

## 5. DIAGNOSTIC PROGRAM

This Chapter presents a detailed description of the Diagnostic Program for a Model 3040 Disk System when it is interfaced with a PDP-8 Computer.

### Program Description

The Table of Tests and Errors provides a fast reference for the error messages and the tests that produce them. Following the table is an explanation of what each test does and how to interpret the error messages.

TABLE 5-1. TESTS AND ERRORS

Test No.	Test Description	Error Numbers
1	Control, Status, Track and Sector Register Test, Skip Test	1, 2, 210-213
2	Interrupt Test	3
3	Word Count/Current Address Test	4
4	Logical Address Interlock and Overlap Seek Test	
4.1	Test Unit Ready to seek, read, or write	5
4.2	Seek to Sector 0, hardware error and busy flags clear	6, 206
4.3	Overlap seek to maximum sector +1; test Logical Address Interlock	7, 11-14
4.4	Overlap seek to Sector 0	15, 17-22
4.5	Overlap seek to maximum sector	23, 25-30
4.6	Overlap seek with simulated data transfer on same port; check busy flag	31, 33-36
4.7	Overlap seek with simulated data transfer on another port	37, 41-44

TABLE 5-1 (continued)

Test No.	Test Description	Error Numbers
4.8	Seek/Read Maximum sector +1; test Logical Address Interlock, skip on error test	45-47, 207
4.9	Seek/Write maximum sector +1; test Logical Address Interlock, skip on error test	50-52, 207
5	Format Test (for Moving Head Disks only)	
5.1	Format disk with Write Protect Bit = 0	53-55
5.2	Write block number in data portion of each block	75-100
5.3	Read each block and verify block address is in data portion	101-104
5.4	Format Sector 0 with incorrect block address	173-175
5.5	Attempt to read Sector 0, check for Address Verification error	176-177
5.6	Attempt to write Sector 0, check for Address Verification error	200-201
5.7	Format all sectors in write-protect mode Write Protect Bit = 1	56-60
5.8	Write maximum block number minus block number in data portion of each sector	105-110
5.9	Read and verify that maximum block number minus block number is in data portion of each sector	111-114
5.10*	Attempt to format with format switch normal; check for format error	202-203
5.11*	Attempt to write with format switch normal and sectors write-protected; check for Write Lockout error	204-205
5.12	Reformat the disk with Write Protect Bit = 0	64-66

\*Special format tests which are executed only if requested by the user in the test specification section of the Diagnostic Operation.

TABLE 5-1 (continued)

Test No.	Test Description	Error Numbers
6	One Word Write/Read Test	
6.1	Write the block number in the data portion of all sectors	115-120
6.2	Read all sectors and verify that they were written correctly	121-124
7	Seek All Blocks Test	125-130
8	Random Seek Test	131-134
9	Single Sector Write/Read Test	
9.1	Write entire disk with data pattern one sector at a time	135-141
9.2	Read entire disk one sector at a time and verify accuracy	142-146
9.3	Read entire disk 1-1/2 sectors at a time and verify accuracy	147-153
10	Multiple Sector Write/Read Test	
10.1	Write entire disk 1-1/2 sectors at a time with fixed data pattern	154-160
10.2	Read entire disk 1-1/2 sectors at a time and verify accuracy	161-165
10.3	Read entire disk one sector at a time and verify accuracy	166-172

## Diagnostic Program Tests

Test No. 1 - Control, Status, Track and Sector Register Tests, Skip Test

### Description:

This test sequentially transmits one bit at a time out from the computer and reads it back from the Control Register (CNR) to verify the transmission. It checks bit numbers 0-2, 5-11, one bit at a time. After each bit has been successfully received at and read back from the controller, a Master Clear command is issued (PDP 8/E line only) and the test checks to verify that bits 5, 6, 10, and 11 were cleared. Note that bits 0-2, 7-9 are not affected by a Master Clear command, so they are ignored in this portion of the test.

The program then transmits bit 11 to the CNR and verifies that it is read back as bit 11 of the Status Register (STR). This test leaves the Done Flag set, so the Skip on Done instruction is now tested. Now the Clear Status instruction is executed and the STR is read to ensure that it was cleared. The program then performs the same operations on bit 10 (except for the skip test).

Finally the program sequentially transmits bits 7-11, one at a time, and reads it back from the Sector Register (SCR) to check the transmission to and from the SCR.

### Errors:

- 001 - Indicates that a bit did not get set in the CNR when transmitted from the computer.
- 002 - Indicates that one of the bits set in the CNR did not clear when a Master Clear command was issued.
- 210 - Indicates that a bit did not read back from the STR.

211 - Indicates that a bit did not clear in the STR when the Clear Status Command was executed.

212 - Indicates that the controller did not skip when the Done Flag was set and the Skip on Done Flag instruction was executed.

213 - Indicates that a bit did not get set in the SCR when transmitted from the computer.

**Test No. 2** - Interrupt Test

Description:

An interrupt receive address is loaded into memory address 0002 and an interrupt is generated by setting the interrupt enable and done bits in the CNR using the CNR load instruction. The program verifies that an interrupt is generated within the maximum amount of time.

Errors:

003 - Indicates that no interrupt occurred when the interrupt enable and done bits were set in the CNR.

**Test No. 3** - Word Count/Current Address Test

Description:

This test transmits selected values from the computer to the Track Address Register (TAR) in the controller using the word count/current address sequence command. Each value is loaded into the AC and transmitted to the TAR. Then the contents of the TAR are checked. The first value transmitted is all zeros, initiating the word count/current address function to address 0. The second value transmitted is 7776 which will cause the last two words in memory to be referenced in the output mode. (Note: This is an all-ones test except for the least significant bit.) The next value transmitted is alternating ones and zeros, starting with a zero in the least significant bit position. The

final value transmitted has a one in the least significant bit position with zeros in the rest of the word.

Errors:

004 - Indicates that the word count/current address sequence did not load the proper value into the TAR.

Test No. 4
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 - Logical Address Interlock and Overlap Seek Test

This test is composed of the following sub-tests described below.

Sub-Test 4.1

Description:

This sub-test interrogates the Seek Status Register (SSR) to verify that the selected disk is ready to seek, read, or write.

Errors:

005 - Indicates that the disk is not ready to seek, read, or write.

Sub-Test 4.2

Description:

This sub-test performs an overlap seek to Sector 0 and verifies that the hardware error and busy flags are both cleared.

Errors:

006 - Indicates that the hardware error and/or busy flags did not clear with a seek to Sector 0.

206 - Indicates that the Ready to Seek, Read or Write line did not return to zero within the maximum allowable 300 milliseconds when the seek to Sector 0 was attempted.

### Sub-Test 4.3

#### Description:

This sub-test executes a seek to the maximum sector plus one and tests the Logical Address Interlock. This test and the following overlap seek tests use subroutine LAI4 to perform the seeks and the error checking. The controlling information for each test is stored following the call to the subroutine and in the AC which contains the block number to which the seek is issued.

Subroutine LAI4 operates as follows: It first clears the error and done flags in the CNR, issues the overlap seek, checks to see if the Ready to Seek, Read, or Write line returns to zero within a maximum of 300 milliseconds. Next the values in the SSR for all ports other than the port being tested are checked to make sure they have not changed, and the flags that were set during this operation are checked to verify they were handled properly. These include busy, hardware error and the done flags.

Seeking to the maximum address plus one should generate a Logical Address Interlock hardware error. Also, the done flag should be set but the busy flag should not be set.

#### Errors:

- 007 - Indicates that the Ready to Seek, Read, or Write line did not return to zero within 300 milliseconds after an overlap seek was executed.
- 011 - Indicates that a portion of the SSR associated with a port other than the port being tested changed during the execution of an overlap seek.
- 012 - Indicates that the busy flag was set during an overlap seek when it should not have been.
- 013 - Indicates that a hardware error failed to occur but should have during an overlap seek.

014 - Indicates that the done flag failed to get set upon completion of an overlap seek.

#### Sub-Test 4.4

##### Description:

This sub-test performs an overlap seek to Sector 0 and does the checking described in Sub-Test 4.3. In this case, since the proper operation of the Logical Address Interlock in Sub-Test 4.3 insures that the head will be positioned over Sector 0, the done flag should be set. The test verifies that it is set and that no false errors are set during this operation.

##### Errors:

015 - Indicates that the Ready to Seek, Read, or Write line did not return to zero within 300 milliseconds after an overlap seek was executed.

017 - Indicates that a portion of the SSR associated with a port other than the port being tested changed during the execution of an overlap seek.

020 - Indicates that the busy flag was set during an overlap seek when it should not have been.

021 - Indicates that a hardware error occurred on the overlap seek when it should not have.

022 - Indicates that the done flag failed to get set upon completion of an overlap seek.

#### Sub-Test 4.5

##### Description:

This sub-test performs an overlap seek to the maximum sector and performs the checks described in Test 4.3. In this case, the done flag should be set but neither the hardware error nor the busy flags should be set in the SSR.



Errors:

- 023 - Indicates that the Ready to Seek, Read, or Write line did not return to zero within 300 milliseconds after an overlap seek was executed.
- 025 - Indicates that a portion of the SSR associated with a port other than the port being tested changed during the execution of an overlap seek.
- 026 - Indicates that the busy flag was set during an overlap seek when it should not have been.
- 027 - Indicates that a hardware error occurred on the overlap seek when it should not have.
- 030 - Indicates that the done flag failed to get set upon completion of an overlap seek.

Sub-Test 4.6

Description:

This sub-test attempts an overlap seek to the maximum sector while simulating a data transfer on the same port. The data transfer is simulated by setting the Pseudo Busy flip flop using the Word Count/Current Address operation and also loading the number of the port being tested into the CNR. When the overlap seek is attempted under these conditions, a busy flag should be set and the hardware error and done flags should not be set.

Errors:

- 031 - Indicates that the Ready to Seek, Read, or Write line did not return to zero within 300 milliseconds after an overlap seek was executed.
- 033 - Indicates that a portion of the SSR associated with a port other than the port being tested changed during the execution of an overlap seek.

034 - Indicates that the busy flag was not set on the overlap seek when  
033 - it should have been.

035 - Indicates that a hardware error occurred during the overlap seek  
operation when it should not have.

036 - Indicates that the done flag was erroneously set during the overlap  
seek operation.

#### Sub-Test 4.7

##### Description:

This sub-test performs an overlap seek while a simulated data transfer on another port is being executed. The data transfer is simulated by leaving the Pseudo Busy flip flop set but altering the unit select in the CNR to the number of a port other than the one being tested. Then a seek to the maximum sector is performed. No changing of cylinders is required since the head was properly positioned over this maximum sector before the test was initiated. During the test, the busy flag should be cleared. No hardware error should occur, and the done flag should not be set since there is a data-transfer in progress.

##### Errors:

037 - Indicates that the Ready to Seek, Read, or Write line did not return to zero within 300 milliseconds after an overlap seek was executed.

041 - Indicates that a portion of the SSR associated with a port other than the port being tested changed during the execution of an overlap seek.

042 - Indicates that the busy flag was set during an overlap seek when it should not have been.

043 - Indicates that a hardware error occurred on the overlap seek when it should not have.

044 - Indicates that the done flag was erroneously set during the overlap seek operation.

#### Sub-Test 4.8

##### Description:

In this sub-test, a Seek/Read operation to the maximum sector plus one is attempted using subroutine LAI6. The Seek/Read command is issued and the program waits for the done flag to be set. It verifies that a hardware error is indicated in the SSR and that the Logical Address Interlock error is properly displayed in the STR. It then checks that the Skip on Error instruction correctly generates a skip in this case.

##### Errors:

- 045 - Indicates that the controller did not terminate the operation attempting to read the maximum sector plus one in the maximum allowable time.
- 046 - Indicates that the STR failed to show the occurrence of a Logical Address Interlock after attempt to read the maximum sector plus one.
- 047 - Indicates that the SSR did not properly show a hardware error after the attempt to read the maximum sector plus one.
- 207 - Indicates that the controller did not skip when the error flag was set and the Skip on Error command was executed.

#### Sub-Test 4.9

##### Description:

This test attempts to perform a Seek/Write to the maximum sector plus one doing the same checks as in Sub-Test 4.8.

##### Errors:

- 050 - Indicates that the controller did not terminate the operation attempting to write the maximum sector plus one in the maximum allowable time.

051 - Indicates that the STR failed to show the occurrence of a Logical Address Interlock after attempt to write the maximum sector plus one.

052 - Indicates that the SSR did not properly show a hardware error after the attempt to write the maximum sector plus one.

207 - Indicates that the controller did not skip when the error flag was set and the Skip on Error command was executed.

Test No. 5
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 - Format Test (For Moving-Head Disks Only)

This test is composed of the sub-tests described below.

Sub-Test 5.1

Description:

In this part of the test, the disk is formatted for normal operation (Write Protect Bit is zero) using the subroutine FRM15. This subroutine is used whenever a format operation is being performed. It sets the format enable bit in the CNR, moves the proper word count pointer to the Word Count register, initiates a Word Count/Current Address Sequence, and then initiates a format write to the selected sector using subroutine RDWR. The program then checks that the done flag gets set within the maximum allowable time. When the done flag has been set, the STR is checked to verify that no error has occurred and that the busy and interrupt enable flags are not set. Then the program compares the value of the Track Address Register (TAR) and Sector Register (SCR) with the address of the track and sector to be written. Note that the SCR is not incremented at the end of a format sequence as it is at the end of a normal write operation.

Errors:

053 - Indicates that the done flag did not get set in the maximum allowable time after a sector was formatted. Note that the TAR and SCR

should contain the number of the track and sector being formatted at the time the error occurred.

054 - Indicates that the STR indicated an error occurred when a sector was being formatted.

055 - Indicates that the contents of the TAR and SCR, which should equal the number of the track and sector being formatted, are incorrect.

### Sub-Test 5.2

#### Description:

In this sub-test the block address of each sector is written in the first two words of the data portion of that sector using subroutine WRB11.

#### Errors:

075 - Indicates that the done flag was not set in the maximum allowable time when attempting to write the block number in the data portion of a sector.

076 - Indicates that the STR indicated an error occurred during the data transfer when attempting to write the block number into the data portion of a sector.

077 - Indicates that the data in the buffer was modified during the write operation.

100 - Indicates that the third word in the buffer was modified during the two-word write operation when attempting to write the block number in the data portion of the sector.

### Sub-Test 5.3

#### Description:

In this sub-test, each sector is read to verify that the block address was written correctly in the data portion of the sector. Upon successful

... test, if switch 6 is set to a 1, a completion message is typed out and the computer halts. The program may be reinitiated by starting it at address 201<sub>8</sub> if the same input parameters are to be used.

Errors:

- 101 - Indicates that the done flag was not set in the maximum allowable time when attempting to read the block number in the data portion of a sector.
- 102 - Indicates that the STR indicated an error occurred during the data transfer when attempting to read the block number from the data portion of a sector.
- 103 - Indicates that the data in the buffer was modified during the read operation.
- 104 - Indicates that the third word in the buffer was modified during the two-word read operation when attempting to read the block number in the data portion of the sector.

Sub-Test 5.4

Description:

This sub-test formats Sector 0 with an incorrect block number.

Errors:

- 173 - Indicates that the done flag did not get set in the maximum allowable time after a sector was formatted.
- 174 - Indicates that the STR indicated an error occurred when a sector was being formatted.
- 175 - Indicates that the contents of the TAR and SCR, which should equal the number of the track and sector being formatted, are incorrect.

### Sub-Test 5.5

#### Description:

In this sub-test an attempt is made to read Sector 0 by issuing a read instruction. The value in the STR should be 4405 indicating an Address Verification error occurred during the read operation.

#### Errors:

- 176 - Indicates that the Controller did not terminate the read operation in the maximum allowable time.
- 177 - Indicates that the contents of the STR at the end of the read operation were not what they should have been.

### Sub-Test 5.6

#### Description:

In this sub-test an attempt is made to write on Sector 0. The expected value in the STR is 4401 indicating an Address Verification error occurred during the write operation.

#### Errors:

- 200 - Indicates that the Controller did not terminate the write operation in the maximum allowable time.
- 201 - Indicates that the contents of the STR at the end of the write operation were not what they should have been.

### Sub-Test 5.7

#### Description:

In this sub-test, subroutine FRM15 is used to format the disk with every sector being write-protected. This is done by setting the write-protect bit (the most significant bit) in the Track Address Word.

Errors:

- 056 - Indicates that the done flag did not get set in the maximum allowable time after a sector was formatted.
- 057 - Indicates that the STR indicated an error occurred when a sector was being formatted.
- 060 - Indicates that the contents of the TAR and SCR, which should equal the number of the track and sector being formatted, are incorrect.

Sub-Test 5.8

Description:

This sub-test using subroutine WRB11 writes in the data portion of each sector a value equal to the maximum block number minus the block number of the sector being written. If the format switch is enabled these write operations should be executed.

Errors:

- 105 - Indicates that the done flag was not set in the maximum allowable time when attempting to write the block number in the data portion of a sector.
- 106 - Indicates that the STR indicated an error occurred during the data transfer when attempting to write the block number into the data portion of a sector.
- 107 - Indicates that the data in the buffer was modified during the write operation.
- 110 - Indicates that the third word in the buffer was modified during the two-word write operation when attempting to write the block number in the data portion of the sector.



### Sub-Test 5.9

#### Description:

In: This sub-test, each sector is read to verify that the value of the maximum block number minus the block number was correctly written in the sector.

#### Errors:

- 111 - Indicates that the done flag was not set in the maximum allowable time when attempting to read the block number in the data portion of a sector.
- 112 - Indicates that the STR indicated an error occurred during the data transfer when attempting to read the block number from the data portion of a sector.
- 113 - Indicates that the data in the buffer was modified during the read operation.
- 114 - Indicates that the third word in the buffer was modified during the two-word read operation when attempting to read the block number in the data portion of the sector.

### Sub-Test 5.10

#### Description:

If Switch Register Bit 7 is set during the format test, a message requesting that the operator disable the format switch will be typed out; otherwise the diagnostic will continue with Sub-Test 5.12. Once the format switch has been disabled and the Continue key has been depressed, subroutine FRM5 will be used to attempt to format Sector 0. This attempt to format the disk with the format switch disabled should result in the value 5041 being displayed in the STR.

5001

Errors:

- 202 - Indicates that the Controller did not terminate the read operation in the maximum allowable time.
- 203 - Indicates that the contents of the STR at the end of the read operation were not what they should have been.

Sub-Test 5.11

Description:

In this sub-test, an attempt is made to write into Sector 0 with the format switch disabled. This should result in a Write Lockout error indicated by the value 4041 in the STR since the sector is write protected. At the conclusion of this test, a message telling the operator to enable the format switch will be typed out so that the format test can be continued.

Errors:

- 204 - Indicates that the Controller did not terminate the write operation in the maximum allowable time.
- 205 - Indicates that the contents of the STR at the end of the write operation were not what they should have been.

Sub-Test 5.12

Description:

This sub-test formats the entire disk in the normal mode (Write Protect Bit = 0) using subroutine FRM15.

Errors:

- 064 - Indicates that the done flag did not get set in the maximum allowable time after a sector was formatted.
- 065 - Indicates that the STR indicated an error occurred when a sector was being formatted.
- 066 - Indicates that the contents of the TAR and SCR, which should equal the number of the track and sector being formatted, are incorrect.

Test No. 6 - Two-Word Write/Read Test

This test is composed of the sub-tests described below.

Sub-Test 6.1

Description:

In this sub-test the block address of each sector is written in the first two words of the data portion of that sector. This test is performed by subroutine WRB11, which is also used in the Sub-Tests 5.2 and 5.8.

The operation of WRB11 is as follows: It sets up the parameters for the read/write subroutine (RDWR) and then uses subroutine WRB15 to write all sectors, beginning with sector 3 and writing every fourth sector. The reason for this interlace is to get maximum efficiency by providing the program with the time it needs to perform the diagnostic checks between sectors rather than wasting entire disk revolutions.

Errors:

- 115 - Indicates that the done flag was not set in the maximum allowable time when attempting to write the block number in the data portion of a sector.
- 116 - Indicates that the STR indicated an error occurred during the data transfer when attempting to write the block number into the data portion of a sector.
- 117 - Indicates that the data in the buffer was modified during the write operation.
- 120 - Indicates that the third word in the buffer was modified during the two-word write operation when attempting to write the block number in the data portion of the sector.

## Sub-Test 6.2

### This Description:

In this sub-test, all sectors are read using the same interlace as in Sub-Test 6.1 to verify that the information written in Sub-Test 6.1 was written correctly. Again, subroutines WRB15 and RDWR are used.

### Errors:

- 121 - Indicates that the done flag was not set in the maximum allowable time when attempting to read the block number in the data portion of a sector.
- 122 - Indicates that the STR indicated an error occurred during the data transfer when attempting to read the block number from the data portion of a sector.
- 123 - Indicates that the data in the buffer was modified during the read operation.
- 124 - Indicates that the third word in the buffer was modified during the two-word read operation when attempting to read the block number in the data portion of the sector.

### Test No. 7 - Seek All Blocks Test

#### Description:

Using subroutine RDWR, the combination Seek/Read instruction is executed on Sector 0, and since the first two words of the data portion of all sectors contain their respective block numbers, it can verify that the appropriate sector is reached and read. The same operation is performed on the maximum sector, then on Sector 1, then on the maximum sector -1, and so on until all sectors have been read. This test exercises the head positioning movement and verifies the operation of the Sector Counter on the moving head disk,

and verifies the head selection electronics and the Sector Counter on the fixed head disk. Notice that for the moving head disk, this method of operation verifies that moving the head across the center track a large number of times does not distort the information on that track.

Errors:

- 125 - Indicates that the done flag was not set in the maximum allowable time when attempting to read the block number in the data portion of a sector.
- 126 - Indicates that the STR indicated on error occurred during the data transfer when attempting to read the block number from the data portion of a sector.
- 127 - Indicates that the data in the buffer was modified during the read operation.
- 130 - Indicates that the third word in the buffer was modified during the two-word read operation when attempting to read the block number in the data portion of the sector.

Test No. 8
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 - Random Seek Test

Description:

In this test, a series of 512 seeks to random sectors is performed. After each seek, the data portion of the sector (which contains the block number) is read to verify that the correct sector was reached. Subroutine RDWR is used to perform these operations.

Errors:

- 131 - Indicates that the done flag was not set in the maximum allowable time when attempting to read the block number in the data portion of a sector.

132 - Indicates that the STR indicated an error occurred during the data transfer when attempting to read the block number from the data portion of a sector.

133 - Indicates that the data in the buffer was modified during the read operation.

134 - Indicates that the third word in the buffer was modified during the two-word read operation when attempting to read the block number in the data portion of the sector.

Test No. 9
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 - Single Block Write/Read Test

Sub-Test 9.1

Description:

In this test, a data pattern that fills the entire sector is written in each sector - one sector at a time. The pattern used is constructed as follows: (a) the first two words of every sector are the complement of the block number to help in the identification of an incorrect sector; (b) each of the next fourteen 12-bit words contains a pattern of alternating ones and zeros expressed as 5252<sub>g</sub>; (c) the next sixteen words are all zeros; (d) the next sixteen words are formed by shifting a zero through a pattern of ones starting with the zero in the least significant bit position and moving it to the most significant position, then restarting with the least significant bit; (e) the next sixteen words are alternating patterns of 7070<sub>g</sub> and its complement repeated eight times; (f) the next sixteen words are alternating ones and zeros expressed as 2525<sub>g</sub>; (g) the next sixteen words are a data pattern which shifts a one through a pattern of zeros, starting with the one in the least significant bit position and moving it to the most significant bit position, then back to the least significant bit; (h) the next sixteen words are alternating words of all ones and all zeros starting with the word of all ones. The

above data pattern of 128 words is repeated as necessary to fill the sector.

The subroutine that writes the data on the disk for this test is DSKRW. It controls the interlacing to insure that maximum disk efficiency is obtained. It sets up the parameters for RDWR. This routine can be used for either reading or writing.

RDWR operates as follows: After initiating the write or read operation, it waits for the done flag to be set. After the done flag is set, the STR is checked for the occurrence of errors and the Track Address Register and Sector Register values are checked to be sure they were incremented by the correct amount. The contents of buffer location BUF1 (data) is compared with the contents of buffer location BUF2 (read/write buffer) to insure that the data was not modified during the write operation and was read correctly during the read operation.

If Switch Register Bit 8 is set, the computer will print all data errors; if not, the program will print only the first eight data errors found. The word following the last word in the read/write buffer is always checked to make sure it was not modified during the operation.

The RDWR subroutine is entered for the write portion of the test from DSKRW. This subroutine writes every sixth or every twelfth sector on the disk depending upon whether a one sector or two sector write is being employed. This interlacing, which requires six passes through the disk in order to write every sector, is done to provide enough program time to do the necessary comparison between writes without losing an entire disk revolution.

Between every write operation, the block number in BUF1 and BUF2 is changed but no other changes are made in the data pattern.

Errors:

- 135 - Indicates that the controller did not complete the write function in the maximum allowable time.
- 136 - Indicates that the STR indicated an error occurred during the transfer of the data pattern.
- 137 - Indicates that the SCR or TAR did not have the proper value after the termination of the operation.
- 140 - Indicates that there was an error in the data comparison during a data transfer operation. If Switch Register Bit 8 is set, all errors detected during this buffer compare test are typed out.
- 141 - Indicates that the word in the buffer which is one greater than the word count during a data transfer operation, was modified during the operation.

Sub-Test 9.2

Description:

In this sub-test the entire disk is read one sector at a time. The sub-routine DSKRW is used to call RDWR. DSKRW reads every eighth or every sixteenth sector depending upon whether a one or two sector read is required. This interlacing permits the checks to be done between read operations rather than wasting an entire disk revolution after each read operation.

The data pattern in each sector is compared against what it should be to verify that the write operations in 9.1 were done correctly.



Errors:

- 142 - Indicates that the controller did not complete the read function in the maximum allowable time.
- 143 - Indicates that the STR indicated an error occurred during the transfer of the data pattern.
- 144 - Indicates that the SCR or TAR did not have the proper value after the termination of the operation.
- 145 - Indicates that there was an error in the data comparison during a data transfer operation. If Switch Register Bit 8 is set, all errors detected during this buffer compare test are typed out.
- 146 - Indicates that the word in the buffer which is one greater than the word count during a data transfer operation, was modified during the operation.

Sub-Test 9.3

Description:

In this sub-test DSKRW is used to read the entire disk 1-1/2 sectors at a time while verifying the data patterns on each sector. This tests the multiple sector read operations.

Errors:

- 147 - Indicates that the controller did not complete the read function in the maximum allowable time. Note that if the value in the SCR is one greater than it should be, the error occurred during the reading of the second sector of the multiple sector operation.

150 - Indicates that the STR indicated an error occurred during the transfer of the data pattern.

151 - Indicates that the SCR or TAR did not have the proper value after the termination of the operation.

152 - Indicates that there was an error in the data comparison during a data transfer operation. If Switch Register Bit 8 is set, all errors detected during this buffer compare test are typed out.

153 - Indicates that the word in the buffer which is one greater than the word count during a data transfer operation, was modified during the operation.

Test No. 10 - Multiple Sector Write/Read Test

Sub-Test 10.1

Description:

In this sub-test, subroutines DSKRW and RDWR are used to write the data patterns described in Test 9.1 onto the entire disk in 1-1/2 sector segments.

Errors:

154 - Indicates that the controller did not complete the write function in the maximum allowable time. Note that if the value in the SCR is one greater than it should be, the error occurred during the writing of the second sector of the multiple sector operation.

155 - Indicates that the STR indicated an error occurred during the transfer of the data pattern.

156 - Indicates that the SCR or TAR did not have the proper value after the termination of the operation.

- 157 - Indicates that there was an error in the data comparison during a data transfer operation. If Switch Register Bit 8 is set, all errors detected during the buffer compare test are typed out.
- 160 - Indicates that the word in the buffer which is one greater than the word count during a data transfer operation, was modified during the operation.

### Sub-Test 10.2

#### Description:

In this sub-test the entire disk is read and the data patterns verified in segments of 1-1/2 sectors, just as they were written in Sub-Test 10.1. The subroutines DSKRW and RDWR are used for these operations.

#### Errors:

- 161 - Indicates that the controller did not complete the read function in the maximum allowable time. Note that if the value in the SCR is one greater than it should be, the error occurred during the reading of the second sector of the multiple sector operation.
- 162 - Indicates that the STR indicated an error occurred during the transfer of the data pattern.
- 163 - Indicates that the SCR or TAR did not have the proper value after the termination of the operation.
- 164 - Indicates that there was an error in the data comparison during a data transfer operation. If Switch Register Bit 8 is set, all errors detected during the buffer compare test are typed out.
- 165 - Indicates that the word in the buffer which is one greater than the word count during a data transfer operation, was modified during the operation.

### Sub-Test 10.3

#### Description:

In this sub-test, the entire disk is read one sector at a time and the data patterns are verified.

#### Errors:

- 166 - Indicates that the controller did not complete the read function in the maximum allowable time.
- 167 - Indicates that the STR indicated an error occurred during the transfer of the data pattern.
- 170 - Indicates that the SCR or TAR did not have the proper value after the termination of the operation.
- 171 - Indicates that there was an error in the data comparison during a data transfer operation. If Switch Register Bit 8 is set, all errors detected during this buffer compare test are typed out.
- 172 - Indicates that the word in the buffer which is one greater than the word count during a data transfer operation, was modified during the operation.