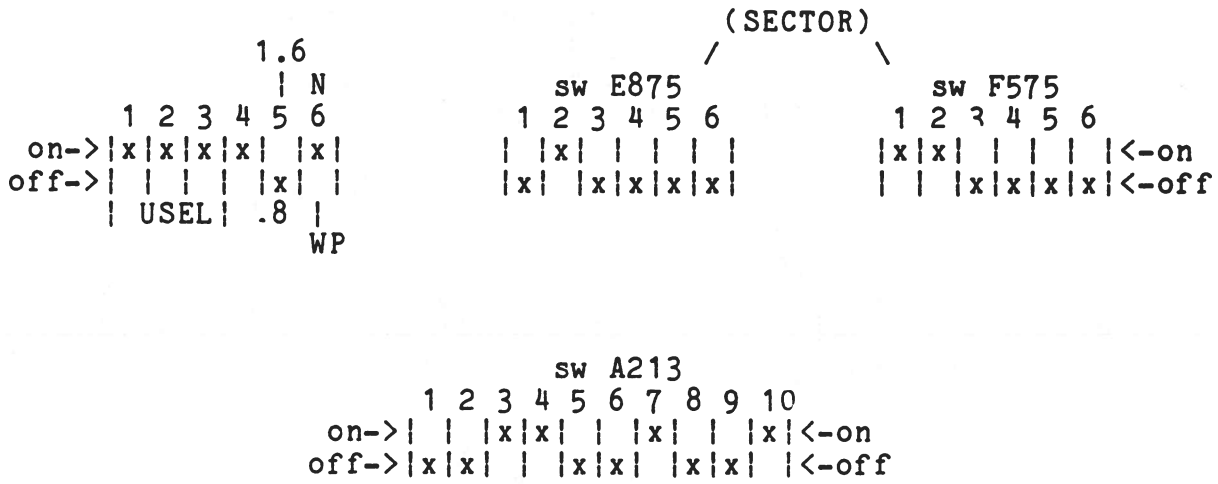


Display Drive Configuration

```
Drive Name:  9720-500
Base DU Unit Number:  000
Number of Heads:  010
Number of Sectors Per Track:  070
Number of Cylinders:  01217
Number of Logical Units:  001

Logical Unit Size (Blocks):  00838350
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS

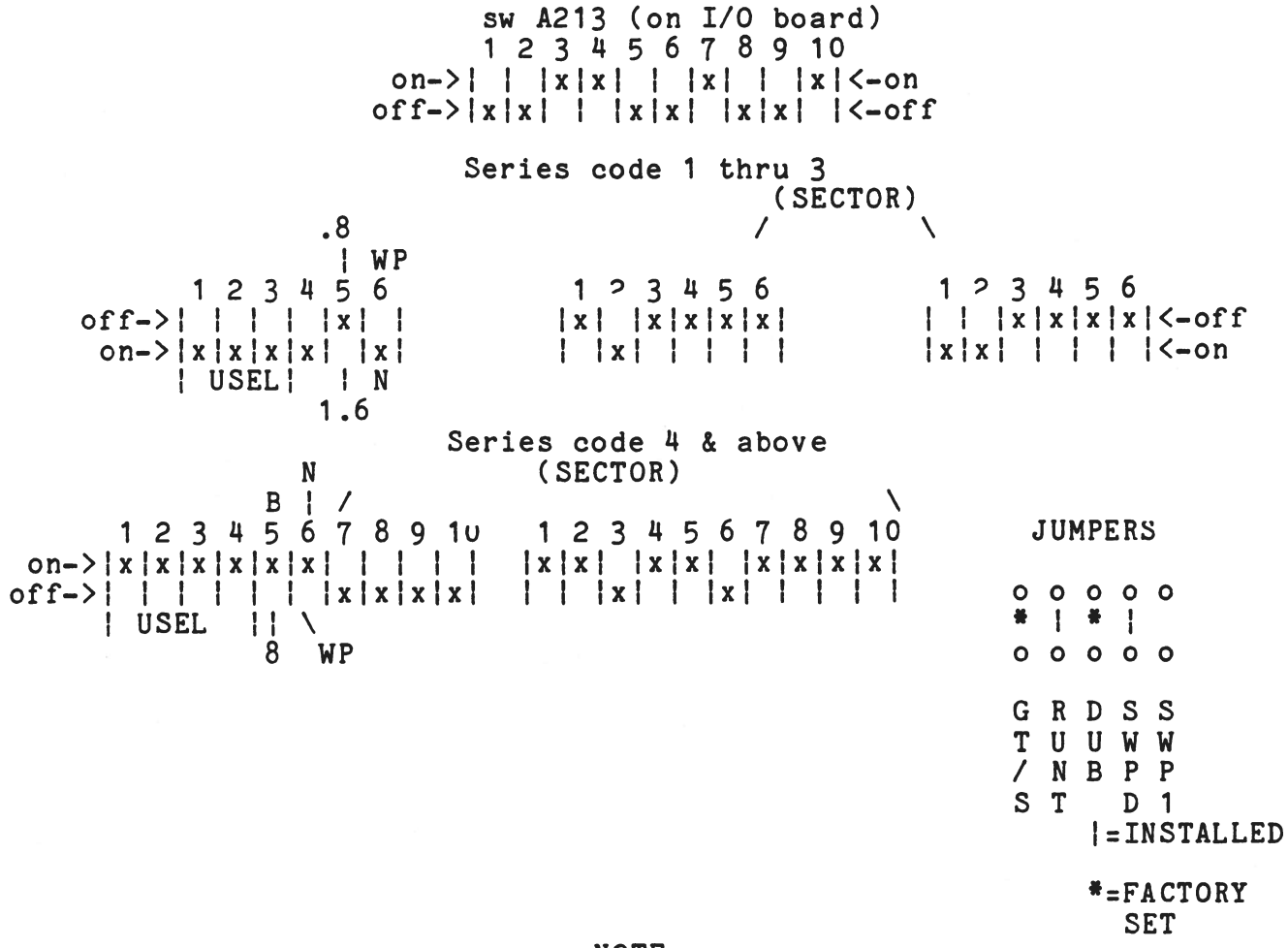


Display Drive Configuration

Drive Name: 9720-736
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 051
Number of Cylinders: 01635
Number of Logical Units: 001

Logical Unit Size (Blocks): 01224750 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS



NOTE:

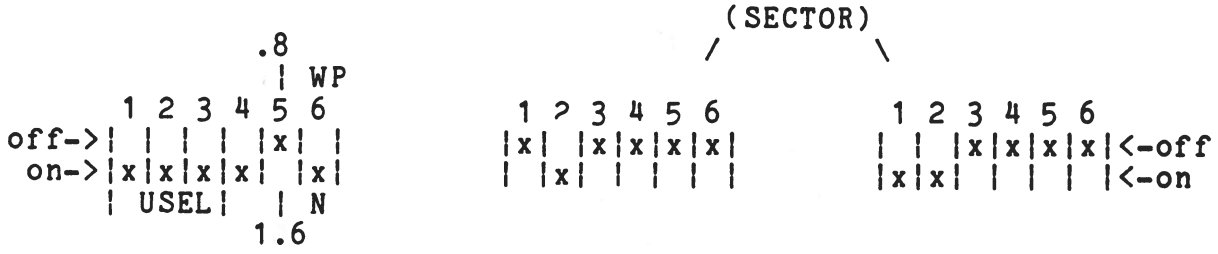
Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

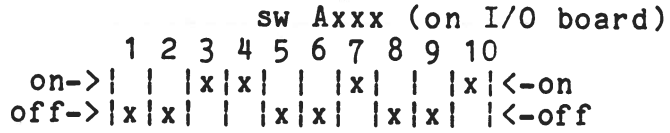
Display Drive Configuration

Drive Name: 9720-750
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 070
Number of Cylinders: 01217
Number of Logical Units: 001

Logical Unit Size (Blocks): 01257525 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS





NOTE:

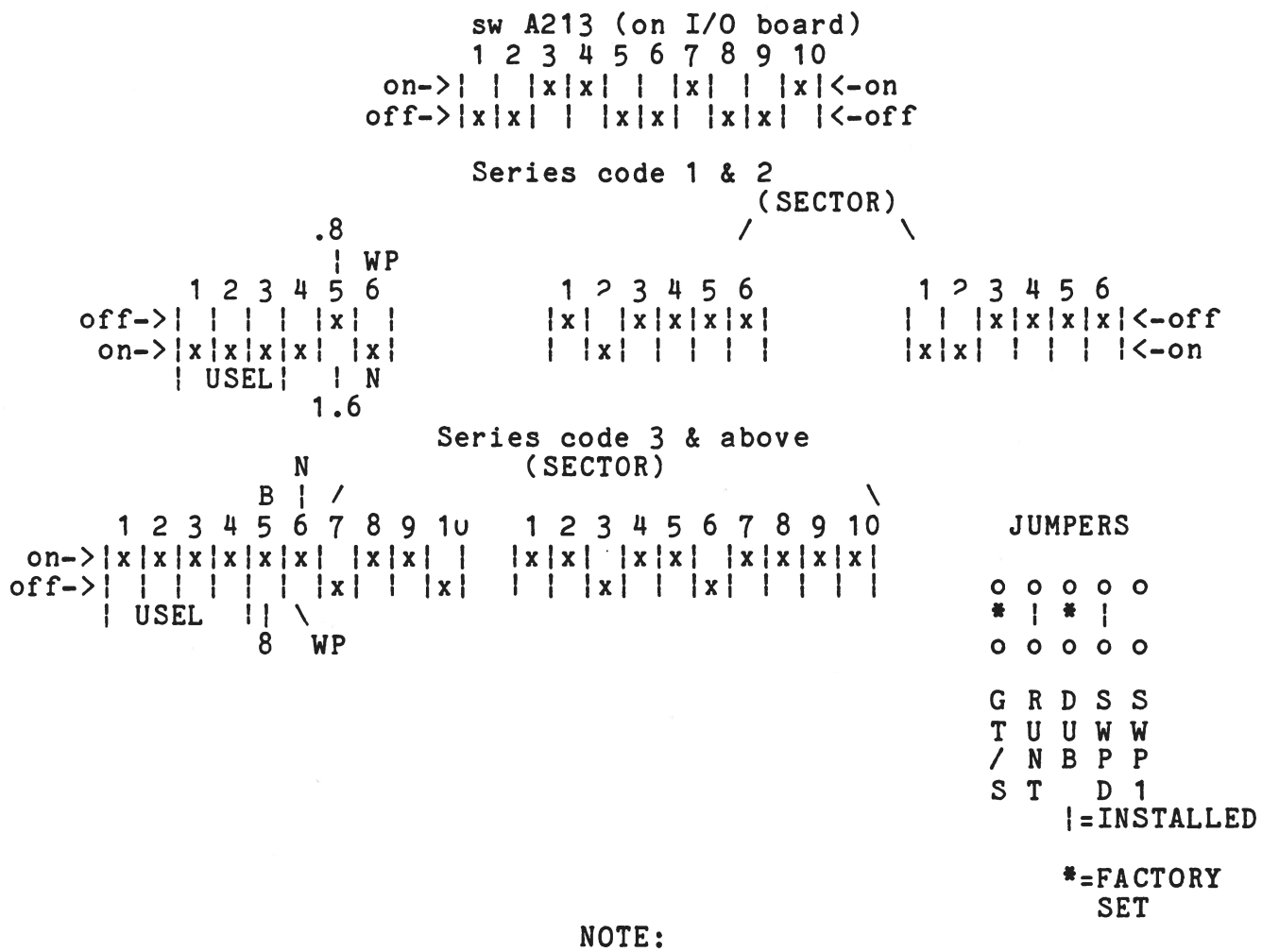
Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

Drive Name: 9720-850
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 070
Number of Cylinders: 01381
Number of Logical Units: 001

Logical Unit Size (Blocks): 01427265 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS



NOTE:

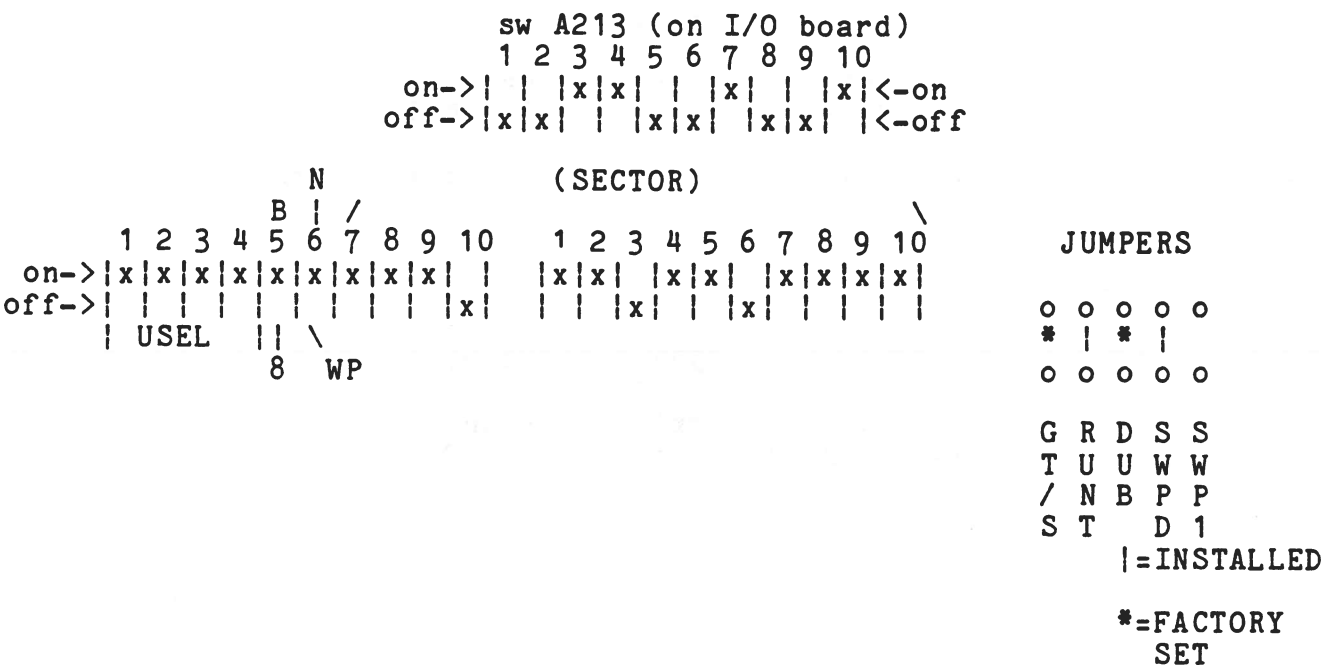
Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

Drive Name: 9720-1230
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 086
Number of Cylinders: 01635
Number of Logical Units: 001

Logical Unit Size (Blocks): 02082075 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS



NOTE:

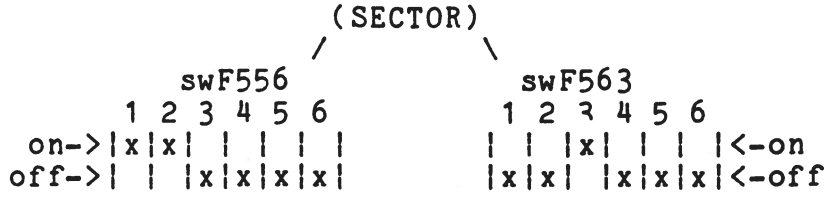
Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

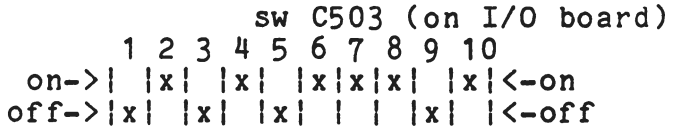
Display Drive Configuration

Drive Name: 9772-1350
Base DU Unit Number: 000
Number of Heads: 019
Number of Sectors Per Track: 086
Number of Cylinders: 01420
Number of Logical Units: 001

Logical Unit Size (Blocks): 02290070 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS





NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

FUJITSU M2322

Display Drive Configuration

```
Drive Name:  M2322
Base DU Unit Number:  000
Number of Heads:  010
Number of Sectors Per Track:  035
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00279140
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS (SECTOR):

		1	2	3	4	5	6	7
sw2	on	x	x	x				x
	off				x	x	x	
sw3	on			x				
	off	x	x		x	x	x	x

FUJITSU M2333

Display Drive Configuration

```
Drive Name:  M2333
Base DU Unit Number:  000
Number of Heads:  010
Number of Sectors Per Track:  069
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00558280
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS (SECTOR):

		1	2	3	4	5	6	7
sw2	on	x	x	x			x	
	off				x	x		x
sw3	on		x					
	off	x		x	x	x	x	x

Display Drive Configuration

Drive Name: M2344
Base DU Unit Number: 000
Number of Heads: 027
Number of Sectors Per Track: 069
Number of Cylinders: 00624
Number of Logical Units: 001

Logical Unit Size (Blocks): 01141992 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS (SECTOR):

		1	2	3	4	5	6	7
sw3	on	x	x	x		x		
	off				x	x		x
sw4	on		x					
	off	x		x	x	x	x	x

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

```
Drive Name:  M2351A
Base DU Unit Number:  000
Number of Heads:  020
Number of Sectors Per Track:  048
Number of Cylinders:  00842
Number of Logical Units:  001

Logical Unit Size (Blocks):  00789600
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE JUMPER SETTINGS

(SECTOR)

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

(INTERFACE)

LOC.	INSTALLED		
AE7	3-4	6-7	10-11

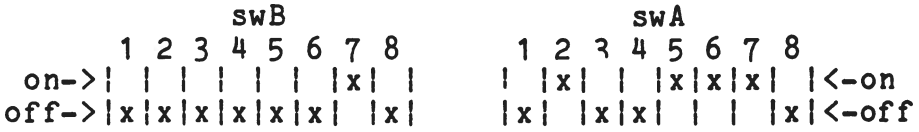
Display Drive Configuration

Drive Name: M2361A
Base DU Unit Number: 000
Number of Heads: 020
Number of Sectors Per Track: 069
Number of Cylinders: 00842
Number of Logical Units: 001

Logical Unit Size (Blocks): 01142400 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE JUMPER SETTINGS

(SECTOR)



(INTERFACE)

LOC.	INSTALLED
AE7	3-4 6-7 10-11

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

Drive Name: M2372
Base DU Unit Number: 000
Number of Heads: 027
Number of Sectors Per Track: 069
Number of Cylinders: 00745
Number of Logical Units: 001

Logical Unit Size (Blocks): 01364148 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE JUMPER SETTINGS

(SECTOR)

NOTE:

Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

Drive Name: M2382
Base DU Unit Number: 000
Number of Heads: 027
Number of Sectors Per Track: 084
Number of Cylinders: 00745
Number of Logical Units: 001

Logical Unit Size (Blocks): 01665063 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE JUMPER SETTINGS

(SECTOR)

NOTE:

Because of tne size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. Tt depends on which operating system is used.

Display Drive Configuration

Drive Name: DK815-10
Base DU Unit Number: 000
Number of Heads: 015
Number of Sectors Per Track: 070
Number of Cylinders: 01737
Number of Logical Units: 001

Logical Unit Size (Blocks): 01795725 (see note)
Diagnostic Partition Size (Cylinders): 00001

DRIVE SWITCH SETTINGS

(SECTOR)

sw28		sw27		sw41	
1	x	1	x	1	x
2	x	2	x	2	x
3	x	3	x	3	x
4	x	4	x	4	x
5	x	5	x	5	x
6	x	6	x	6	x
7	x	7	x	7	x
8	x	8	x	8	x
open	closed	open	closed	open	closed

NOTE:

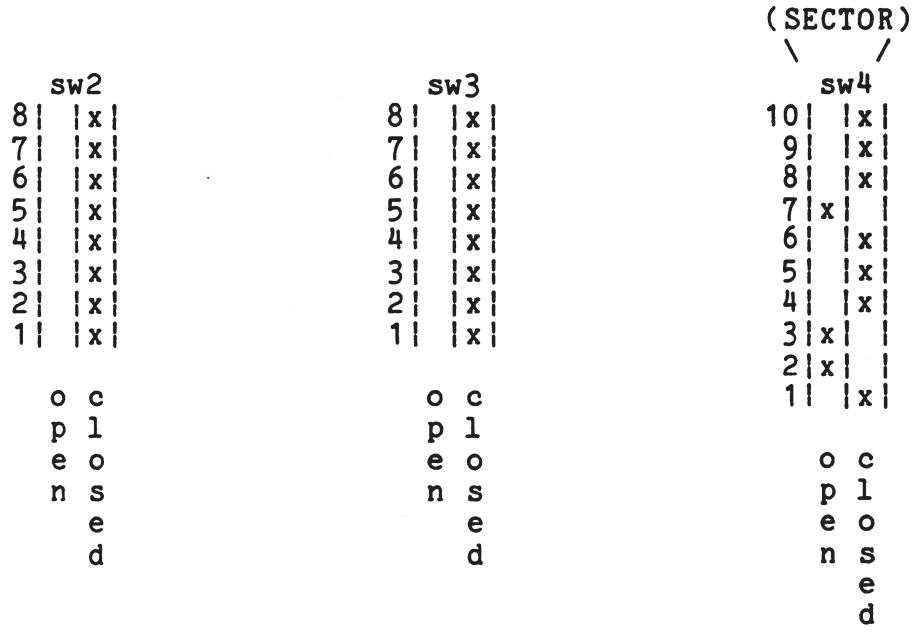
Because of the size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. It depends on which operating system is used.

Display Drive Configuration

Drive Name: D2268H
Base DU Unit Number: 000
Number of Heads: 010
Number of Sectors Per Track: 070
Number of Cylinders: 00823
Number of Logical Units: 001

Logical Unit Size (Blocks): 00566490
Diagnostic Partition Size (Cylinders): 00001

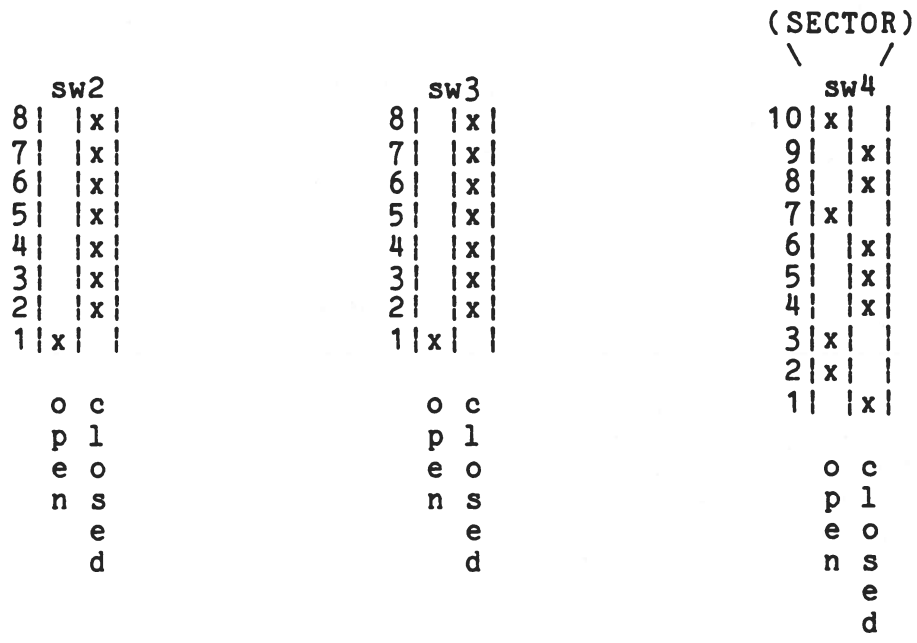
DRIVE SWITCH SETTINGS



Display Drive Configuration

Drive Name: D2362
Base DU Unit Number: 000
Number of Heads: 023
Number of Sectors Per Track: 070
Number of Cylinders: 00850
Number of Logical Units: 001

Logical Unit Size (Blocks): 01345776 (see note)
Diagnostic Partition Size (Cylinders): 00001



NOTE:

Because of tne size of this drive, it may be necessary to partition the drive to get full usage of all logical blocks. Tt depends on which operating system is used.

TOSHIBA MK286FC

Display Drive Configuration

```
Drive Name:  MK286FC
Base DU Unit Number:  000
Number of Heads:  011
Number of Sectors Per Track:  071
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00632170
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS

option switch

```
     1 2 3 4 5 6 7 8
on  |x|x|x| | | |x| |
off | | | |x|x|x| |x|
```

sector switch

```
     1 2 3 4 5 6 7 8 9 10
    |x| | |x|x|x| |x|x|x| on
    | |x|x| | | |x| | | | off
```

TOSHIBA MK288FC

Display Drive Configuration

```
Drive Name:  MK288FC
Base DU Unit Number:  000
Number of Heads:  015
Number of Sectors Per Track:  071
Number of Cylinders:  00823
Number of Logical Units:  001

Logical Unit Size (Blocks):  00862050
Diagnostic Partition Size (Cylinders):  00001
```

DRIVE SWITCH SETTINGS

option switch

```
     1 2 3 4 5 6 7 8
on  |x|x|x| | | |x| |
off | | | |x|x|x| |x|
```

sector switch

```
     1 2 3 4 5 6 7 8 9 10
    |x| | |x|x|x| |x|x|x| on
    | |x|x| | | |x| | | | off
```

SECTION 3

OPERATION -- BOOT, FORMAT, AND DIAGNOSTICS

The operation of the controller includes communication with the system and formatting the disk. Formatting is accomplished by prompting the operator for selecting inputs. The program is in components on the controller. Formatter error messages are also included in this section.

COMMUNICATION WITH CRT OR HARD COPY CONSOLE

If using the optional Dilog Format Paddle Card, the system console must be set up as follows:

- 9600
- 8 bit
- no parity
- 1 stop bit

If the system console is attached directly to the host, the setup is as follows:

- 9600, 4800, 2400, 1200
- 8 bit
- no parity
- 1 stop bit

DILOG PDP-11 BOOTSTRAP PROCEDURE

The controller not only supports standard DEC devices, but also allows the use of the onboard formatter. When DU is used, the standard DEC emulation is called. When FT is used, the onboard formatter is enabled for use through the system console.

The controller supports boot on boot address 775000. (Characters underlined are output by the system; characters not underlined are input by the operator.) Proceed as follows:

Method A

1. Power up the system.
2. Break to ODT.
3. Start execution at 775000 (octal).

Method B

1. Power up the system
2. Break to ODT

3. Initialize the controller by writing the IP register (IP and SA registers are listed below; XXXXXX = IP, YYYYYY = SA):

   @ XXXXXX/000000 0 <CR>

   The controller will DMA the boot code to host memory when the PDP host is enabled through the SA register.

   @ YYYYYY/004400 77777 <CR>

   Start the boot with

   @ 2000G

   IP and SA register addresses are as follows:

IP REGISTER OCTAL ADDRESS	SA REGISTER OCTAL ADDRESS
772150	772152
760334	760336
760340	760342
760344	760346
760354	760356
760360	760362
760374	760376
760400	760402

   *Enter one of the following: DM0, DP0, DL0, DR0, MS0, MT0, DY0, DU, FT, or MU <CR>.

   Definitions are as follows:

   DM = RK06/07 Disk
   DP = RP02/03 Disk
   DL = RL01/02 Disk
   DR = RM03/05/80 Disk
   MS = TS11 Tape
   MT = Tape
   MU = (TMSCP) Tape
   DY = RX02 Floppy Disk
   DU = DU Emulation
   FT = Enable onboard formatter through system console
   MU = TMSCP Tape

Booting can be executed from logical units other than "0" shown above by entering the desired logical unit number, i.e., 1, 2, 3, ... or 7.

VAX-11/730 COMMUNICATIONS PROCEDURE

1. On the VAX-11/730, press the Restart switch.

2. Enter the code below. (Underlined values are outputs to the terminal.) The values of the IP and SA registers are listed in Table 3-1.

>>> D/P/L F26804 80000001 <CR>

>>> D/P/W <IP> 0 <CR>

>>> D/P/W <SA> 3FFF <CR>

>>> D/G/L F 200 <CR>

>>> C <CR>

VAX-11/750 COMMUNICATIONS PROCEDURE

1. On the VAX-11/750, press the Restart switch.

2. Enter the code below. (Underlined values are outputs to the terminal.) The values of the IP and SA registers are listed in Table 3-1.

   >>> D/P/L F30804 80000001 <CR>

   If the controller is plugged into the second Unibus adapter in the VAX-11/750, enter the following line; otherwise, omit this entry and proceed to the next entry:

   >>> D/P/L F32804 80000001 <CR>

   >>> D/P/W <IP> 0 <CR>

   >>> D/P/W <SA> 3FFF <CR>

   If the controller is plugged into the second Unibus adapter in the VAX-11/750, enter the following line; otherwise, omit this entry and proceed to the last two entries.

   >>> D/P/L 237 F80000 <CR>

   >>> D/G/L F 200 <CR>

   >>> C <CR>

Table 3-1. VAX-11/730/750 IP/SA Addresses

Switch SW1			IP (Octal)	First Unibus Adapter <IP> IP Hex Address Entered	First Unibus Adapter <SA> SA Hex Address Entered
SW1-1	SW1-2	SW1-3			
OFF	OFF	OFF	772150	FFF468	FFF46A
ON	OFF	OFF	760334	FFE0DC	FFE0DE
OFF	ON	OFF	760340	FFE0E0	FFE0E2
ON	ON	OFF	760344	FFE0E4	FFE0E6
OFF	OFF	ON	760354	FFE0EC	FFE0EE
ON	OFF	ON	760360	FFE0F0	FFE0F2
OFF	ON	ON	760374	FFE0FC	FFE0FE
ON	ON	ON	760400	FFE100	FFE102
				Second Unibus Adapter	
SW1-1	SW1-2	SW1-3			
OFF	OFF	OFF	772150	FBF468	FBF46A
ON	OFF	OFF	760334	FBE0DC	FBE0DE
OFF	ON	OFF	760340	FBE0E0	FBE0E2
ON	ON	OFF	760344	FBE0E4	FBE0E6
OFF	OFF	ON	760354	FBE0EC	FBE0EE
ON	OFF	ON	760360	FBE0F0	FBE0F2
OFF	ON	ON	760374	FBE0FC	FBE0FE
ON	ON	ON	760400	FBE100	FBE102

VAX 11/780 COMMUNICATIONS PROCEDURE

1. On the VAX-11/780, press the Restart switch.

2. Enter the code below. (Underlined values are outputs to the terminal.) The values of the IP and SA registers are listed in Table 3-2.

   >>> I <CR>

   >>> D/P/L 20006804 80000001 <CR>

   If the controller is plugged into a second, third, or fourth Unibus adapter in the VAX-11/780, enter the following; otherwise, proceed to the next entry:

   Second UB: >>> D/P/L 20008804 80000001 <CR>
   Third UB: >>> D/P/L 2000A804 80000001 <CR>
   Fourth UB: >>> D/P/L 2000C804 80000001 <CR>

   >>> D/P/W <IP> 0 <CR>

   >>> D/P/W <SA> 3FFF <CR>

   If one Unibus adapter is used, enter the first line of code. If more than one are used, enter the appropriate code as follows:

   First UB: >>> D/P/L 22E 20100000 <CR>
   Second UB: >>> D/P/L 22E 20140000 <CR>
   Third UB: >>> D/P/L 22E 20180000 <CR>
   Fourth UB: >>> D/P/L 22E 201C0000 <CR>

   >>> D/G/L F 200 <CR>

   >>> C <CR>

VAX 86XX COMMUNICATIONS PROCEDURE

1. Reset the VAX 86XX.

2. Enter the code below. (Underlined values are outputs to the terminal.) The values of the IP and SA registers are listed in Table 3-2.

   >>> I <CR>

   >>> D/P/L 20006804 80000001 <CR>

   If the controller is plugged into a second, third or fourth Unibus adapter in the VAX 86XX, enter the following; otherwise, proceed to the next entry:

   Second UB: >>> D/P/L 20008804 80000001 <CR>
   Third UB: >>> D/P/L 2000A804 80000001 <CR>
   Fourth UB: >>> D/P/L 2000C804 80000001 <CR>

   >>> D/P/W <IP> 0 <CR>

   >>> D/P/W <SA> 3FFF <CR>
   >>> D/P/L 21D 01010101 <CR>
   >>> D/P/L 221 01010101 <CR>
   >>> D/P/L 225 01010101 <CR>
   >>> D/P/L 229 C0010101 <CR>

   Enter one of the following, depending upon which UNIBUS adapter the controller is plugged into:

   First UB: >>> D/P/L 22E 20100000 <CR>
   Second UB: >>> D/P/L 22E 20140000 <CR>
   Third UB: >>> D/P/L 22E 20180000 <CR>
   Fourth UB: >>> D/P/L 22E 201C0000 <CR>

   >>> D/G/L F 200 <CR>

   >>> C <CR>

Table 3-2. VAX-11/780 and VAX-86XX IP/SA Addresses

Switch SW1			IP (Octal)	First Unibus Adapter <IP> IP Hex Address Entered	First Unibus Adapter <SA> SA Hex Address Entered
SW1-1	SW1-2	SW1-3			
OFF	OFF	OFF	772150	2013F468	2013F46A
ON	OFF	OFF	760334	2013E0DC	2013E0DE
OFF	ON	OFF	760340	2013E0E0	2013E0E2
ON	ON	OFF	760344	2013E0E4	2013E0E6
OFF	OFF	ON	760354	2013E0EC	2013E0EE
ON	OFF	ON	760360	2013E0F0	2013E0F2
OFF	ON	ON	760374	2013E0FC	2013E0FE
ON	ON	ON	760400	2013E100	2013E102
				Second Unibus Adapter	
SW1-1	SW1-2	SW1-3			
OFF	OFF	OFF	772150	2017F468	2017F46A
ON	OFF	OFF	760334	2017E0DC	2017E0DE
OFF	ON	OFF	760340	2017E0E0	2017E0E2
ON	ON	OFF	760344	2017E0E4	2017E0E6
OFF	OFF	ON	760354	2017E0EC	2017E0EE
ON	OFF	ON	760360	2017E0F0	2017E0F2
OFF	ON	ON	760374	2017E0FC	2017E0FE
ON	ON	ON	760400	2017E100	2017E102
				Third Unibus Adapter	
SW1-1	SW1-2	SW1-3			
OFF	OFF	OFF	772150	201BF468	201BF46A
ON	OFF	OFF	760334	201BE0DC	201BE0DE
OFF	ON	OFF	760340	201BE0E0	201BE0E2
ON	ON	OFF	760344	201BE0E4	201BE0E6
OFF	OFF	ON	760354	201BE0EC	201BE0EE
ON	OFF	ON	760360	201BE0F0	201BE0F2
OFF	ON	ON	760374	201BE0FC	201BE0FE
ON	ON	ON	760400	201BE100	201BE102
				Fourth Unibus Adapter	
SW1-1	SW1-2	SW1-3			
OFF	OFF	OFF	772150	201FF468	201FF46A
ON	OFF	OFF	760334	201FE0DC	201FF0DE
OFF	ON	OFF	760340	201FE0E0	201FE0E2
ON	ON	OFF	760344	201FE0E4	201FE0E6
OFF	OFF	ON	760354	201FE0EC	201FE0EE
ON	OFF	ON	760360	201FE0F0	201FE0F2
OFF	ON	ON	760374	201FE0FC	201FE0FE
ON	ON	ON	760400	201FE100	201FE102

FORMATTING PROGRAM

After communication is established, the program is ready to format the disks.

The formatter's terminal I/O interface supports the following keys:

- DELete/Back Space: Delete the previous character input
- CTRL-U: Delete the entire input
- CTRL-C: Aborts the current process and returns to the main menu
- CTRL-P: Prints out current cylinder address on the printer
- CTRL-S: (XOFF, Transmit Off); Stops the display on screen
- CTRL-Q: (XON, Transmit On); Continues display on screen after CTRL-S

Inputs and outputs to or from the program are in decimal with the exception of the following:

- IP/SA registers are displayed in octal.
- ECC error patterns are displayed in hexadecimal.
- Format data pattern is represented in hexadecimal.

The first display of the program will be:

```
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
DILOG On-Board Disk Formatter                IP/SA Address: 772150
Model: DQ246/DQ256                                   Version: A-A
- - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
                          No Drive is Selected

     Are you using a (P)rinter or (C)RT?
```

In the logo the IP/SA address depends on the switch settings described in Section 2. The address shown above is the IP register. Add 2 for the SA register (772152). The version is the hardware (first) and software (second) revision.

Enter P or C. If C is entered, rolling addresses will be displayed on the screen at format time. If P is entered, the address will not be printed unless an error is detected. To print a cylinder address at any time, press CTRL P. In the descriptions below, the logo is omitted but will be displayed on the screen, as shown above.

Main Menu

After the terminal type, C or P, has been selected, the logo will be displayed followed by the main menu:

No Drive is Selected

Main Formatter Menu
- - - - - - - - - - -

0 - Select SMD Drive 0
1 - Select SMD Drive 1
2 - Select SMD Drive 2
3 - Select SMD Drive 3
4 - Display Drive Configuration
5 - Rebuild Unit Control Block
6 - Modify Base DU Unit Number
7 - Format Drive
8 - Bad Block Scan

Enter a Selection:

If a drive has been selected previously, the display at the top will be similar to the following:

SMD Drive 000 Selected

A drive must be selected (0-3) before other items on the menu (4-6) can be entered. If a drive has been selected, the configuration of that drive may be displayed by entering 5. Item 6, Modify Base DU Unit Number, changes the previously assigned Base DU Number. Item 7, Format Drive, is used for partitioning disks on all four drives, identifying and replacing bad media areas, and reporting errors.

Items on the Main Menu are desribed below with the entry number in parentheses.

Select SMD Drive (0-3)
- - - - - - - - - - - - -

A maximum of four drives (0-3) may be selected. Each drive may be partitioned into a maximum of four logical units (0-3).

NOTE

> The number of logical units is 4, but the designation of logical units in the format section is 0-3. When selecting, check the parameters in parentheses; for example, (2 ... 4) indicates number, (0-3) indicates designation.

If a drive is selected and has not been previously formatted, the program will prompt for the drive parameters, partitioning, and Base DU unit number. If the emulation cannot read the drive parameters from the Unit Control Block, the controller will disconnect from the host. If the formatter cannot read the drive parameters from the Unit Control Block, the program will invoke the query session. If the unit is selected and the parameters are displayed, the implication is the drive has a valid Unit Control Block. These terms are described below.

An example of a query session and responses follows:

```
                    SMD Drive 000 Selected

Drive Characteristics Query Session
- - - - - - - - - - - - - - - - - -
(CTRL-C ABORTS TO MAIN MENU)

Drive Name:  XYZ

Number of Heads:  10

Number of Sectors Per Track:  32

Number of Cylinders:  800

Would you like to partition the drive (Y/N)?
```

Input ranges are as follows: Drive name, 14 alpha numeric characters; Heads, 1-127; Sectors, 2-127; Cylinders, 2-32767. The number of sectors per track is defined by the drive setup. If an incorrect value is entered, an error message will be displayed:

```
Input does not match number of sector pulses (064).

***** UNIT SELECT ERROR:  Drive Setup Conflict *****
** ** ** ** ** Press <CR> to continue ** ** ** ** **
```

The 064 indicates the number of sectors defined by the drive setup. Other inputs may vary within maximum ranges of the drive; for example, the user may require partitioning of 700 cylinders and 9 heads. If the inquiry to partition the drive is No, the drive will be partitioned as one logical unit. If Yes, the user may select from 2 to 4 logical units as shown in the following example:

```
Number of Logical Units (2 ... 4): 4
```

The next inquiry will be similar to the following:

```
Base DU Unit (0 ... 252): 250 (See Note)
```

The BASE DU Unit assigns a sequential DU number to each logical unit on the drive, such that the BASE DU UNIT is assigned to the first logical unit (Logical Unit 0). The range of the DU unit varies according to the previous response; for example, if 3 logical units had been selected, the range would be (0 ... 253), or 1 logical unit (0 ... 255). The logical unit corresponds to the DU unit. In the example above (4 logical units), the numbers would be as follows:

NOTE

This base unit number is for example only. In normal system configuration this will be a 0.

Logical Unit Number	DU Unit Number
0	250
1	251
2	252
3	253

The controller divides a drive into logical units and reports these units to the host as DU units. After the query session or if selected from the main menu, the drive configuration will be displayed.

Display Drive Configuration (4)
- - - - - - - - - - - - - - - - -

From the example above, the drive configuration will be displayed as follows:

SMD Drive 000 Selected (XYZ)

Display Drive Configuration
- - - - - - - - - - - - - - - -

Drive Number: XYZ
Base DU Unit: 250
Number of Heads: 010
Number of Sectors Per Track: 064
Number of Cylinders: 00800
Number of Logical Units: 004

Logical Unit Size (Blocks): 00234740
Diagnostic Partition Size (Cylinders): 000004

Modify Above Parameters (Y/N)? <N>

The logical unit and diagnostic partition sizes are the results of the input values above. The number of sectors per track is derived by taking the manufacturer's bytes per track and dividing by DILOG's bytes per sector--which have a value of 584 bytes/sector. Refer to Section 2 for drive switch settings. If heads, cylinders, or logical units are changed, the results will change. The sizes of logical units on the drive are equal and are determined by the drive size and number of logical units. Any cylinders remaining after the drive is partitioned will be added to the Diagnostic Partition (initially the Diagnostic Partition size is one cylinder). If modification is required, the program will prompt again for new inputs.

Rebuild Unit Control Block (5)
- - - - - - - - - - - - - - - - -

This portion of the program tests and rebuilds the Unit Control Block. The program formats the UCB, rewrites drive parameters, and reads back the drive parameters for verification; data from the host area in the drive is not changed during this operation. After 5 is selected from the main menu, the first display will be as follows:

Testing Unit Control Block ...

If the test is successful, the following will appear:

```
Successful; UCB is OK.
```

If the test fails, a display similar to the following will appear:

```
Failed; UCB is corrupted.

***** UCB READ ERROR: Non-correctable Data Field Error *****
** ** ** ** **      Press <CR> to continue      ** ** ** ** **
```

The above error message indicates the reason for the failure. Furthermore, the error type corresponds to the error generated by reading the last UCB copy.

NOTE

Errors are listed below after the Format section.

The next display is:

```
***  ***  ***   CAUTION   ***  ***  ***
If you continue. Unit Control Block on
the selected drive will be overwritten.
***  ***  ***  ***  ***  ***  ***  ***

Would you like to continue (Y/N)? <N>
```

If the response is No, the program will exit to the main menu. If the response is Yes, the program displays the current drive parameters and permits the user to modify the parameters, followed by:

```
Recovering Drive Parameters ... Rebuild Operation
```

If the rebuild is successful, the following will appear:

```
Rebuild operation completed.
```

If rebuild failed, a display similar to the following will appear:

```
Rebuild operation failed.

*****   UCB READ:  Non-correctable Data Error  *****
** ** ** ** ** Press <CR> to continue ** ** ** ** **
```

NOTE

The Unit Control Block must be rebuilt with the same drive parameters with which it was formatted previously (Item 7 from the Main Menu, Format Drive, is described below).

Modify Base DU Unit Number (6)

If Item 6 is selected, the DU unit numbers may be changed starting with the first or base unit number. For the above example, the following would be displayed:

```
Base DU Unit (0 ... 252): <250>
```

To change the unit number, enter the new number; for example, 200, and the following will appear:

```
Base DU Unit (0 ... 252): <250> 200
Current Base DU Unit Updated.

Updating Unit Control Block

** ** **  Press <CR> to continue ** ** **
```

If the operation is successful, the Unit Control Block will be updated with the new Base DU number. If the operation fails, an error message similar to the one below will appear. This operation does not affect the data on the host area.

```
*****  UCB READ ERROR: Invalid Drive Characteristics *****
** ** ** ** **     Press <CR> to continue     ** ** ** ** **
```

Format Drive (7)

After selection and configuration of drives, the drives are ready for formatting. The program divides, or partitions, the disks into areas for different uses. Figure 3-1 shows two examples of partitioning. Drive parameters are recorded in the Unit Control Block. The host area is for user data, the Replacement and Caching Table (RCT) is used for listing bad-media replacement. There is also a replacement sector at the end of each track. Each drive has an area for diagnostics for use by the host.

When 7 is entered from the Main Menu, the following will appear:

```
SMD Drive 000 Selected

Format Menu

  1 - Format Entire Drive
  2 - Format Logical Unit
  3 - Format Diagnostic Partition
  0 - Exit Menu

Enter Selection: <000>
```

An entire drive, a logical unit, or the diagnostic partition may be formatted. Formatting one logical unit or the diagnostic partition does not affect the data on the other logical units.

If 1 or 2 is selected, the following will appear:

```
*** *** *** CAUTION *** *** ***
    If you continue. ALL DATA will
    be lost on the selected unit!!
*** *** *** *** *** *** *** ***

    Would you like to continue (Y/N)? <N>
```

If yes is selected, the following appears:

```
          SMD Drive 000 Selected

Format SMD Drive 000
(CTRL-C ABORTS TO FORMAT MENU)

     Data Pattern (0...FF): <00>
```

The data pattern is a combination of 1's and 0's written to and read from the drive. To check all bits, the most efficient patterns, in hex, are AA and 55.

If 1 is selected, the entire drive will be formatted as illustrated in Figure 3-1. In the example below, the disk is partitioned into four logical units. The cylinder address and the bad-block scan will roll on the screen as each cylinder is addressed. The program writes headers, initializes the RCT to a no-defect state, scans and reports bad blocks, and lists the blocks available to the user. The cylinder addresses shown below are for the last cylinder in each logical unit. The diagnostic partition which is formatted last is generally one or two cylinders.

```
Formatting DU250 (Logical Unit 000):
  Writing headers at cylinder 00145
  Initializing RCT to no defect state
  Bad-block scan at cylinder: 00145
  Number of available blocks: 00031682

Formatting DU251 (Logical Unit 001):
  Writing headers at cylinder 00292
  Initializing RCT to no defect state
  Bad-block scan at cylinder: 00292
  Number of available blocks: 00031682

Formatting DU252 (Logical Unit 002):
  Writing headers at cylinder 00439
  Initializing RCT to no defect state
  Bad-block scan at cylinder: 00439
  Number of available blocks: 00031682

Formatting DU253 (Logical Unit 003):
  Writing headers at cylinder 00586
  Initializing RCT to no defect state
  Bad-block scan at cylinder: 00586
  Number of available blocks: 00031682
```

```
    Formatting Diagnostic Partition
      Writing headers at cylinder 00588
      Diagnostic Partition Size (cylinders): 00001
  Format operation has completed

    **  **  **  Press <CR> to continue  **  **  **
```

If a 2 is selected, the same prompts will appear as when an entire drive is formatted, except after Data Pattern, the following will appear:

```
        Logical Unit Number (0...003): <000>
```

The selected logical unit will then be formatted:

```
    Formatting DU000 (Logical Unit 000)
      Writing headers at cylinder 00145
      Initializing RCT to no defect state
      Bad-block scan at cylinder 00145
      Number of available blocks: 00031682
  Format operation has completed

    **  **  **  Press <CR> to continue  **  **  **
```

If 3 is selected from the menu, the display will resemble the following:

```
    Formatting Diagnostic Partition
      Writing headers at cylinder 00588
      Diagnostic partition size (cylinders): 00001
    Format operation has completed

    **  **  **  Press <CR> to continue  **  **  **
```

If an error occurs, the bad-block display will resemble the following:

```
    BAD-BLOCK found at LBN 00025050 (CYL:00632, HEAD:000, SECT:000)
    Error Type:  Correctable Data Field Error
                 (PATTERN: 01FA02,  VECTOR: 00061   LENGTH: 10 bits)
    Replacing LBN 00025050 with RBN 00000349 (Non-Primary)
```

In the example above, the error type is the ECC correction pattern. The vector is the number of bytes from the beginning of the sector in error and the length is the error burst in bits. Other errors are listed below.

An LBN (Logical Block Number) is the position in the DU unit which is used by the host. The RBN (Replacement Block Number) is also used by the host but is placed at the end of a track on the disk. If the replacement sector is not on the same track where the error occurred, the sector is considered as a non-primary replacement sector, and if at the end of the track where the error occurred, it is primary.

Figure 3-1 is a simplified description of the partitioning of two drives as one logical unit and three logical units.

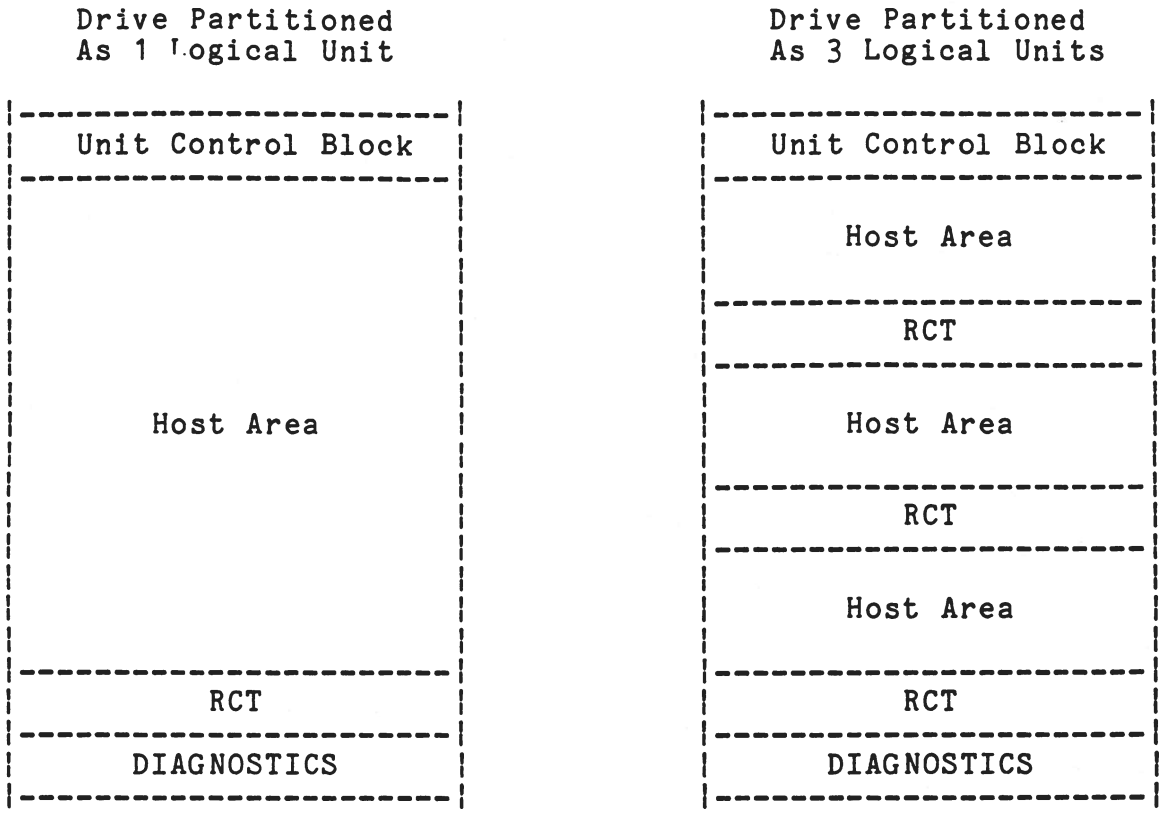


Figure 3-1. Drive Partitioning

Bad-Block Scan (8)

After the drives have been formatted, this option can be used to run patterns across the selected unit in order to locate and replace bad blocks. This can be achieved by means of read scan. write/read user-defined patterns, or write/read DILOG's default patterns. The entire drive or a logical unit may be scanned. The menu is as follows:

SMD Drive 001 Selected (XYZ)

Bad-Block Scan Menu
---
1 - Scan Entire Drive
2 - Scan a Logical Unit
0 - Exit Menu

Enter a Selection: <001> 1

Once the operator has selected the unit and the area which is to be scanned, the controller will prompt for the number of patterns. If the response to the above question is zero (0), the controller will read over the selected area without writing data patterns; any bad blocks found will then be replaced. Note that when a bad block is replaced, the data on the bad block will be lost.

If the operator responds with a nine (9), the controller will write eight data patterns across the selected area. Each write is followed by a read in order to detect bad media which will then be replaced. Patterns selected are as follows: 0000, 5555. AAAA, 8B8B, 3333, 3091, B6D9, 2D2D.

If the operator responds with a number between one (1) and eight (8), the controller will prompt for the data pattern(s). After the data pattern(s) have been selected, the controller will then write the "n" patterns (where "n" is the number of data patterns selected by the operator) across the selected area, each write will then be followed by a read in order to detect and replace bad media.

The following lists the data patterns:

```
                        SMD Drive 001 Selected    (XYZ)

Scan SMD Drive 001 (XYZ)
------------------------
(CTRL-C ABORTS TO FORMAT MENU)

  Number of patterns (0..9): <009> 8

  Data Pattern 1 (0...FFFF): <0000>
  Data Pattern 2 (0...FFFF): <5555>
  Data Pattern 3 (0...FFFF): <AAAA>
  Data Pattern 4 (0...FFFF): <8B8B>
  Data Pattern 5 (0...FFFF): <3333>
  Data Pattern 6 (0...FFFF): <3091>
  Data Pattern 7 (0...FFFF): <B6D9>
  Data Pattern 8 (0...FFFF): <2D2D>

***   ***   ***   CAUTION   ***   ***   ***
   If you  continue, ALL DATA will
   be lost on the selected unit!!!
***   ***   ***  ***   ***   ***  ***   ***

Would you like to continue (Y/N)? <N> No
```

Errors

Error types and error contexts are listed below. The context describes what function was being performed when the error occurred. Error types may have more than one cause. Three stand-alone errors are listed separately.

Error Type	Description
Unit Not Selected	Drive is not selected--possible bad connection or drive not powered up.
Multiple Unit Selected	More than one drive has the same SMD unit number--check drive setup.
Drive Not Ready	Drive did not spin up--perhaps drive power problem.
Seek Operation Failed	Drive was not able to complete the seek, or the seek was to a non-existent cylinder--check drive parameters.
Drive Fault	Drive fault condition--consult drive manual.
Sector Not Found	Unable to locate a sector or header miscompare--probably bad media in header.
RCT Access Failed	RCT partition corrupted.
Unable to Read Replacement Sector	During read scan, sector was previously replaced but replacement sector is bad.
Correctable Data Field Error	Bad media in data field; error is corrected using ECC.
Non-correctable Data Field Error	Bad media in data field; length of error is too large to be corrected.
Sector Overrun	Drive not formatted properly--check drive setup.
No Data Synch Field	Data Synch Field changed due to bad media.
Unit Write Protected	The drive is hardware write protected.
No Sector/Index Pulse	Sector or Index pulse not received--check drive manual.

Unable to Write Headers	During formatting, headers could not be written--check drive manual.
DDC Time-out	Integrated circuit in controller timed out--reselect drive from main menu.
Drive Setup Conflicts	During query session, program detects drive parameters which conflict with drive setup.
Invalid Drive Characteristics	Drive characteristics read from the drive are invalid. Could be number of sectors not set up properly, unit control block is corrupted (use 5 from the Main Menu to rebuild Unit Control Block), or drive has not been formatted via Universal Formatter.
Abort upon operator request	Operator pressed CNTRL-C keys to abort operation.
Unexpected Late-interlock (F)	Fatal error--contact DILOG Customer Service.
FIFO Data Lost (F)	Fatal error--contact DILOG Customer Service.
Fatal DDC Error (F)	Fatal error--contact DILOG Customer Service
Software Detected Fatal Error (F)	Fatal error--contact DILOG Customer Service.

Error Context	Description
UNIT SELECT	Error occurred during unit select.
UCB READ	Error occurred when reading drive parameters from Unit Control Block; unable to read any of the multiple copies.
UCB WRITE	Error occurred when writing drive parameters to Unit Control Block; unable to write any of the multiple copies.
UCB FORMAT	Error occurred during formatting the Unit Control Block; unable to format any of multiple copies.

RCT READ	Error occurred during reading an RCT block. Unable to read any of multiple copies.
RCT WRITE	Error occurred during writing to RCT block. Unable to write any of multiple copies.
RCT FORMAT	Error occurred during formatting of RCT partition. Unable to format any of multiple copies.
READ	Error occurred during reading data from the host area.
WRITE	Error occurred during writing data to the host area.
FORMAT	Error occurred during formatting to the host area.
REPLACE	Error occurred during bad block replacement. Unable to replace bad LBN with RBN as described by type error.

Stand-Alone Errors	Description
INPUT OUT OF RANGE	Input is not within the expected range.
INPUT IS REQUIRED	No default for prompt.
RCT IS FULL	The Replacement and Caching Table (RCT) on the selected drive is full. The drive should be reformatted.

SECTION 4

DIAGNOSTICS

Two DEC RC25 diagnostics may be used to test the controller. They are ZRCFB3, Front End Test, and ZRCDA1, Disk Exerciser.

SETUP AND SELF TEST

Install the controller as described in Section 2. Apply power to the system, and verify that the green LED lights. Install the XXDP+ diagnostic floppy in the floppy drive and boot the system. When the boot switch on the system is toggled, the LED will go out, but will light again when the controller is brought online by the diagnostic.

When booting is completed, the XXDP+ sign-on will appear:

```
XXDP-SM SMALL MONITOR VERSION 2
BOOT FROM DY0
28KW MEMORY
UNIBUS SYSTEM

RESTART ADDR: 152010
THIS IS XXDP-SM  TYPE "H" OR "H/L" FOR HELP
```

(NOTE: 28KW = 28 Kilowords)

FRONT END TEST ZRCFB3

The controller will support only tests 1-8 which must be selected by the user. These tests will bring the controller through initialization several times and do extensive checks on the DMA capability. Once the prompt "." has appeared, type the following command line to start ZRCFB3 diagnostic:

```
.R ZRCFB3
```

The system will echo the filename to let the user know that the file is being loaded.

```
.R ZRCFB3
ZRCFB3.BIN
```

When the diagnostic has been loaded, the diagnostic startup message will appear on the user's console.

```
DRSSM-F0
CZRCF-A-0
RC25 FRONT END/HOST DIAGNOSTIC
UNIT IS AZTEC RC25 PLATTER
RSTRT ADR 145676

DR>
```

The diagnostic can be started by typing the following command line:

```
DR>START/TEST:1-8<CR>
```

The above command line instructs the diagnostic supervisor to start the test but initiate only tests 1 through 8. The supervisor will then prompt the user for hardware or software changes.

```
CHANGE HW (L)  ?
```

The diagnostic must be informed of the hardware parameters of the system under test. Enter the following information.

```
CHANGE HW (L)  ? Y<CR>
```

Enter the number of controllers that are being tested.

```
# UNITS (D)  ? 1<CR>
```

The diagnostic will then prompt the user to enter the following information for the number of units that have been selected. The following is an example:

```
UNIT 0
IP ADDRESS (O)  172150  ? <CR>
VECTOR (O)  154  ? <CR>
BR LEVEL (O)  5  ? <CR>
PLATTER ADDRESS[ES] (D)  ? 0<CR>
```

The platter address is the unit number of the disk drive under test. Since the controller does not support the tests which require a disk, this question is not appropriate, but must be answered to start the diagnostic. Once the hardware questions are answered, the supervisor will prompt for software changes.

```
CHANGE SW (L)  ?
```

The software question can be answered NO because the controller does not support the tests which require a disk drive.

```
CHANGE SW (L)  ? N<CR>
```

The diagnostic will print each test as it runs and will inform the user of any errors that occur.

```
TESTING UNIT #:   0     IP_REGISTER:172150       PLATTER #:0

TEST  1  REGISTER EXISTENCE TEST
TEST  2  STEP 1 READ/WRITE POWERUP DIAGNOSTICS
TEST  3  DIAGNOSTIC WRAP TEST
TEST  4  VECTOR AND BR LEVEL TEST
TEST  5  STEP 1-3 READ/WRITE DIAGNOSTIC
TEST  6  PURGE POLL TEST
TEST  7  SMALL RING TEST
TEST  8  LARGE RING TEST
```

When the diagnostic has completed all the tests, the end of pass message will be printed and the diagnostic will be restarted.

```
DZRCF    EOP     1
         0  TOTAL ERRORS

DR>EXIT<CR>
```

DISK EXERCISER, ZRCDA1

The controller is also compatible with the multi-drive exerciser,ZRCDA1. This diagnostic will bring the controller online and issuerandom record numbers to the selected unit(s). This diagnostic alsosupports multiple controllers as well as multiple units on a singlecontroller.

Once the XXDP prompt "." is displayed, run ZRCDA1 by typing the following command line:

```
.R ZRCDA1<CR>
```

The system will echo the filename to inform the user that the program is being loaded:

```
.R ZRCDA1
 ZRCDA1.BIN
```

Once the diagnostic is loaded, the diagnostics startup message will be displayed on the user's console:

```
DRSSM-FO
CZRCD-A-0
RC25 DISK EXERCISER
UNIT IS SINGLE RC25 PLATTER
RSTRT ADR 145676

DR>
```

Patch as follows:

	ADDRESS	IS	SHOULD BE
PATCH 1	26070	16237	12737
	26072	50	143326
PATCH 2	30644	1003	1367
PATCH 3	30704	1003	1367
PATCH 4	37522	1416	240

Start the test after the diagnostic supervisor prompt "DR>" appears.

```
DR>START<CR>
```

The supervisor will then prompt the user to change hardware or software default parameters:

```
CHANGE HW (L)  ?
```

The diagnostic must be informed of the hardware parameters of the system under test. Enter the following command line to change hardware parameters:

```
CHANGE HW (L)  ? Y<CR>
```

Enter the number of controllers or drives that are currently being tested:

```
# UNITS (D)  ? 1<CR>
```

If 2 is entered the next prompt will appear twice so that the second controller or second drive may be selected.

The diagnostic will prompt the user to enter the following information for the number of units that have been selected:

```
UNIT 0
IP ADDRESS (O) 172150  ? <CR>
VECTOR (O) 154  ? <CR>
BR LEVEL (D)  5  ? <CR>
PLATTER ADDRESS (UNIT PLUG) (D)  0  ? <CR>
ALLOW WRITES TO CUSTOMER DATA AREA ON THIS PLATTER (L)  ?
   Y<CR>
** WARNING - CUSTOMER DATA AREA MAY BE OVERWRITTEN! ...
   CONFIRM (L)  ? Y<CR>
```

The platter address is the unit number of the disk drive under test. The customer data area is the host data area of the disk drive and is used to test the controller. Backup any data in the host partition, if necessary, before continuing with the diagnostic.

After the hardware questions are answered, the supervisor will prompt the user for any software changes:

```
CHANGE SW (L)  ?
```

The user can take the default software values because all SMD drives are larger than an RC25. If the tests are being run on a contracted unit, some of the software values may have to be changed to prevent errors.

If the selected unit is fully formatted, use the default values by typing NO to the software query:

```
CHANGE SW (L)  ? N<CR>
```

To change the software default values. answer YES to the software query:

```
CHANGE SW (L)  ? Y<CR>
```

The user will then be prompted by the supervisor to input the following information:

ERROR LIMIT (0 FOR NO LIMIT) (D) 32 ? <CR>

Enter the error limit that must be reached before a unit is deselected by the diagnostic. The default value of 32 is used.

TRANSFER LIMIT IN MEGABYTES (0 FOR NO LIMIT) (D) 2 ? <CR>

Enter the number of bytes to be transferred between the controller and the diagnostic. Effectively, this will select the time required to reach an END OF PASS.

SUPPRESS PRINTING ERROR LOG MESSAGES (L) Y ? <CR>

The default value should be used unless multiple errors occur and more information is required to resolve the problem.

RUN DM EXERCISER INSTEAD OF MULTI-DRIVE SUBTEST (L) N ? <CR>

The default must always be taken because the controller does not support Diagnostic Mode (DM) of operation.

RANDOM SEEK MODE (L) Y ? <CR>

The best possible test is to seek randomly across the entire disk surface. Therefore, the default value should be used.

STARTING TRACK (D) 0 ? <CR>

The starting track number is to be entered. (Because the controller does not emulate the RC25, the questions regarding starting and ending track numbers do not apply. If the unit under test is fully formatted and is more than 40 megabytes, the diagnostic will not overflow the cylinder address.)

ENDING TRACK (D) 1641 ? <CR>

Enter the ending track number. If the unit is larger than an RC25 unit (40 megabytes), the default can be used.

READ-COMPARES PERFORMED AT THE CONTROLLER (L) Y ? <CR>

The default value is used to require the controller to compare the data read with host memory.

THE REMAINING QUESTIONS APPLY ONLY TO UNPROTECTED PLATTERS.

The user can use the default values for the remaining questions.

WRITE ONLY (L) N ? <CR>

The disk drive under test is never a write only disk; therefore, always take the default.

```
WRITE-COMPARES PERFORMED AT THE CONTROLLER (L) Y ? <CR>
```

The controller will perform write checks if the default is taken.

```
CHECK ALL WRITES AT HOST BY READING (L) N ? <CR>
```

The diagnostic will NOT issue read commands to check the data just written if the default is taken. Otherwise, the diagnostic software will perform the write check function.

```
USER DEFINED DATA PATTERN (L) N ? <CR>
```

The data pattern used in the diagnostic is worst case. To ensure prompt testing, always use the default value.

```
SELECT PREDEFINED DATA PATTERN (0 FOR SEQUENTIAL SELECTION)

(D) 0 ? <CR>
```

Always use the default value.

The test will begin after the hardware and software questions are answered.

```
INIT SUBTEST START

ABOUT TO VERIFY VECTOR 154(0) FOR DEVICE 172150(0)
...COMPLETED
```

The diagnostic will run until the transfer limit is reached. After the limit has been reached, the diagnostic will print status information about the unit under test and display the END OF PASS message:

```
CZRCD EOP      1
   0 TOTAL ERRS
```