

**LOTUS 720/730 CONTROLLER (DC720-730)**

**DIAGNOSTICS**

**Version 1.3**

**PRELIMINARY DOCUMENTATION**

**Revision 02**

**March 10, 1986**

**Document Order Number: HTP0052**

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## Section 1

### INTRODUCTION

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#### 1.1 GENERAL DESCRIPTION

POINT 4 Data Corporation provides a diagnostic program that verifies the disk and tape controller sections of the LOTUS 720/730 Controller Board (DC720-730). In addition, the diagnostic verifies that the controller board interfaces with several different disk drives and up to four streamer tape drives. The program can be provided with the IRIS Operating System or supplied as a stand-alone program on a streamer tape.

The diagnostic is designed for a user-technician. Typically, a user will run the controller test options to verify that the controller can communicate with the disk and tape drives. The technician will use portions of the diagnostic for troubleshooting problems with the controller board and/or disk and tape drives. A stop-and-loop-on-error option is provided to allow a user-technician to analyze an error condition or to print the error message and continue operating.

The diagnostic includes 18 options that provide comprehensive testing for the LOTUS 720/730 Controller Board as well as the disk and tape drives. All test options can be used for the LOTUS 730 Controller Board. Only those options that test memory, buffers, DEBUG, the tape controller interface, and the tape drives can be used for the LOTUS 720 Controller Board. For example, any option that tests both disk and tape interfaces must not be used on a LOTUS 720 Controller. The options and their associated tests are described in Section 2.

Some tests require that additional information be entered prior to execution. Program execution is indicated by various progress messages.

Commands are entered at the terminal by typing the appropriate command character or string followed by a <RETURN>. This <RETURN> is not shown unless it is the only command required or follows a control character.

## 1.2 HARDWARE CONFIGURATION

The following hardware configuration is required for the operation of the LOTUS 720/730 Controller diagnostics.

1. POINT 4 MARK 5 or 9 CPU
2. LOTUS 720 or 730 (DC720 or 730) Controller Board
3. MIGHTY MUX Board
4. Display Terminal
5. Streamer Tape Unit
6. SMD Interface Disk Drive (refer to the LOTUS Controllers Manual for a list of drives)

## 1.3 RESTRICTIONS

1. All tests except the controller tests will destroy data on the peripheral being tested (disk or tape). The user-technician should back up a disk prior to running any option that accesses disk. A blank or scratch tape should be used for tape tests. The tape should be retensioned prior to any test. Options M or N may be used to retension the tape. The tape should be retensioned if it is used for more than 10 passes of any tape option.
2. Combined disk and tape tests must not be run on the LOTUS 720 Controller Board. Only those options listed in Section 1.5 can be used.
3. In order to use DBUG with the diagnostic program, the system must have 64K words or larger. The first time the diagnostic is entered, the program attempts to relocate DBUG from location 40000 to 100000 (octal). If a user has a 32K word system, DBUG is not relocated and the following message is displayed:  
"SYSTEM IS 32K - DBUG NOT RELOCATED"
4. A help module is provided only for the ENTER TEST OPTION prompt. Invoking the help module by entering H at any other time causes the following message to be displayed:  
NO HELP MESSAGE AVAILABLE
5. DISCUTILITY must be run to format the disk prior to restoring it from tape or loading the IRIS Operating System if an option has been executed that accesses the disk.
6. A disk or tape error log is generated if N is entered for the response to the stop-and-loop-on-error query.

## 1.4 SET UP AND OPERATING PROCEDURES

This section is a step-by-step description of the procedure required to make the diagnostic program operational.

1. If the LOTUS 720/730 diagnostic is delivered with the IRIS Operating System (Version 8.2C or later), skip to step 5.
2. To load the diagnostic from streamer tape, press the STOP, then the APL button on the front panel.
3. Enter P42.
4. At the prompt, PROGRAM, enter 0 (zero). The diagnostic is then loaded and the following messages are displayed:

```
*** POINT 4 DATA CORPORATION ***  
15442 DEL AMO AVENUE, TUSTIN, CA  
PHONE NO. (714)-838-2225  
*** DC720-730 DISK-TAPE DIAGNOSTIC-VERSION n.n ***
```

```
NUMERIC INPUT AND OUTPUT IS OCTAL-EXCEPT FOR ERROR LOG
```

```
***DIAGNOSTIC DESTROYS EXISTING DATA-DO BACKUP***  
STOP AND LOOP ON ERROR? (Y or N) >
```

where

n.n - current revision number

Proceed to step 6.

5. To load the diagnostic program and DBUG from the IRIS Operating System, shut down the system; from the IRIS manager account, enter

```
SHUTDOWN <CTRL-E>key<CTRL-E>DI.720730.n.n,@40000
```

where

key - password assigned to the SHUTDOWN command by the system manager (default is X)

n.n - current revision number

6. To execute the diagnostic and relocate DBUG, do the following:
  - a. Press STOP and APL on the front panel.
  - b. Enter J2 (this results in DBUG being relocated to location 100000 octal, if the system is 64K words or larger).

7. The user-technician can now execute DEBUG if it was relocated. Two options are available for entering DEBUG; these options are as follows:

- a. The first option is to enter DEBUG at this point, press STOP and APL; enter J100000.
- b. The second option is to enter DEBUG via the Main Menu option Q. This selection can be entered when the ENTER TEST OPTION prompt is displayed.

If DEBUG is executed, refer to the description of DEBUG commands in the IRIS R8 Installation and Configuration Manual. If the diagnostic is executed, the messages listed in step 2 are displayed.

8. Enter your selection for the stop-and-loop-on-error query. The following query message is then displayed:

```
ENTER DEVICE TO TEST 1=DISK,2=TAPE,3=BOTH (DEFAULT=1) >
```

- a. The following query messages are displayed from options 1 and 3.

```
ENTER DISK DEVICE CODE (DEFAULT=27) >  
ENTER DISK DRIVE NUMBER (0,1,2,3 DEFAULT=0) >  
DISPLAY DISK CHARACTERISTIC TABLE? (Y or N) >
```

If the drive entry number is unknown, enter Y to list all of the disk drives supported by the 730 Controller.

```
ENTER DRIVE ENTRY NUMBER OR NAME >  
ENTER DESIRED NUMBER OF PASSES (DEFAULT=1) >
```

Enter the desired number of passes (1 to 177777 octal).

```
ENTER TEST OPTION >
```

- b. The following query messages are displayed for option 2.

```
ENTER TAPE DRIVE NUMBER (1,2,3,4 DEFAULT=1) >  
ENTER DESIRED NUMBER OF PASSES (DEFAULT=1) >
```

Enter the desired number of passes (1 to 177777 octal).

```
ENTER TEST OPTION >
```

9. Enter H to display the Main Menu, which is described in Section 1.5.

## 1.5 MAIN MENU

The various options are designed to do a specific test or a group of tests depending on the option selected. Messages reporting the progress and status of the various functions are displayed at the terminal.

The test options are selected via the Main Menu. To display the Main Menu, at the ENTER TEST OPTION prompt, enter H.

The following options are then displayed:

- A = DISK CONTROLLER TEST
- B = DISK AND TAPE CONTROLLER TEST
- C = FORMAT-VERIFY FORMAT HEADERS
- D = WRITE-READ-COMPARE DISK
- E = WRITE-VERIFY DISK
- F = SELECTIVE READ DISK
- G = DISK AND TAPE TEST
- J = TAPE CONTROLLER TEST
- K = SELECTIVE WRITE TAPE
- L = SELECTIVE READ TAPE
- M = RETENSION TAPE
- N = ERASE TAPE
- P = WRITE-READ-COMPARE TAPE
- Q = ENTER DEBUG (RESIDES AT 100000)
- R = DUMP WRITE BUFFER
- S = DUMP READ BUFFER
- T = QUICK DISK AND TAPE DIAGNOSTIC
- U = FIFO BUFFER TEST

To execute an option, enter the letter designator at the command prompt (>) and press <RETURN>. A detailed description of each option is given in Section 2.

The following options can be used for testing the LOTUS 720 Controller:

<u>Option</u>	<u>Description</u>
J	Tape Controller Test
K	Selective Write Tape
L	Selective Read Tape
M	Retension Tape
N	Erase Tape
P	Write-Read-Compare Tape
Q	Return to DEBUG
R	Dump Write Buffer
S	Dump Read Buffer
U	FIFO Buffer Test



## **1.6 STANDARD PROGRESS AND QUERY MESSAGES**

The standard progress and query messages displayed by the various test options are described in the following subsections.

### **1.6.1 STANDARD PROGRESS MESSAGES**

The following progress messages are displayed for most test options:

```
COMPLETED PASS NUMBER =nnnnnn
(nnnnnn=current pass number)
*** ALL PASSES COMPLETED ***
NO DISK ERRORS
```

### **1.6.2 DISK QUERY MESSAGES**

The following query messages are displayed from the various disk test options.

```
ENTER DISK DEVICE CODE (DEFAULT=27)
ENTER DISK DRIVE NUMBER (DEFAULT=0)
DISPLAY DISK CHARACTERISTIC TABLE? (Y or N)
ENTER DRIVE ENTRY NUMBER OR NAME
(entry of Y displays all disks supported by the LOTUS 730
Controller)
ENTER DESIRED NUMBER OF PASSES (DEFAULT=1)
(1 to 177777 valid range)
WRITE-READ-COMPARE COMPLETE DISK? (Y or N)
FORMAT COMPLETE DISK? (Y or N)
WRITE-VERIFY COMPLETE DISK? (Y or N)
ENTER PATTERN TO WRITE-READ (DEFAULT=66666)
ENTER STARTING SURFACE NUMBER
ENTER LAST SURFACE NUMBER
STOP AFTER PROM TEST? (Y or N)
ENTER STARTING TRACK NUMBER
ENTER LAST TRACK NUMBER
ENTER STARTING SECTOR NUMBER
ENTER LAST SECTOR NUMBER
STOP AND LOOP ON ERROR? (Y or N)
```

If Y is entered at the stop-and-loop-on-error query, the program displays the error messages and goes into a loop where the error was detected. If N is entered, the program continues operation when an error is detected. Error messages are displayed. The disk error log is only generated if N is entered for this query.

### 1.6.3 TAPE QUERY MESSAGES

The following query messages are displayed from various tape options:

ENTER TAPE DRIVE NUMBER (1,2,3,4 DEFAULT=1)  
ENTER DESIRED NUMBER OF PASSES (DEFAULT=1)  
ENTER PATTERN TO WRITE-READ (DEFAULT=66666)

### 1.6.4 PARTIAL DISK QUERY MESSAGES

The following query messages are displayed if the user-technician elects to do partial disk functions. The pattern query is not displayed for format functions.

ENTER PATTERN TO WRITE-READ (DEFAULT=66666)  
ENTER STARTING SURFACE NUMBER  
ENTER LAST SURFACE NUMBER  
ENTER STARTING TRACK NUMBER  
ENTER LAST TRACK NUMBER  
ENTER STARTING SECTOR NUMBER  
ENTER LAST SECTOR NUMBER

## 1.7 STANDARD ERROR MESSAGES

There are four standard error message screens that may be generated by disk or tape tests.

### 1.7.1 DISK CONTROLLER STATUS REGISTER

The following messages may be displayed for disk controller errors:

```
FROM ADDRESS = nnnnnn
(nnnnnn=memory or listing address where failure occurred)
EXPECTED STATUS =nnnnnn ACTUAL STATUS =mmmmmm
(nnnnnn=expected status,mmmmmm=actual status received)
CONTROLLER STATUS DECODES TO:-
DATA LATE
READ-WRITE TIMEOUT
VERIFY ERROR
HEAD ADDRESS ERROR
CYLINDER ADDRESS ERROR
BAD SECTOR FLAG
ECC ERROR
ILLEGAL SECTOR OR HEAD ADDRESS
DRIVE ATTENTION-DRIVE 3
DRIVE ATTENTION-DRIVE 2
DRIVE ATTENTION-DRIVE 1
DRIVE ATTENTION-DRIVE 0
READ-WRITE DONE
CONTROLLER FULL
*** LOOPING ON ERROR***
(displayed if loop-on-error was selected)
```

### 1.7.2 DISK DRIVE STATUS REGISTER

The following error messages may be displayed for disk drive errors:

```
DRIVE STATUS DECODES TO:
DRIVE FAULT
ILLEGAL COMMAND
ILLEGAL ADDRESS
DRIVE WRITE DISABLED
DRIVE BUSY
DRIVE READY
DRIVE RESERVED
INVALID STATUS
*** LOOPING ON ERROR***
(displayed if loop-on-error was selected)
```

### 1.7.3 TAPE CONTROLLER STATUS REGISTER

The following error messages may be displayed for tape controller errors:

CONTROLLER STATUS DECODES TO:  
DIRECTION  
INTERRUPT  
REQUEST  
TAPE READY  
ON LINE  
EXCEPTION  
\*\*\* LOOPING ON ERROR\*\*\*  
(displayed if loop-on-error was selected)

### 1.7.4 TAPE DRIVE EXCEPTION STATUS WORDS

The following error messages may be displayed for tape drive errors:

DRIVE STATUS DECODES TO:  
RESET OCCURRED  
BEGINNING OF TAPE  
NO DATA DETECTED  
ILLEGAL COMMAND  
FILE MARK DETECTED  
BLOCK IN ERROR NOT FOUND  
UNRECOVERABLE DATA ERROR  
END OF TAPE  
CARTRIDGE WRITE PROTECTED  
DRIVE NOT ON LINE  
CARTRIDGE NOT IN PLACE  
\*\*\* LOOPING ON ERROR\*\*\*  
(displayed if loop-on-error was selected)

## Section 2

### LOTUS DC720/730 TEST OPTIONS

---

This section describes the tests performed for each option.

#### 2.1 DISK CONTROLLER TEST - OPTION A

Option A includes several subtests for the disk controller board. The tests are designed to verify the interface to the disk drives by issuing Recalibrate and Seek commands.

##### 2.1.1 BUSY-DONE-ATTENTION BIT TEST

This subtest issues an IO-Reset, then checks that Busy and Done are both cleared. After a pause, the following messages may be displayed if either of these flags is not cleared:

```
DISK CONTROLLER TEST
TIMEOUT ERROR
BUSY DID NOT RESET
DONE DID NOT RESET
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
```

A command is then issued that should clear all of the drive attention bits. The controller status is read and the attention bits are checked for being cleared. If any of the bits remain set, the error messages listed in Section 1.7.1 may be displayed.

### 2.1.2 MEMORY ADDRESS REGISTER TEST

This subtest writes to the memory address register to verify it is operational. The register is incremented from 0-177777. Each time a value is written to the register, another command is issued to another register to determine if another command changes the data pattern in the memory address register. The data is read back and compared with the output pattern.

The memory address register is also tested using different device codes.

If errors are detected, the following messages are displayed:

```
DISK CONTROLLER TEST
MEMORY ADDRESS REGISTER ERROR
(nnnnnn=memory or listing address where failure occurred)
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
EXPECTED =nnnnnn
(nnnnnn=expected data pattern)
ACTUAL =mmmmmmmm
(mmmmmmm=pattern read from the memory address register)
```

### 2.1.3 HEAD-SECTOR-SECTOR-COUNT REGISTER TEST

This subtest writes to the Head-Sector-Sector-Count (HSSC) register to verify that it is operational. The register is incremented from 0-177777. Each time a value is written to the register, another command is issued to another register to check that issuing another command does not change the HSSC register data. The register is then read back and the pattern is compared to the pattern written.

This subtest also uses different device codes to check the HSSC register.

If errors are detected, the following messages are displayed:

```
DISK CONTROLLER TEST
HEAD-SECTOR-COUNT REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=expected data pattern)
ACTUAL =mmmmmmmm
(mmmmmmm=actual pattern read from the HSSC register)
```

#### 2.1.4 CONTROLLER FULL TEST

This subtest verifies that the controller-full flag is set and reset. The test issues a Release command with an illegal device code. The controller status is read back and the status is checked to see that the controller-full bit did not set with this command. If the bit is set, the following error messages are displayed:

```
DISK CONTROLLER TEST  
CONTROLLER FULL SET BY ILLEGAL DEVICE CODE
```

The test then issues a read status and pulses it to cause the controller-full bit to be set. The status word is then tested to see if the bit is set. If the bit is not set, the following error messages are displayed:

```
DISK CONTROLLER TEST  
CONTROLLER FULL DID NOT SET
```

A delay of 10 microseconds is then initiated. After the delay, the status is read and the controller-full bit is checked to see whether it was reset (off). If the bit is not cleared, the following error messages are displayed:

```
DISK CONTROLLER TEST  
CONTROLLER FULL DID NOT RESET
```

Refer to Section 1.7.1 for additional error messages.

#### 2.1.5 INTERRUPT ACKNOWLEDGE TEST

This subtest masks out all interrupts. It issues an interrupt acknowledge and tests whether any interrupts occurred. If an interrupt did occur, the following error messages are displayed:

```
DISK CONTROLLER TEST  
INTERRUPT ERROR  
FROM ADDRESS =nnnnnn  
(nnnnnn=memory or listing address where failure occurred)
```

## 2.1.6 DRIVE ATTENTION-INTERRUPT ACKNOWLEDGE TEST

This subtest uses Recalibrate commands to test the drive attention bits. A Recal command is issued for drives 0, 1, 2, and 3. The drive attention bits are checked for being set after each command. If errors are detected, the following error messages are displayed:

```
DISK CONTROLLER TEST
DRIVE ATTENTION NOT SET
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
```

The subtest then sets up the interrupt vector point and issues an interrupt acknowledge and checks whether an interrupt occurred. If an interrupt did occur, the following error messages are displayed:

```
DISK CONTROLLER TEST
ILLEGAL INTERRUPT
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
```

The subtest then disables interrupts and masks out all but the disk controller. An interrupt acknowledge is issued for the disk controller. The device code before and after the interrupt is compared. If the device codes do not compare, the following error messages are displayed:

```
DISK CONTROLLER TEST
DEVICE CODE ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
EXPECTED =nnnnnn
(nnnnnn=expected device code)
ACTUAL =mmmmmmm
(mmmmmm=device code after interrupt)
```

The subtest disables interrupts and unmask all interrupts. Seek commands are then issued to each drive. The status is read and compared to an expected value. If an error is detected, the following error messages are displayed:

```
DISK CONTROLLER TEST
TIMEOUT ERROR
CONTROLLER STATUS ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
EXPECTED =nnnnnn
(nnnnnn=expected device code)
ACTUAL =mmmmmmm
(mmmmmm=device code after interrupt)
CONTROLLER FULL DID NOT RESET
```



### 2.1.7 BUSY SET AND RESET TEST

This subtest uses a verify and an IO-Reset command to test that busy is set and reset at proper times. If errors are detected, the following error messages are displayed:

```
DISK CONTROLLER TEST
BUSY DID NOT SET
BUSY DID NOT RESET
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
```

### 2.1.8 DONE SET AND RESET TEST

This subtest clears the controller, then issues a Read Buffer command. It loads the memory address register and issues a start pulse. After a specified delay, the read-write done bit in the controller status word is checked. If read-write done is not set, the following error messages are displayed:

```
DISK CONTROLLER TEST
READ-WRITE DONE NOT SET
```

Refer to Section 1.7.1 for additional error messages.

### 2.1.9 DRIVE PORT TEST

This subtest issues a Release command to all four drive ports. It verifies that the controller-full bit is cleared in the controller status word. The test also checks that the invalid status bit in the drive status word is cleared. If errors are detected, the following error messages are displayed:

```
DISK CONTROLLER TEST
TIMEOUT ERROR
CONTROLLER FULL DID NOT RESET
NO STATUS RECEIVED
DRIVE NUMBER =nnnnnn
(nnnnnn=drive number 0,1,2,or 3)
```

Refer to Sections 1.7.1 and 1.7.2 for additional error messages.

### 2.1.10 SECTOR AND HEAD PROM TEST

This subtest determines the number of sectors and heads for each drive on volumes 0 and 1. These values are determined by the switch settings on the LOTUS 730 Controller Board for each drive and are displayed at the terminal. The values are displayed in octal. The user-technician may elect to stop after the values are displayed or to display them and continue program execution. If errors are detected, the following error messages are displayed:

```
DISK CONTROLLER TEST
SECTOR PROM ERROR
HEAD PROM ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
NUMBER OF HEADS =nnnnnn
(nnnnnn=number of heads calculated)
ANY KEY AND CR=EXIT, CR ONLY=CONTINUE
```

### 2.1.11 RECALIBRATE-SEEK TEST

This subtest clears the controller and checks that the controller-full bit is not set in the status word. It then issues a Recalibrate command. The drive status is read and tested for valid status, not reserved, and ready. A Seek command is then issued to cylinder number 40. If errors are detected, the following error messages are displayed:

```
DISK CONTROLLER TEST
CONTROLLER FULL DID NOT RESET
STATUS ERROR
DRIVE RESERVED
DRIVE NOT READY
CONTROLLER FULL NOT SET
DRIVE ATTENTION NOT SET
DRIVE BUSY
DRIVE READY OR BUSY NOT SET
NO SEEK END
STATUS ERROR
```

Refer to Sections 1.7.1 and 1.7.2 for additional error messages.

## 2.2 DISK AND TAPE TEST

This option is a combination of the tests performed under options A and J. Refer to Sections 2.1 and 2.8 for a description of the tests.

## 2.3 FORMAT AND VERIFY FORMAT HEADERS - OPTION C

This test formats a complete or partial disk drive by issuing a Format command. The Format command does not use interleaving. The disk drive is formatted one track at a time. When the format is completed, the Read Format Header command is issued to verify that the headers were written correctly. During the test, the cylinder number is displayed at the lower left part of the display terminal. If errors are detected, the following error messages are displayed:

```
*** FORMATTING DISK ***  
*** READING FORMAT HEADERS ***  
COMPLETED PASS NUMBER =nnnnnn  
(nnnnnn=current pass number)  
*** ALL PASSES COMPLETED ***
```

Refer to Sections 1.7.2 and 1.7.2 for additional error messages that may be displayed.

## 2.4 WRITE-READ-COMPARE DISK - OPTION D

This test writes-reads and compares data on a whole or partial disk drive. The following three data patterns are used:

166666  
133333  
66666

The cylinder number is displayed at the lower left of the screen while the test is in progress. Refer to Section 1.6.4 for the partial disk query messages.

The following progress messages are displayed:

COMPLETED PASS NUMBER =nnnnnn  
(nnnnnn=current pass number)  
\*\*\* ALL PASSES COMPLETED \*\*\*  
WRITING DATA-PATTERN =nnnnnn  
(nnnnnn=current pattern being written to disk)  
READING-COMPARING DATA-PATTERN =nnnnnn  
(nnnnnn=current pattern being read and compared)

If errors are detected, the following error messages may be displayed:

DATA COMPARE ERROR  
FROM ADDRESS =nnnnnn  
(nnnnnn=memory or listing address where failure occurred)  
SURFACE NUMBER =nnnnnn  
(nnnnnn=surface number when error was detected)  
CYLINDER NUMBER =nnnnnn  
(nnnnnn=cylinder number when error was detected)  
SECTOR NUMBER =nnnnnn  
(nnnnnn=sector number in error)  
WORD NUMBER = nnnnnn  
(nnnnnn=word number in buffer where data did not compare)

Refer to Sections 1.7.1 and 1.7.2 for additional error messages.

## 2.5 WRITE-VERIFY DISK - OPTION E

This test writes a data pattern to a complete or partial disk. The following test pattern is used:

66666

A Read Verify command is issued to verify that the data output compares with the data read. During the test, the cylinder number is displayed at the lower left of the screen.

Section 1.6.4 provides a list of the query messages. The following progress messages are displayed:

```
WRITING DATA-PATTERN =nnnnnn
(nnnnnn=pattern entered by user for
partial disk or 66666 for complete disk)
VERIFYING DATA-PATTERN =nnnnnn
(nnnnnn=pattern read from disk)
COMPLETED PASS NUMBER =nnnnnn
(nnnnnn=current pass number)
*** ALL PASSES COMPLETED ***
```

Refer to Sections 1.7.1 and 1.7.2 for error messages that may be displayed from this test.

## 2.6 SELECTIVE READ DISK - OPTION F

This test reads a complete or partial disk. It is designed to aid in troubleshooting suspect sections of disk. During this test, the cylinder number is displayed at the lower left of the screen.

Section 1.6.4 provides a list of the query messages. The following progress messages are displayed:

```
*** READING DISK ***
COMPLETED PASS NUMBER =nnnnnn
(nnnnnn=current pass number)
*** ALL PASSES COMPLETED ***
```

Refer to Sections 1.7.1 and 1.7.2 for error messages that may be displayed from this test.

## 2.7 DISK AND TAPE TESTS - OPTION G

This option is designed to do comprehensive testing of the controller (both disk and tape) and the disk and tape drives. Included in this option are the A, C, D, E, J, and P tests. Refer to the specific sections that describe these tests in detail. Refer to Sections 1.7.1 through 1.7.4 for error messages that may be displayed from this test.

## 2.8 TAPE CONTROLLER TEST - OPTION J

Option J includes several subtests for the tape controller board. The tests are designed to verify the interface to the tape drives.

### **2.8.1 BUSY-DONE-RESET TEST**

This subtest issues an IO-Reset command and verifies that Busy and Done are both cleared.

If errors are detected, the following error messages are displayed:

```
TAPE CONTROLLER TEST
TIMEOUT ERROR
BUSY NOT RESET
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where failure occurred)
DONE NOT RESET
```

### **2.8.2 EXCEPTION-MEMORY-BLOCK COUNT TEST**

This subtest reads the controller status and checks that the exception bit is reset in the status word. The memory address and block count registers are then read to verify that both registers were cleared by the IO-Reset command in the previous test.

If errors are detected, the following messages are displayed:

```
TAPE CONTROLLER TEST
EXCEPTION BIT NOT RESET
MEMORY ADDRESS REGISTER ERROR
BLOCK COUNT REGISTER ERROR
```

Refer to Section 1.7.3 for additional error messages.

### 2.8.3 ILLEGAL DEVICE CODES - USING MEMORY ADDRESS REGISTER

This subtest writes all ones to the memory address register. Seventy illegal device codes are used to test that they do not cause a change in the data in the register.

If errors are detected, the following messages are displayed:

```
TAPE CONTROLLER TEST
MEMORY ADDRESS REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=pattern written to the memory address register)
ACTUAL =mmmmmm
(mmmmmm=pattern read back from the memory address register)
```

### 2.8.4 ILLEGAL DEVICE CODES - USING BLOCK COUNT REGISTER

This subtest writes a test pattern (377) to the block count register. This represents the largest number that can be inserted into the register during normal operations. A command with an illegal device code is then issued. The register is read back and compared with the output data.

If errors are detected, the following error messages are displayed:

```
TAPE CONTROLLER TEST
BLOCK COUNT REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=pattern 377 written to the block count register)
ACTUAL =mmmmmm
(mmmmmm=pattern read back from the block count register)
```

### 2.8.5 DEVICE CODES - USING COMMAND REGISTER

This subtest writes a test pattern (40377) to the command register. The pattern is then read back and compared to the output pattern. A command with an illegal device code is then issued. The command register is read back and the input pattern is compared to the output pattern (40377).

If errors are detected, the following error messages are displayed:

```
TAPE CONTROLLER TEST
COMMAND REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn= pattern 40377 written to the command register)
ACTUAL =mmmmmm
(mmmmmm=pattern read back from the command register)
```

### 2.8.6 MOVING ONES AND ZEROS - USING MEMORY ADDRESS REGISTER

This subtest writes a moving one-and-zero pattern to the memory address register. After each pattern is written to the register, a command with an illegal device code is issued. The register is then read back and the input pattern is compared to the output pattern.

If errors are detected, the following error messages are displayed:

```
TAPE CONTROLLER TEST
MEMORY ADDRESS REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=pattern written to the memory address register)
ACTUAL =mmmmmm
(mmmmmm=pattern read back from the memory address register)
```



### 2.8.7 MOVING ONES AND ZEROS - USING COMMAND REGISTER

This subtest writes a moving one-and-zero pattern to the command register. After each pattern is written, a command with an illegal device code is issued. The register is then read back and the input pattern is compared to the output pattern.

If errors are detected, the following error messages are displayed:

```
TAPE CONTROLLER TEST
COMMAND REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=pattern written to the memory address register)
ACTUAL =mmmmmmmm
(mmmmmmm=pattern read back from the memory address register)
```

### 2.8.8 BOOT PROM TEST

This subtest performs the following functions:

- Clears the read buffer
- Issues a Reset command to the tape unit
- Reads the tape exception status (6 bytes) to clear the exception condition
- Reads the boot PROMs into memory starting at the first 1K boundary of the read buffer
- Verifies that the memory address register is updated by 400 for each transfer
- Verifies that the interrupts are functioning

If errors are detected, the following error messages may be displayed:

```
TAPE CONTROLLER TEST
DONE NOT RESET
TIMEOUT ERROR
DONE NOT SET
MEMORY ADDRESS REGISTER ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=calculated memory address)
ACTUAL =mmmmmmmm
(mmmmmmm=contents of the memory address register)
ILLEGAL INTERRUPT
INTERRUPTS NOT DISABLED
DEVICE CODE ERROR
```

### 2.8.9 FIRST TAPE UNIT TEST

This subtest clears the tape controller, then issues a Reset command to tape. The following functions are then performed:

- The tape controller's status is read to check if the exception bit is on.
- Bits 1-5 of the controller's status word are tested to verify that they are reset.
- If the tape exception bit is on, the tape status bytes are read to clear the exception. The exception bit is then checked to verify tht it has been reset.
- The following bits are checked to verify that they have been set:

Request  
Drive Ready  
Direction  
Interrupt

- Interrupts are checked to verify that they are functioning.

If errors are detected, the following error messages may be displayed:

TAPE CONTROLLER TEST  
EXCEPTION BIT NOT SET  
CONTROLLER BITS 1-5 NOT RESET  
BUSY NOT SET  
REQUEST BIT NOT SET  
TIMEOUT ERROR  
EXCEPTION BIT NOT RESET  
DRIVE NOT READY  
DIRECTION BIT NOT SET  
INTERRUPT BIT NOT RESET  
INTERRUPT BIT NOT SET  
NO INTERRUPT  
ONLY DRIVE READY SHOULD BE SET

Refer to Section 1.7.3 for additional error messages that may be displayed.

## 2.8.10 SELECT DRIVE - REWIND DRIVE TEST

This subtest tests the drive for being ready before starting the test. A Read Status command is issued to clear the exception bit if an exception condition results from the drive ready test. The test then performs the following functions:

- Issues a Select command
- Checks the controller's status word for the request bit being set
- Checks the tape drive again for being ready
- Checks the setting of the exception bit again; if the exception bit is set, reads the tape status again to clear the exception bit
- Checks the status bytes for the beginning-of-tape bit; if the tape is not at the beginning, issues a Rewind command
- Checks the request bit once more for being set
- Checks the done bit for being set

If errors are detected, the following error messages may be displayed:

```
TAPE CONTROLLER TEST
TAPE NOT AT BEGINNING OF TAPE(BOT)
BUSY NOT SET
REQUEST BIT NOT SET
TIMEOUT ERROR
DONE NOT SET
DRIVE NOT READY
```

Refer to Section 1.7.4 for additional error messages that may be displayed.

## 2.9 SELECTIVE WRITE TAPE - OPTION K

This test does a continuous write to a streamer tape. 35,000 blocks in groups of 40 are written to tape. The user is requested to enter the pattern to be written. The default pattern is 66666. This option was designed to assist technicians in troubleshooting suspect tape drives.

If errors are detected, the following error messages may be displayed:

```
STREAMER TAPE TEST
BUSY NOT SET
EXCEPTION NOT ON AFTER RESET COMMAND
RESET BIT NOT CLEARED-AFTER CLEAR RESET COMMAND
DONE NOT SET
```

Refer to Sections 1.7.3 and 1.7.4 for additional error messages that may be displayed.

## 2.10 SELECTIVE READ TAPE - OPTION L

This test does a continuous read of a streamer tape. 35,000 blocks in groups of 40 are read from tape. This program is designed to read tapes generated by the continuous write routine in Section 2.9. The user is requested to enter the pattern to be read or to use the default of 66666. This option was designed to assist technicians in troubleshooting suspect tape drives.

If errors are detected, the following error messages may be displayed:

```
STREAMER TAPE TEST
BUSY NOT SET
EXCEPTION NOT ON AFTER RESET COMMAND
RESET BIT NOT CLEARED-BY CLEAR RESET COMMAND
DONE NOT SET
BUSY NOT SET
```

Refer to Sections 1.7.3 and 1.7.4 for additional error messages that may be displayed.

## 2.11 RETENSION TAPE - OPTION M

This test retensions the tape unit. This option should be executed if the tape has been used several times for short write or read operations. It should also be executed if the tape has not been used for a long time or if the user does not know the last time it was retensioned. The option requires approximately 2 minutes to complete. A message informing the user of the time required is displayed.

If errors are detected, the following error messages may be displayed:

```
STREAMER TAPE TEST  
EXCEPTION NOT ON AFTER RESET COMMAND  
DONE NOT SET  
RESET BIT NOT CLEARED-BY CLEAR RESET COMMAND  
BUSY NOT SET
```

Refer to Sections 1.7.3 and 1.7.4 for additional error messages that may be displayed.

## 2.12 ERASE TAPE - OPTION N

This test erases a streamer tape. It may be used in place of the retension option. The tape is erased from beginning-of-tape to end-of-tape. The option requires approximately two minutes to complete. A message informing the user of the time required is displayed.

If errors are detected, the following error messages may be displayed:

```
STREAMER TAPE TEST  
RESET BIT NOT CLEARED-BY CLEAR RESET COMMAND  
EXCEPTION NOT ON AFTER RESET COMMAND  
BUSY NOT SET  
DONE NOT SET
```

Refer to Sections 1.7.3 and 1.7.4 for additional error messages that may be displayed.

## 2.13 WRITE-READ-COMPARE TAPE - OPTION P

This test writes, reads, and compares three data patterns to and from tape. The patterns used for the test are:

```
166666
133333
66666
```

Five groups of data are written, read, and compared. Refer to Appendix A for specific tape formats.

This test was designed to do comprehensive testing of the streamer tape drive. If errors occur, it is suggested that the user-technician first do the retension option; if errors still occur, try another tape cartridge.

The following progress messages are displayed during execution:

```
WRITING DATA-PATTERN =nnnnnn
(nnnnnn=current pattern being written to tape)
NUMBER OF BLOCKS RE-WRITTEN OR SOFT ERRORS READ =nnnnnn
(nnnnnn=if write data, number of blocks rewritten;
if read data, number of soft errors read)
NUMBER OF EXTENDED GAPS OR READ BUFFER UNDERRUNS =mmmmmm
(mmmmmm= if write data, number of extended gaps;
if read data, number of buffer underruns)
*** REWINDING TAPE ***
READING DATA-PATTERN =nnnnnn
(nnnnnn=current pattern being read from tape)
*** FILE MARK DETECTED ***
*** DATA COMPARE OK ***
COMPLETED PASS NUMBER =nnnnnn
(nnnnnn=current pass number)
*** ALL PASSES COMPLETED ***
```

The following error messages may be displayed:

```
STREAMER TAPE TEST
DATA COMPARE ERROR
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=current data pattern being written to tape)
ACTUAL =mmmmmm
(mmmmmm=actual data read from tape)
WORD NUMBER =nnnnnn
(nnnnnn=word displacement in read
buffer where data error occurred)
BUSY DID NOT RESET
DONE DID NOT RESET
```

Refer to Sections 1.7.3 and 1.7.4 for additional error messages that may be displayed.

## 2.14 RETURN TO DEBUG - OPTION Q

This option is selected to enter DEBUG from the Main Menu. DEBUG must have been loaded at 100000 (octal).

The following error message is displayed if DEBUG has been modified or not loaded:

DEBUG MODIFIED OR NOT LOADED

The Main Menu is then displayed.

## 2.15 DUMP WRITE BUFFER - OPTION R

This option is selected to display all or part of the write buffer. The format for the display is the memory address followed by 10 octal words of data as follows:

aaaaaa= xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx xxxxxx

where

aaaaaa - memory address incremented by octal 10 for each line  
xxxxxx - contents of the write buffer

The data is displayed in pages. One page is 10 octal lines plus the following option message:

RETURN KEY=NEXT LINES-ANY KEY AND RETURN=EXIT

No error messages are displayed from this option.

## 2.16 DISPLAY READ BUFFER - OPTION S

This option is selected to display all or part of the read buffer. The format for the display is the memory address followed by 10 octal words of data. The format is the same as shown in Section 2.15. The data is displayed in pages. One page is 10 octal lines plus an option message. No error messages are displayed from this option.

## 2.17 QUICK DISK AND TAPE DIAGNOSTIC - OPTION T

This test can be used as a quick diagnostic to verify that both the disk and tape controller sections of the board are functioning and can communicate with the disk and tape drives. The test does selective formatting and writing to disk.

The data is read from disk and written to tape; it is then read back from the tape and the disk. The two buffers are then compared.

This test only does every 10th cylinder and should not be used as a comprehensive disk and tape drive test. The data pattern used from this test is 166666.

If errors are detected, the following error messages may be displayed:

```
DISK CONTROLLER TEST
TAPE CONTROLLER TEST
BUSY NOT SET
DONE NOT SET
DATA COMPARE ERROR
WORD NUMBER =nnnnnn
(nnnnnn=word displacement in the disk or
tape buffer where error is)
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=data read from disk)
ACTUAL =mmmmmm (mmmmmm=data read from tape)
```

Refer to Sections 1.7.1 through 1.7.4 for additional error messages that may be displayed.



## 2.18 FIFO BUFFER TEST - OPTION U

This test writes data patterns to the 17 words of the FIFO buffer. The patterns range from 0-177777. Each pattern is output to the FIFO buffer then read back and compared to the expected pattern. The data pattern being tested is in the lower left of the screen.

If errors are detected, the following error messages may be displayed:

```
DONE NOT SET
DATA COMPARE ERROR
WORD NUMBER =nnnnnn
(nnnnnn=word displacement in the read
buffer where the error is)
FROM ADDRESS =nnnnnn
(nnnnnn=memory or listing address where error occurred)
EXPECTED =nnnnnn
(nnnnnn=data pattern written to the FIFO buffer)
ACTUAL =mmmmmm
(mmmmmm=data pattern read from the FIFO buffer)
```

## Section 3

### DISK AND TAPE ERROR LOGS

---

#### 3.1 DISK ERROR LOG

The disk error log is generated only if N is entered in response to the stop-and-loop-on-error query. This log is displayed after all passes of the program have been completed. The information displayed is as follows:

SURFACE NUMBER - in both octal and decimal

TRACK NUMBER - in both octal and decimal

SECTOR NUMBER - in both octal and decimal

ERROR COUNT - in both octal and decimal

#### NOTE

The error count represents the number of times the same error was detected during all passes of the program.

### 3.2 TAPE ERROR LOG

The tape error log is generated for tape write-read-compare functions. A running error count is logged and displayed after all passes of the program have been completed. These values are displayed only in octal. The type of errors displayed depend on the function that was performed.

Errors resulting from a write function are listed as follows:

NUMBER OF BLOCKS RE-WRITTEN =

NUMBER OF EXTENDED GAPS =

Errors resulting from a read function are listed as follows:

NUMBER OF SOFT ERRORS READ =

NUMBER OF BUFFER UNDERRUNS =

## Appendix A

### STREAMER TAPE FORMAT-WRITE COMMAND

---

50 BLKS	F M	6000 BLKS	F M	50 BLKS	F M	6000 BLKS	F M	50 BLKS	F M	6000 BLKS	F M	50 BLKS	F M	6000 BLKS	F M	50 BLKS	F M	6000 BLKS	F M
------------	--------	--------------	--------	------------	--------	--------------	--------	------------	--------	--------------	--------	------------	--------	--------------	--------	------------	--------	--------------	--------

where

FM - FILE MARK

BLKS - BLOCKS; ONE BLOCK = 400 (octal) WORDS

121-33

#### NOTE

When the groups of blocks are read back from tape, only 40 blocks of each 50-block file is compared. The program does search and verify that each file mark is detected.