AA-M185B-TC

UDA50 Maintenance Guide

digital

AA-M185B-TC

UDA50 Maintenance Guide

Digital Equipment Corporation
Colorado Springs, Colorado

1st EDITION, FEBRUARY, 1982
2nd EDITION, NOVEMBER, 1982

The information in this manual is for informational purposes and is subject to change without notice.

Digital Equipment Corporation assumes no responsibility for any errors which may appear in this manual.

Printed in U.S.A.

This document was set on DIGITAL's computerized typesetting system.

The following are trademarks of Digital Equipment Corporation, Maynard, Massachusetts:

DEC	DECUS	DECnet
DECsystem-10	DECSYSTEM-20	DECwriter
DIBOL	Digital Logo	EduSystem
IAS	LSI-11	MASSBUS
OMNIBUS	PDP	PDT
Q-BUS	RSTS	RSX
UNIBUS	VAX	VMX
	VT	

CONTENTS

1	**INTRODUCTION**	**Page**
1.1	SCOPE OF MANUAL	1
1.2	UDA50 MAINTENANCE PHILOSOPHY	1
1.3	UDA50 FIELD REPLACEABLE PARTS	1
1.4	UDA50 UPGRADE	1
1.5	UDA50 DIFFERENCES	2
1.6	UDA50 MAINTENANCE FEATURES	3
1.7	UDA50 ADDRESS SWITCHES AND JUMPERS	5
1.8	UNIBUS OVERLOADING	8
1.9	UNIBUS OVERLOADING EXCEPTIONS	11
1.10	UDA50 PRIORITY PLUG	11
1.11	RELATED DOCUMENTATION	12
1.12	INSTALLATION OF BOOTSTRAP ROM	13
2	**UDA50 FAULT ISOLATION**	
2.1	UDA50-RESIDENT DIAGNOSTICS	15
2.1.1	UDA50 LED Error Codes	15
2.1.2	Status/Address Register Codes	18
2.2	UDA50 SUBSYSTEM DIAGNOSTICS	22
2.2.1	PDP-11 Subsystem Diagnostics	23
2.2.2	VAX Subsystem Diagnostics	24
2.3	UDA50 SUBSYSTEM TROUBLESHOOTING	25
2.3.1	UDA50-Resident Diagnostics	25
2.3.2	UDA50 Host-Resident Diagnostic	25
2.3.3	Subsystem Error Message Information	27

FIGURES **Page**

1-1	UDA50 Illustrated Parts	2
1-2A	Diagnostic LED Locations on the UDA50 Modules	4
1-2B	Diagnostic LED Locations on the UDA50 Modules	4
1-3A	M7161 Address Switch and Jumper Locations	6
1-3B	M7485 Address Switch and Jumper Locations	7
1-4	UDA50 Switch Setting for Address 772150	8
2-1	UDA50 Subsystem Troubleshooting Flowchart	26
2-2	Real-Time Drive State Interpretation	29
2-3	Drive Status Bytes	31
2-4	Sub-unit Mask Bit Layout Examples	45
2-5	Status Message Interpretation	46

TABLES **Page**

1-1	UDA50 Modules	3
1-2	UNIBUS Delay	9
2-1	LED Error Codes	15
2-2	SA Register Error Codes	18
2-3	Real-Time Drive State Code Interpretation	33
2-4	Bit Description of Status Message Bytes	37

1 INTRODUCTION

1.1 SCOPE OF MANUAL

The *UDA50 Maintenance Guide* describes the maintenance and troubleshooting procedures needed to support the UDA50 Disk Controller. This guide covers both UDA50-resident diagnostic and UDA50 host-resident diagnostic operating procedures. When troubleshooting disk subsystem problems, refer to the service manuals of the disk products in the subsystem for device-specific service information.

1.2 UDA50 MAINTENANCE PHILOSOPHY

The maintenance philosophy planned for the UDA50 Disk Controller is module replacement. Field Service personnel should not attempt to replace or repair component parts within these modules.

1.3 UDA50 FIELD REPLACEABLE PARTS

The UDA50 Disk Controller consists of two hex modules, two flat ribbon intermodule cables, an unshielded Standard Interface (SDI) cable assembly, an I/O bulkhead assembly, and some assorted hardware. Figure 1-1 illustrates the major Field replaceable Units (FRUs) in a UDA50 assembly.

1.4 UDA50 UPGRADE

The UDA50 has been upgraded to increase its performance. The differences between the old UDA50 and the upgraded UDA50 will be called out in this manual where applicable.

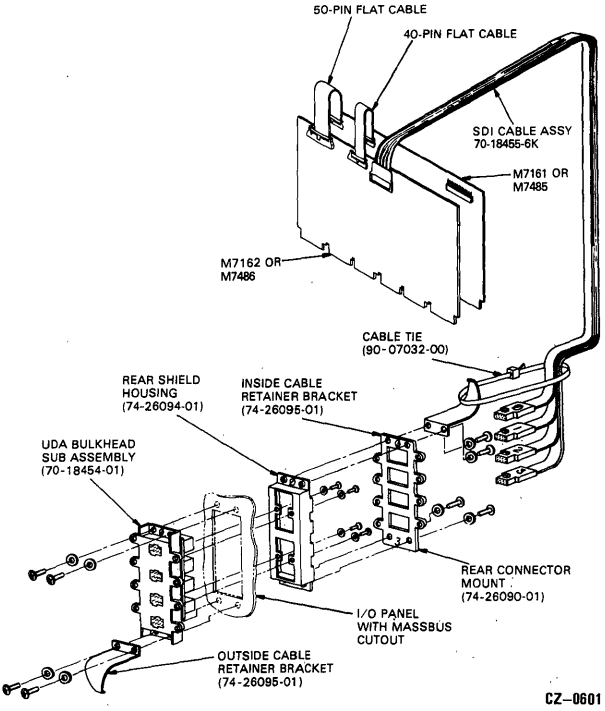

Figure 1-1 UDA50 Illustrated Parts

1.5 UDA50 DIFFERENCES

The upgraded UDA50 consists of two new modules. Refer to Table 1-1. Some of the features which increase the performance of the new UDA50 are:

- Increased RAM size on the M7486 module from 4K to 16K.

- Minor hardware modification to make buffering easier.
- Etched-in capability to use larger PROMS.
- Selectable jumpers for UNIBUS delays for various systems.

Table 1-1 UDA50 Modules

OLD UDA50 MODULES	NEW UDA50 MODULES
M7161	M7485
M7162	M7486

CAUTION

The new UDA50 M7485 and M7486 modules are not upward or downward compatible with the old UDA50 M7161 and M7162 modules. Under no circumstances should a new UDA50 module be used to replace a failing old UDA50 module unless both modules are replaced as a set.

1.6 UDA50 MAINTENANCE FEATURES

The UDA50 Disk Controller has the following maintenance features.

- UDA50-resident diagnostics
- UDA50 LED maintenance displays
- UDA50 host-resident diagnostics

The UDA50-resident diagnostic is a PROM-based microcode program that performs UDA50 self-diagnosis upon power-up or hard initialization.

A UDA50 maintenance display is located on each UDA50 module. Each display consists of four LEDs. These LEDs display current resident diagnostic activity and error codes caused by malfunctions. Figures 1-2A and 1-2B show the location of the maintenance LEDs on each module.

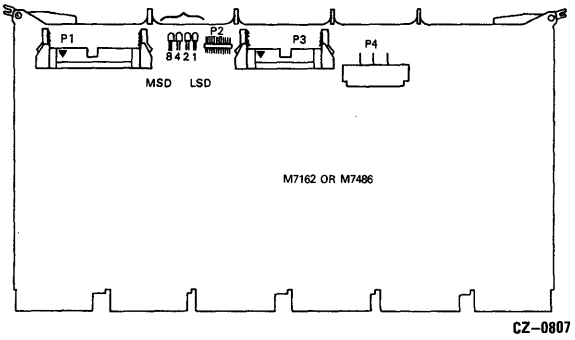

Figure 1-2A Diagnostic LED Locations on the UDA50 Modules

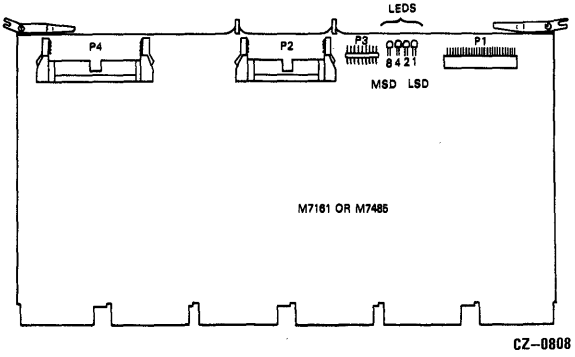

Figure 1-2B Diagnostic LED Locations on the UDA50 Modules

The UDA50 host-resident diagnostics contain four tests that isolate subsystem faults to the UNIBUS or disk drives. A system exerciser program is also provided to test the performance of the entire disk subsystem.

1.7 UDA50 ADDRESS SWITCHES AND JUMPERS

The UDA50 Disk Controller contains two registers that are visible to the UNIBUS I/O page. They are the initializing and polling (IP) register and the status and address (SA) register. The IP and SA registers are assigned an octal UNIBUS address of 772150 and 772152, respectively.

The UNIBUS address selector switches and jumper plugs W4 and W5 are used to set the UNIBUS address for the IP register. The location of these switches and jumpers on UDA50 module (M7161) is shown in Figure 1-3A. The location of these switches and jumpers on UDA50 module (M7485) is shown in Figure 1-3B. Set the UNIBUS address switches and jumpers for both modules to the positions shown in Figure 1-4 to select UNIBUS address 772150.

In past disk products, a vector address was also physically selectable. This is not true with the UDA50 Disk Controller. A vector address typically 154 (octal) will be supplied by the software.

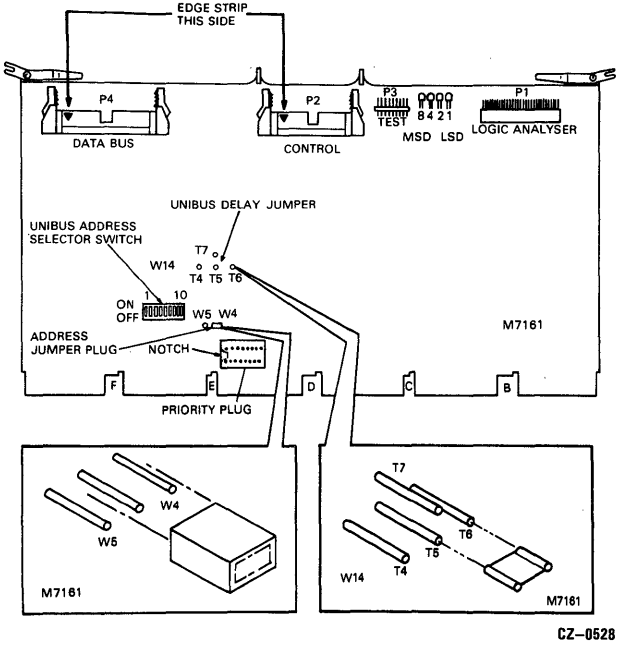

Figure 1-3A M7161 Address Switch and Jumper Locations

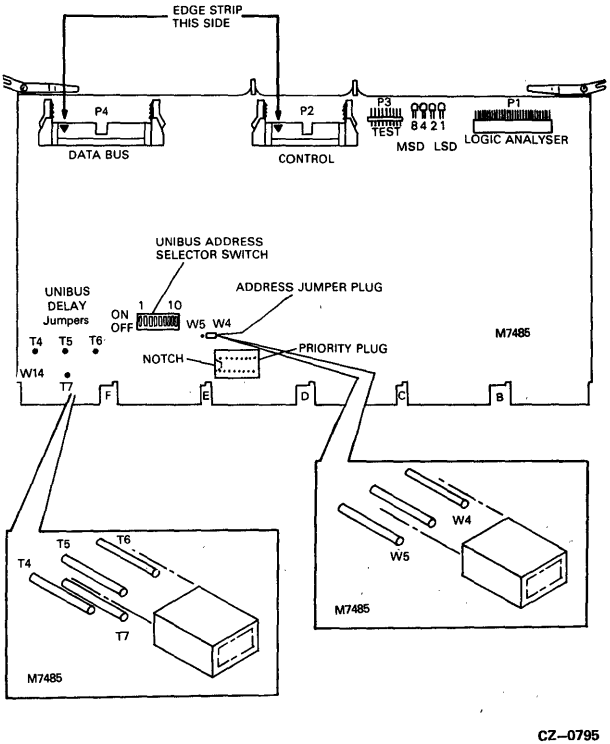

Figure 1-3B M7485 Address Switch and Jumper Locations

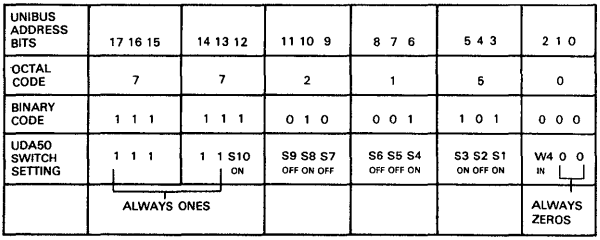

Figure 1-4 UDA50 Switch Setting for Address 772150

NOTE

UNIBUS address bit 2 is selected by jumper plugs W4 and W5. Only one jumper plug can be in place at a time. When jumper W4 is IN, bit 2 equals 0. When jumper W5 is IN, bit 2 equals 1.

NOTE

The UNIBUS address switches and jumpers should be set for a floating address when a second UDA50 is installed on a system. Check the system configuration and UNIBUS addresses of all devices

1.8 UNIBUS OVERLOADING

A set of jumpers has been inserted on both the M7161 and M7485 modules to prevent UNIBUS overloading. The location of these jumpers on UDA50 module (M7161) is shown in Figure 1-3A. The location of these jumpers on UDA50 module (M7485) is shown in Figure 1-3B.

Table 1-2 shows the amount of delay, jumper configuration, and system configuration.

Table 1-2 UNIBUS Delay

Amount of Delay	Jumper Config.	Type of System
0 usec	T4-T5	UDA installed and the only disk drive is a RL02 or a RK07 (11/70 system with an RK07 and 1mb DMR will not work *)
6.2 usec	T5-T6	UDA installed with multiple DMR11s or DMC11s or DZ11s
		11/44 system (or any other PDP-11 with ECC memory) using RM02 or RP04/05/06 disk drives
		11/44 with RL02 or RK07 disk drives
		11/24 system (or any other PDP-11 with non-ECC memory) with one or two UDAs installed with other disk controllers and a DZ11

* The UDA/RK07/DMR11 configuration gives data late errors from the RK07 regardless of the UDAs jumper setting. Because of this, either an RK07 or a UDA, but not both can be configured on the 11/70 when a 1mb DMR11 is present.

Table 1-2 UNIBUS Delay (Cont)

Amount of Delay	Jumper Config.	Type of System
		VAX systems should be treated as an 11/24 for UNIBUS configuration
		UDA installed on the UNIBUS with one or more real time data acquistion devices, and real time data overrun or underflow is observed †
10 usec	T5-T7	11/44 system with RL02 and RK07 disk drives
		11/70 system with a UDA/RL02/DMR11 (1mb) mix

† If underflow or overrun conditions are observed after setting the UDAs jumper to the 6.2 usec. position, the UDAs jumper must be set to the 10 usec. position (T5-T7).

1.9 UNIBUS OVERLOAD EXCEPTIONS

There are exceptions to using the UNIBUS delay in preventing overload and to the number of UDAs that can be installed on a system. They are:

1. The UDA should not be installed on a UNIBUS system which has a bus repeater because the repeater slows the UNIBUS. Other devices such as RK07, RM02, and RP04/05/06 may also experience data late conditions.

2. The UDA must be installed after all non-buffered devices on the UNIBUS.

3. On PDP-11 systems, there may be no more than two UDAs installed on a UNIBUS. However on VAX systems, no more than one UDA should be installed on a UNIBUS with non-buffered UNIBUS peripheral devices.

NOTE

The old UDA50 M7161 module has the UNIBUS delay jumpers installed starting with M7161 module revision E. Check this module and its delay jumpers if you are having UNIBUS overload problems.

1.10 UDA50 PRIORITY PLUG

All UDA50 M7161 and M7485 modules are shipped with a level 5 priority plug. This is the recommended priority level for UDA50 disk subsystems and thus, the priority plug need not be changed for the majority of installations. If another priority level is required in some special circumstance, then the current priority plug must be removed and the new one inserted. The location of the priority plug is shown in Figure 1-3. It should be inserted so that the notch on the priority plug aligns with the hole on the module socket.

1.11 RELATED DOCUMENTATION

The UDA50 Disk Controller related documentation is listed below.

Documentation is available from the Printing and Circulation Services, 444 Whitney St., Northboro, Massachusetts 01532.

- *UDA50 Disk Controller User Guide* (EK-UDA50-UG)
- *UDA50 Disk Controller Service Manual* (EK-UDA50-SV)

Documentation is available from the Software Distribution Center Order Administration/Processing, 20 Forbes Rd., Northboro, Massachusetts 01532.

- *UDA50 Field Maintenance Print Set* (MP-01331)
- *UDA50 Programmer's Documentation Kit* (QP905-GZ) - This kit consists of the following three software manuals.
  - *MSCP Basic Disk Functions Manual* (AA-L619A-TK)
  - *Storage System Diagnostic and Utilities Protocol* (AA-L620A-TK)
  - *Storage System UNIBUS Port Description* (AA-L621A-TK)

- *UDA50 Maintenance Documentation Kit* (QP904-GZ) - This kit consists of a small looseleaf binder, the UDA50 Maintenance Guide, and the current drive maintenance guides that operate on the UDA50.

    - *UDA50 Maintenance Guide* (AA-M185B-TC) - The above maintenance guide is an 8 × 5-1/2 inch looseleaf.

    - *RA80 Maintenance Guide* (AA-M186A-TC) - The above maintenance guide is an 8 × 5-1/2 inch looseleaf.

    - *RA81 Maintenance Guide* (AA-M879A-TC) - The above maintenance guide is an 8 × 5-1/2 inch looseleaf.

    - *Maintenance Guide Looseleaf Binder* (AV-L980A-TK)

1.12 INSTALLATION OF BOOTSTRAP ROM

The proper bootstrap ROMs will be shipped with the UDA50. Bootstrap ROM # 23-767A9-00 must be installed on the PDP-11 bootstrap ROM module M9312.

Bootstrap ROM # 23-990A9-00 must be installed on the VAX 11/750.

2 UDA50 FAULT ISOLATION

2.1 UDA50-RESIDENT DIAGNOSTICS

There are two ways of obtaining resident diagnostic information from the UDA50 Disk Controller. The first is through the UDA50 LED error codes. The second is by examining the contents of the UDA50 status/address (SA) register. The SA register contents are also supplied to the host CPU for error logs and diagnostic error reports.

2.1.1 UDA50 LED Error Codes

Table 2-1 lists the LED error codes and indicates which FRU is most likely at fault.

Table 2-1 LED Error Codes

M7161 or M7485 LEDs 8 4 2 1	M7162 or M7485 LEDs 8 4 2 1	Most Likely Failure
o o o ●	x x x x	Undefined
o o ● o	o o o o	M7161 or M7485 or software
o o ● ●	o o o o	M7161 or M7485 or software

Note: ● = LED ON o = LED OFF
x = Does not care condition

When two codes are given for the same error, both indicate the same failure.

Table 2-1 LED Error Codes (Cont)

M7161 or M7485 LEDs 8 4 2 1	M7162 or M7485 LEDs 8 4 2 1	Most Likely Failure
○ ● ○ ○	○ ○ ○ ○	M7161 or M7485 or host inactive
○ ● ○ BLINK	○ ○ ☌ ○	No problem
○ ● ● ○ x x x x	x x x x ○ ● ● ○	Undefined
○ ● ● ● x x x x	x x x x ○ ● ● ○	Undefined
● ○ ○ ○	○ ○ ○ ○	M7161 or M7485 or software
● ○ ○ ● ○ ○ ○ ○	○ ○ ○ ○ ● ○ ○ ●	M7161 or M7485
● ○ ● ○ ● ○ ● ○	○ ○ ○ ○ ● ○ ● ○	M7162 or M7486

Note: ● = LED ON ○ = LED OFF
x = Does not care condition

When two codes are given for the same error, both indicate the same failure.

Table 2-1 LED Error Codes (Cont)

M7161 or M7485 LEDs 8 4 2 1	M7162 or M7485 LEDs 8 4 2 1	Most Likely Failure
● ○ ● ○	x x x x	Undefined
x x x x	● ○ ● ●	
x x x x	● ● ○ ○	M7161 or M7485
● ● ○ ○	x x x x	
● ● ○ ●	x x x x	M7162 or M7486
x x x x	● ● ○ ●	
● ● ● ○	x x x x	M7161 or M7485
x x x x	● ● ● ○	M7162 or M7486
● ● ● ●	● ● ● ●	M7161 or M7485
Cycling pattern	Cycling pattern	No problem if gone in less than 2 seconds after UDA50 initiation otherwise change M7161 or M7485.

Note: ● = LED ON ○ = LED OFF
x = Does not care condition

When two codes are given for the same error, both indicate the same failure.

2.1.2 Status/Address Register Error Codes

More detailed information on UDA50 functional and diagnostic error codes is reported through the SA register. The contents of this register may be examined manually through the CPU console at the UDA50 UNIBUS address plug 2. This address is normally 772152. Table 2-2 lists the SA error codes and indicates the most likely FRU at fault.

Table 2-2 SA Register Error Codes

Error Code (Octal)	Error Description	Most Likely FRU Failed
100001	UNIBUS packet read error	M7161 or M7485*
100002	UNIBUS packet write error	M7161 or M7485*
100003	UDA ROM and RAM parity error	M7161 or M7485 or M7162 or M7486
100004	UDA RAM parity error	M7162 or M7486
100005	UDA ROM parity error	M7161 or M7485
100006	UNIBUS ring read error	M7161 or M7485*

* Possibly the host CPU is at fault.

Table 2-2 SA Register Error Codes (Cont)

Error Code (Octal)	Error Description	Most Likely FRU Failed
100007	UNIBUS ring write error	M7161 or M7485*
100010	UNIBUS interrupt master failure	M7161 or M7485
100011	Host access timeout error	M7161 or M7485*
100012	Host exceeded command limit	M7161 or M7485*
100013	UNIBUS bus master failure	M7162 or M7486
100014	DM XFC fatal error	M7162 or M7486
100015	Hardware timeout of instruction loop	M7161 or M7485*
100016	Invalid virtual circuit identifier	M7161 or M7485*
100017	Interrupt write error on UNIBUS	M7161 or M7485*
104000	Fatal sequence error	M7161 or M7485

* Possibly the host CPU is at fault.

Table 2-2 SA Register Error Codes (Cont)

Error Code (Octal)	Error Description	Most Likely FRU Failed
104040	D processor ALU	M7161 or M7485
104041	D processor control ROM parity error	M7161 or M7485
105102	D processor with no BD #2 or RAM parity error	M7162 or M7486
105105	D processor RAM buffer error	M7162 or M7486
105152	D processor SDI error	M7162 or M7486
105153	D processor write mode wrap serdes error	M7162 or M7486
105154	D processor read mode serdes, RSGEN & ECC error	M7162 or M7486
106040	U processor ALU error	M7161 or M7485
106041	U processor control register error	M7161 or M7485

Table 2-2 SA Register Error Codes (Cont)

Error Code (Octal)	Error Description	Most Likely FRU Failed
106042	U processor DFAIL/control ROM parity/BD #1 test CNT	M7161 or M7485
106047	U processor constant PROM error with D processor running SI test	M7161 or M7485
106055	Unexpected trap found, abort diagnostic	M7161 or M7485
106071	U processor constant PROM error	M7161 or M7485
106072	U processor control ROM parity error	M7161 or M7485
106200	Step 1 data error (MSB not set)	M7161 or M7485 or RE-INIT
107103	U processor RAM parity error	M7162 or M7486
107107	U processor RAM buffer error	M7162 or M7486

Table 2-2 SA Register Error Codes (Cont)

Error Code (Octal)	Error Description	Most Likely FRU Failed
107115	Test count was wrong (BD 12)	M7162 or M7486
112300	Step 2 error	M7161 or M7485
122240	NPR error	M7161 or M7485
122300	Step 3 error	M7161 or M7485
142300	Step 4 error	M7161 or M7485

2.2 UDA50 SUBSYSTEM DIAGNOSTICS

The UDA50 host-resident diagnostics for both the PDP-11 CPU family and the VAX CPU family are described briefly in the following paragraphs. A more detailed description of these diagnostic programs is found in the diagnostic listings that are available from the Software Distribution Center.

If the diagnostic programs report errors, refer to the troubleshooting procedure in Paragraph 2.3.

2.2.1 PDP-11 Subsystem Diagnostics

2.2.1.1 CZUDEC0 — UDA Disk Formatter Program Most disk drives will be shipped with formatted disks. On formatted disk drives, it will not be necessary to run the formatter program. Refer to the disk drive user guide to determine if you must run the formatter program before the diagnostic program.

2.2.1.2 CZUDCC0 — UDA50 and Disk Drive Diagnostic. This diagnostic consists of the following four tests:

- Test 1 - UNIBUS addressing test
- Test 2 - Disk-resident diagnostic test
- Test 3 - Disk functional test
- Test 4 - Disk exerciser test

This program will ask some hardware and software questions of the user. A sample printout of these questions, when the default conditions are elected, is shown below.

```
CHANGE HW (L) ? N *

# UNITS (D) ? 1

UNIT 0
UNIBUS ADDRESS OF UDA (0) 172150 ?
VECTOR (0) 154 ?
BR LEVEL (D) 5 ?
UNIBUS BURST RATE (D) 0 ?
DRIVE NUMBER (D) 0 ?
EXERCISE ON CUSTOMER DATA AREA IN TEST 4 (L) N ?

CHANGE SW (L) ? N *

ENTER MANUAL INTERVENTION MODE FOR SPECIAL DIAGNOSIS (L) N ?

REMAINING SOFTWARE QUESTIONS APPLY TO TEST 4 ONLY
```

```
ERROR LIMIT (D) 32 ?
READ TRANSFER LIMIT IN MEGABYTES - 0 FOR NO LIMIT (D) 0 ?
SUPPRESS PRINTING SOFT ERRORS (L) Y ?
DO INITIAL WRITE ON START (L) Y ?
ENABLE ERROR LOG (L) N ?
```

*The following questions will not be asked when you answer this question with a "N". They are listed here to show you what will be asked if you answer"Y", and what the defaults are.

2.2.1.3 CXDUBC0 -- DECX11 Module – The DECX11 module operates in two modes:

- It performs data transfer over the UNIBUS to the UDA50 internal buffer.
- It performs reads and writes to the customer data area of the disks.

2.2.2 VAX Subsystem Diagnostics

2.2.2.1 ZZ-EVRLB -- UDA Disk Formatter – Most disk drives will be shipped with formatted disks. On these disk drives, it will not be necessary to run the formatter program. Refer to the disk drive user guide to determine if you must run the formatter before the diagnostic program.

2.2.2.2 ZZ-EVRLA -- UDA50 Disk Subsystem Diagnostics – The VAX UDA50 host-resident diagnostic contains the same four tests as the PDP-11 version.

- Test 1 - UNIBUS addressing test
- Test 2 - Disk-resident diagnostic test
- Test 3 - Disk functional test
- Test 4 - Disk exerciser test

Use the verify section of this diagnostic for system installation.

2.2.2.3 ZZ-EVRLC -- Generic Disk Drive Exerciser – This program tests the read and write ability of any SDI type disk drive, and will display differences in the read and write data to the operator.

2.3 UDA50 SUBSYSTEM TROUBLESHOOTING

A brief UDA50 subsystem troubleshooting flowchart is illustrated in Figure 2-1. The troubleshooting procedure recommends examining the error log first.

2.3.1 UDA50-Resident Diagnostics

The UDA50-resident diagnostics are initiated when power is applied to the UDA50 Disk Controller. The CPU should be halted during this test. The four LED indicators on each UDA50 module will display a cycling pattern in the LEDs.

The cycling pattern in the LEDs signifies the completion of a successful UDA50 diagnostic test. Figure 1-2 shows the location of the four LEDs on each UDA50 module.

If the UDA50 LEDs do not display the cycling pattern after power is applied, look up the LED error code in Table 2-1 to locate the problem.

2.3.2 UDA50 Host-Resident Diagnostic

A brief description of the UDA50 host-resident diagnostics is presented in Paragraph 2.2. Use the UDA50 host-resident diagnostic to isolate problems to the UNIBUS or the disk drives.

These diagnostics will send back error messages concerning drive status or real-time drive state. Since the drive status error messages are unique to each disk drive, they will be described in the drive maintenance guide and service manual. The real-time drive state error messages describe what is happening in the drive. Paragraph 2.3.3 describes the error message information.

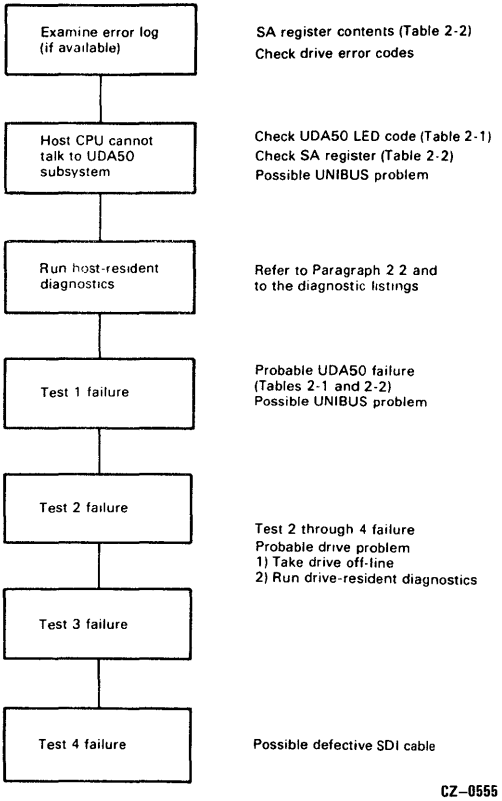

Figure 2-1 UDA50 Subsystem Troubleshooting Flowchart

2.3.3 Subsystem Error Message Information

Error messages will be typed out during the UDA50 host-resident diagnostic if a problem is detected. Three sample printouts are shown below. Sample 1 shows typical drive error printout when running the PDP-11 XXDP + program. Sample 1A shows typical drive error printout when running the VAX diagnostics.

Note that the real-time drive state (RTDS) and the drive status are given in the last examples of samples 1 and 1A. Sample 2 shows a typical UDA50 error printout. The last line of sample 2 gives the contents of the SA register.

Sample 1:
Printout of a Drive Error using XXDP +

```
CZUDC HRD ERR 04041 ON UNIT 00 TST 004 SUB 000 PC: 21044
DISK EXERCISER DM PC:5110 UDA AT 172150 DRIVE 032 RUNTIME 00:00:23
COULD NOT FIND REPLACEMENT FOR
LBN WITH HEA
NOT FOUND
LBN TO REPLACE 900

CZUDC SFT ERR 04006 ON UNIT 00 TST 004 SUB 000 PC: 21044
DISK EXERCISER DM PC:5324 UDA AT 172150 DRIVE 032 RUNTIME 00:00:37
SELECT TRACK AND WRITE LEVEL 1 CMD NOT EXECUTED
ATTEMPT 0
LBN 5252
SECTORS FROM INDEX 13 TRK 1 GRP 0 CYL 6
ORIGIN OF SEEK: GRP 1 CYL 5
REAL TIME STATE 8001
STATUS (R TO L): 0001 1100 0000 0A00 0000 0613 1020
```

Sample 1A:
Printout of a Drive Error using VAX DS

```
EVRLA -- UDA50 Disk Subsystem Diagnostic -- 2.0
Pass 1, test 4, subtest 0, error 4041 19-AUG-1982 12:16:03.71
Hard error while testing DUA32: DM PROGRAM REPORTING AN ERROR


DISK EXERCISER CM PC;5110 UDA at address 772150 DRIVE_DUA32
COULD NOT FIND REPLACEMENT FOR
LBN WITH HEADER NOT FOUND
LBN TO REPLACE 900

END OF HARD ERROR NUMBER 4041

EVRLA -- UDA50 Disk Subsystem Diagnostic -- 2.0
Pass 1, test 4, subtest 0, error 4006 19-AUG-1982 12:16:03.71
Soft error while testing DUA32: DM PROGRAM REPORTING AN ERROR

DISK EXERCISER DM PC;5324 UDA at address 772150 (0) DRIVE_DUA32
SELECT TRACK AND WRITE LEVEL 1 CMD NOT EXECUTED


ATTEMPT 0
LBN 5252
SECTORS FROM INDEX 13 TRK 1 GRP 0 CYL6
ORIGIN OF SEEK: GRP 1 CYL 5
REAL TIME STATE 8001
STATUS (R TO L): 0001 1100 0000 0A00 0000 0613 1020


End of soft error number 4006
```

Sample 2:
Printout of a UDA50 Error using XXDP +

```
CZUDC DVC FTL ERR 00005 ON UNIT 00 TST 001 SUB 002 PC: 023710
UDA INITIALIZE ERROR
UDA RESIDENT DIAGNOSTICS DETECTED FAILURE
UDASA REGISTER = 106040
```

2.3.3.1 Real-Time Drive State Message Interpretation

The real-time drive state message consists of 4 hexadecimal digits. Only four state bits within these hexadecimal digits are of diagnostic value to the field service engineer. The rest of the bits are too transitory and are masked out before the RTDS message is printed. The following are the four important RTDS state bits.

- Read/write ready (R/W RDY)
- Drive available (AVAIL)
- Attention (ATTN)
- Receiver ready (RCVR RDY)

The location of these four state bits within the hexadecimal code is shown in Figure 2-2. The interpretation of the RTDS message requires an understanding of the causes and effects of each bit in the RTDS message. It also requires an understanding of what is meant by drive on-line, drive off-line, drive available and drive unavailable. Definitions of each of the of the four RTDS message bits and the on-line and available states are given.

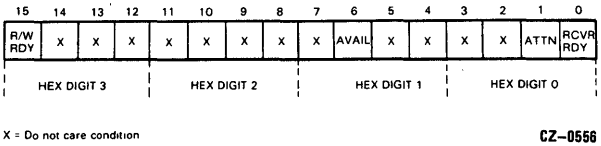

Figure 2-2 Real-Time Drive State Interpretation

The following four terms define the state of the drive as seen from the controller.

- Drive Off-line - The drive is not operational and may not communicate with the controller via the drive control protocol.

- Drive Unavailable - The drive is operating, is visible to, and may at times communicate with the controller. However, the controller may not fully utilize the drive because the drive is drive on-line to another controller.

- Drive Available - The drive is visible to, capable of communicating with, and capable of executing an on-line command. However, the drive is not currently drive on-line to any specific controller.

- Drive On-line - The drive is dedicated to the exclusive use of a particular controller, and is not available to any alternate controller.

The following paragraphs explain the causes, effects, and interrelationships of the four state bits within the RTDS message.

- RECEIVER READY - When RCVR RDY is asserted, it indicates that the drive is ready to receive a command on the SDI interface WRITE/COMMAND line. RCVR RDY is negated while the drive is processing a command.

- ATTENTION - This notifies the controller that a potentially significant status change has occurred in the drive.

  When in the drive on-line state, the drive asserts this signal whenever any of its generic status bits (see Figure 2-3) change, except for the following three cases.

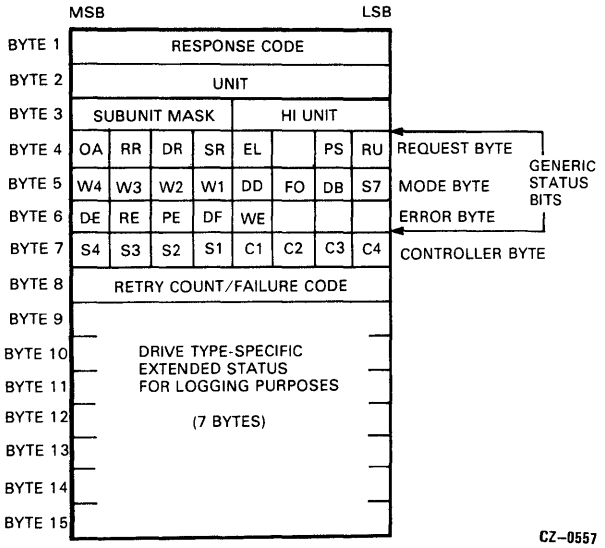

Figure 2-3 Drive Status Bytes

1. A generic status bit changes as a direct consequence of the correct operation of a command.

2. A generic status bit changes as the result of an error in the reception, validation, or execution of a command.

3. The RE status bit changes due to a transmission error outside of a command. The RE bit is described in byte 6 of the drive status message.

- An on-line drive may assert ATTN regardless of whether a command is in progress or not. The drive will continue to assert this signal until it receives a valid get status command from the controller. At this point, the drive will negate the ATTN signal.

  A drive in the available state, that is spinning, always asserts the ATTN signal. The ATTN signal is negated if any condition arises that would prevent the available drive from spinning up under controller command.

- READ/WRITE READY - When R/W RDY is asserted, it indicates that the drive is capable of handling a data transfer to or from the disk surface.

  Upon receipt of a start frame of a command, the drive will negate this signal prior to reasserting RCVR RDY. Once negated, this signal will remain negated until the drive has processed the command and has transmitted the end frame of the response.

  Any head motion will lower this signal until the operation is completed, and the drive is again ready to perform I/O operations.

  The drive asserts R/W RDY after the successful completion of a seek operation. If the operation is unsuccessful, the drive will keep the R/W RDY signal negated and use ATTN to signal the problem.

- AVAILABLE - When AVAIL is asserted, it indicates that the drive is in the drive available state relative to the controller. It is asserted whenever the drive enters the drive available state. The signal is negated when the drive leaves the drive available state.

Use the definitions given above to interpret the RTDS message in Table 2-3.

Table 2-3 Real-Time Drive State Code Interpretation

RTDS HEX CODE	DESCRIPTION
0000	The drive is either in initialization or in an off-line state.
0001	The drive is on-line. Possibly an error state was recently cleared, or the drive spun down with the RUN/STOP switch out.
0002	This code indicates an invalid drive state. ATTN is asserted and the drive cannot receive controller commands with RCVR RDY negated.

Table 2-3 Real-Time Drive State Code Interpretation (Cont)

RTDS HEX CODE	DESCRIPTION
0003	The drive is on-line and one of two conditions exist. 1. The disks are spinning, and there is an error state. 2. The disks are not spinning and there is a switch change active.
0040	This code indicates an invalid drive state. RCVR RDY should be asserted if the drive is in the available state.
0041	The drive is available, but not spinable. The RUN/STOP switch is not pushed in, or there could be an open interlock that prevents spin up.
0042	This code indicates an invalid drive state. ATTN is asserted and the drive cannot receive controller commands with RCVR RDY negated.
0043	The drive is available and spinable.

Table 2-3 Real-Time Drive State Code Interpretation (Cont)

RTDS HEX CODE	DESCRIPTION
8000	This code indicates an invalid drive state. R/W RDY should not be asserted with RCVR RDY negated.
8001	This is the normal drive on-line state.
8002	This code indicates an invalid drive state. ATTN is asserted and RCVR RDY is negated, preventing the drive from receiving controller commands.
8003	The drive is on-line and one of two conditions exist: 1. There is a change of switch state. 2. The drive is reporting a successful retry of a seek with recalibration.
8040	This code indicates an invalid drive state. R/W RDY and AVAIL should never be asserted together. Also, ATTN should be asserted when the drive is available and spinable.

Table 2-3 Real-Time Drive State Code Interpretation (Cont)

RTDS HEX CODE	DESCRIPTION
8041	This code indicates an invalid drive state. R/W RDY and AVAIL should never be asserted together. Also, ATTN should be asserted when the drive is available and spinable.
8042	This code indicates an invalid drive state. R/W RDY and AVAIl should never be asserted together. Also, ATTN is asserted and the drive cannot receive controller commands with RCVR RDY negated.
8043	This code indicates an invalid drive state. R/W RDY and AVAIL should never be asserted together.
FFFF	The controller is unable to get a valid drive state.

2.3.3.2 Status Message Bytes – The status line found in error message sample 1 is the result of the diagnostic performing a get status command. Fourteen of fifteen status bytes are printed out by the error message. Figure 2-3 shows the breakdown of the fifteen status bytes. The first byte is not printed out since it is a response code to the get status command. Bytes 9 through 15 contain drive-specific status bits and the drive service manual or maintenance guide should be consulted for interpretation. [Table 2-4 gives a bit description of status message bytes.]

Table 2-4 Bit Description of Status Message Bytes

Status Byte	Bit Description
Byte 1	**Response Code Field —** Byte 1 is the response code to a controller command.
Byte 2	**Unit Number —** The unit number consists of two hexadecimal digits representing the unit number of the selected disk drive returning the status (0-254).

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
Byte 3	**Subunit Mask** — The subunit mask is a four-bit representation of the sub-unit that is returning the status message. The right-most bit position represents sub-unit 0. The left-most bit position represents sub-unit 3. Only one bit can be set at a time. UDA50 subsystems can handle only drives that can contain up to two sub-units. Therefore, the valid numbers in this status byte can only be a hexadecimal 1 or 2. Figure 2-4 * shows the bit layout. For drives that contain no sub-units (e.g. the RA80), the right-most bit position is always set indicating sub-unit 0.
Byte 3	**High Unit Number** — Byte 3 contains the upper four bits to a 12-bit (3 hexadecimal digits) unit number.
Byte 4	**OA** — A logical one in this position indicates the drive is unavailable to the UDA50. A logical zero indicates the drive is available to the UDA50.

*See Figure 2-4 at the end of this table.

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
Byte 4	**RR** — A logical one in this position indicates that the drive requires an internal readjustment. Some drives do not use this bit.
Byte 4	**DR** — A logical one in this position indicates that there is a request for a diagnostic to be loaded in the drive microprocessor memory. A logical zero indicates that no diagnostic is being requested of the host system.
Byte 4	**SR** — A logical one in this position indicates that the drive spindle is up to speed. A logical zero indicates the drive spindle is not up to speed.
Byte 4	**EL** — A logical one in this bit position indicates that there is loggable information in the extended status area (bytes 9-15). A logical zero indicates that no information is available in the extended status area.

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
Byte 4	**PS** — A logical one in this bit position indicates that the drive port select switch for this controller is pushed in (selected). A logical zero indicates that the switch is out.
Byte 4	**RU** — A logical one in this position indicates that the RUN/STOP switch is pushed in (RUN). A logical zero indicates the switch is out (STOP).
Byte 5	**W4-W1** — Logical ones in any of these four bit positions represent the write-protect status for the sub-unit represented. (e.g., a 0001 indicates that sub-unit 0 within the selected drive is write-protected.)
Byte 5	**DD** — A logical one in this bit position indicates that the drive has been disabled by a controller error routine or diagnostic. The FAULT light is on when this bit is set. A logical 0 indicates that the drive was enabled by a controller error routine or diagnostic.

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
Byte 5	**FO** — A logical one in this position indicates that the drive can be formatted.
Byte 5	**DB** — A logical one in this position indicates that the diagnostic cylinders on the drive can be accessed.
Byte 5	**S7** — A logical one in this bit position indicates that the 576 byte sector format is selected. A logical zero indicates that the 512 byte sector format is selected.
Byte 6	**DE** — A logical one in this position indicates that a drive error has occurred and the drive FAULT lamp may be on.
Byte 6	**RE** — A logical one in this position indicates that an error occurred in the transmission of a command between the drive and the UDA50. The error could be a checksum error or an incorrectly formatted command string.

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
Byte 6	**PE** — A logical one in this position indicates that improper command codes or parameters were issued to the drive.
Byte 6	**DF** — A logical one in this position indicates a failure in the initialization routine of the drive.
Byte 6	**WE** — A logical one in this position indicates a write lock error has occurred.
Byte 7	**S4-S1** — This is a four-bit representation of the sub-units that have their attention available messages suppressed in the UDA50. The right-most bit position represents sub-unit 0. The left-most bit position represents sub-unit 3.

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
	If one of the bits is set, it indicates that the controller is not to interrupt the host CPU with an attention available message when the specified sub-unit raises its available real-time drive status line to the UDA50. The S4-S1 bits reflect the results of a change controller flags command in which attention-available messages are not desired for certain sub-units.
Byte 7	**C1-C4** — This is a four-bit drive status code indicating various states of drive operation. At the present time only three codes are valid. A code of 0000 = drive normal operation. A code of 1000 = the drive is off-line due to being under control of a diagnostic. A code of 1001 = the drive is off-line due to another drive having the same unit identifier (e.g. serial number, drive type, class etc.).

Table 2-4 Bit Description of Status Message Bytes (Cont)

Status Byte	Bit Description
Byte 8	**RETRY COUNT/FAILURE CODE** This 8-bit byte contains one of two types of information depending upon the status of the DF bit (byte 6). The DF bit monitors the drive initialization process. The DF bit remains a zero if initialization is successful. In this case, byte 8 contains the retry count from the previous operation, i.e., a seek operation required fourteen retries to be successful. If a get status command is initiated, byte 8 contains the number 14. The DF bit being set indicates that the drive initialization failed, and therefore byte 8 now contains a specific drive error code. This error code can be looked up in the appropriate drive service manual.

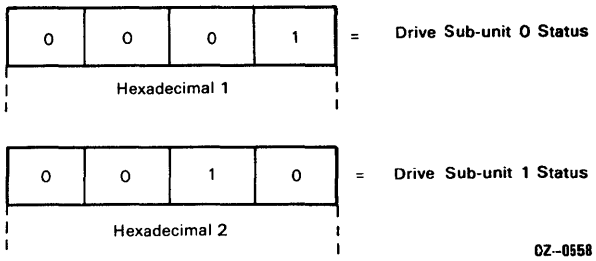

Figure 2-4 Sub-unit Mask Bit Layout Examples

2.3.3.3 Status Message Interpretation – A printout of a drive error was given in paragraph 2.3.3 sample 1. The last line of this error printout gave a status message as follows.

STATUS:	**00**	**01**	**11**	**00**	**00**	**00**	**0A**	**00**	**00**	**00**	**06**	**13**	**10**	**20**
BYTE:	**15**	**14**	**13**	**12**	**11**	**10**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**2**

Use Figure 2-5 to break down the status message byte code. Then use the following byte descriptions to interpret the above status message.

- Byte 1 is the get status response code and is not printed out.
- Byte 2 and the lower half of byte 3 comprise a 3 hexadecimal digit unit number. In the example, the unit number is 020 (hexadecimal) or 32 (decimal).
- Byte 3 (upper half) reflects the sub-unit mask and informs us that the drive sending the status is sub-unit 0 (0001).
- Byte 4 is the request byte and breaks down as follows.

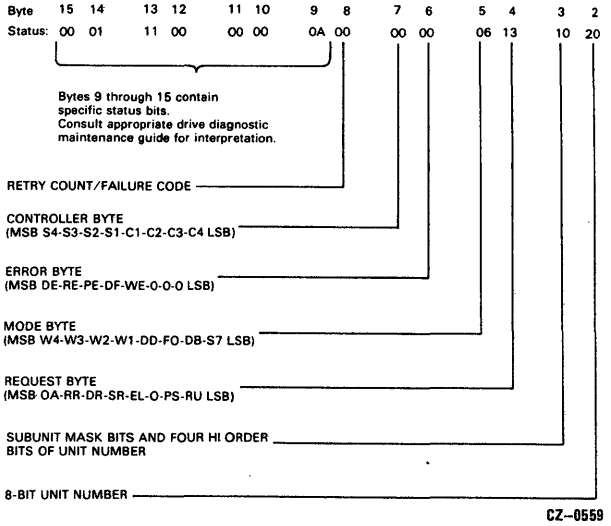

Figure 2-5 Status Message Interpretation

HEX	1	3
BINARY	0001	0011

- The RU bit is set which informs us that the drive has the RUN switch depressed.
- The PS bit is set which informs us that the port select switch for the UDA requesting the status is depressed. (The drive is available to the UDA50).
- The SR bit is set indicating that the drive has the spindle up to speed.

- The OA bit is **not** set indicating the drive is at a drive available state.
- The RR bit is **not** set indicating the selected drive needs no internal adjustment.
- The DR bit is **not** set, indicating the selected drive has no request for an external diagnostic to be loaded into it.

- Byte 5 is the mode byte and breaks down as follows.

HEX	0	6
BINARY	0000	0110

  - The DB bit is set, indicating that a diagnostic cylinder is being accessed on the drive.
  - The FO bit is set, indicating that the drive can be formatted.
  - No bits set in the W4-W1 field indicate that no sub-unit is write-protected.
  - The DD bit is **not** set, indicating the drive has not been disabled by the UDA50 due to some error or diagnostic routine.
  - The S7 bit is **not** set, indicating that 512 byte/sector format is selected for the drive.

- Byte 6 is the error byte, and for this example none of the errors described earlier in this text are active (DE-RE-PE-DF-WE).
- Byte 7 is the controller byte, and for this example a normal drive status is observed (C1-C4 = zeros). The S4-S1 bits being cleared indicate that the UDA50 is to interrupt the host CPU whenever any drive on the subsystem raises its available line to the UDA50.

- Byte 8 is the retry count/failure code and for this example, no retries by the diagnostic were attempted.