MAGNETIC TAPE DIAGNOSTIC NINE-TRACK

7970/13181

Computer
Museum

HP Part No. 13020

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UPDATING SUPPLEMENT FOR DIAGNOSTIC PROGRAM PROCEDURES

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MANUAL IDENTIFICATION

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SUPPLEMENT DESCRIPTION

The purpose of this supplement is to adapt the manual to revised diagnostics and to correct manual errors. Enter the new information (or the change number, if more convenient) into the appropriate places in the manual identified at left.

DIAGNOSTIC PART NO.	REVISION	CHANGES
13020-60001	All	6
13020-60001	D	1 thru 6
13020-60001	E	1 thru 6

Changes 1 through 5 dated 15 November 1971.

Change 6 dated 17 December 1971.

US-1

Printed in U.S.A.

CHANGE	DESCRIPTION

1   Cover Page. Change the revision designation for part number 13020-60001 from "C" to "D."

2   Page MTD–12, step "i."

    a. Change step (1) to read: Set switches 14 and 15 for the type of computer.

TYPE	SW 15	SW 14
2116	reset	reset
2100	reset	set
2114	set	reset

    b. Change step (2) to read: Set switches 0 through 3 for the tape drive speed.

SPEED	SW 3	SW 2	SW 1	SW 0
12.5 ips	reset	reset	reset	set
25 ips	reset	reset	set	reset
37.5 ips	reset	set	reset	reset
45 ips	set	reset	reset	reset

3   Page MTD-12, OPERATOR SERVICE ROUTINES. Change the first two sentences to read: Four separate operator-service routines of the diagnostic allow the operator, using various combinations of the routines, to perform certain checkout and verification procedures. The four routines are: DMA transfer test (DMATR), write tape byte from switch register (WTBSR), command exercise (CE), and write computer word from switch register (WCWSR).

4   Page MTD-13. Precede the WRITE TAPE BYTE FROM SWITCH REGISTER (WTBSR) paragraph with the following:

    DMA TRANSFER TEST (DMATR)

    This routine has a starting address of 500 octal and is used as an extended method for checking the DMA transfer mode of the interface. Switches 0 through 7 determine the bit pattern of the bytes to be written.

    The program writes a 2048-byte record, then backspaces and reads the record twice. Each time, the switch register byte is compared with each byte read into the core buffer. If data errors have occured, the program halts with 102055B in the T-register and the A-register contains the word in error.

    Setting switch 15 to "1" brings the program — to a normal halt with the T-register indicating 102076B. Leaving switch 15 at "0" allows the program to continue transferring records until an end-of-tape condition is detected, at which time the tape automatically rewinds.

CHANGE

DESCRIPTION

5

Page MTD-25, table MTD-4. Precede the 1000_8 entries with the following:

500_8

SWITCH	STATE	FUNCTION
0 - 7	-----------	Defines the tape bytes that are written, depending upon the state of the switches; set = 1, reset = 0.
15	Set	Terminates the program operation.

6

Page MTD-15, READ PREAMPLIFIER GAIN. Change steps "a" and "b" to read as follows:

a. Using the WCWSR routine at 1200 octal, write an alternate "1" and "0" tape.

Note

The tape generated above has a character packing density of 400 characters per inch. The preamplifier outputs are the same for 200 and 400 characters per inch.

b. Set the tape unit preamplifier gains in accordance with the read/write procedure in the tape unit Operating and Service Manual, except use the 400 cpi tape generated above.

MAGNETIC TAPE DIAGNOSTIC NINE-TRACK
7970/13181

INTRODUCTION

This diagnostic program tests the combined functioning of the 13181A Interface Kit (controller and cable) and the 7970 Digital Magnetic Tape Unit. Tests are provided for tape speeds of 12.5, 25, 37.5, and 45 ips.

All tests are modular, and can be put in a test loop to check out individual functions of the controller-tape combination.

Special operating instructions provide a means for using the controller circuitry to test all parameters and characteristics of the tape unit. Except for initialization halts, all halts cause a printout. The diagnostic is compatible with HP system software, and the teleprinter uses the standard SIO driver.

HARDWARE CONFIGURATION

This diagnostic program runs on HP 2100 series computers with a minimum of 4K of memory. Direct memory address (DMA) is optional. A teleprinter is included in the hardware configuration for this diagnostic.

FUNCTIONAL AND OPERATIONAL CHARACTERISTICS

The program is first initialized for the I/O configuration of the system being tested, then goes (at 2000 octal) into the series of tests which constitute the main diagnostic. All tests in the program sequence have consecutive stop numbers, starting with S=0001 for the first test and ending with S=0082 for the last. The program can be run in two modes, auto-select and switch-register control (manual).

Unless an error is detected, the program makes a complete run, then recycles. However, if an error is detected an error message is printed out, along with the associated test number. The program then continues with the rest of the tests--unless the error caused a sequence error in the program. In this case the program would be restarted automatically.

The program can also be halted after an error has been detected and recorded. Any test can be halted when finished and the test (or short sequence of tests) inserted into a loop through the use of another control switch.

When the program is stopped after a current test, either by error halt or switch control, the Test Stop number is displayed in the B-register, with the A-register containing controller and drive status.

After a complete sequence of tests, the diagnostic program will recycle and continue until the program is halted by switch-register control or by pressing the computer HALT button. When halted under switch register control, the program will print the number of diagnostic cycles completed. If the diagnostic detects an end-of-tape condition, the program will automatically rewind the tape and restart the diagnostic at the load point.

Selection of tape units can be done by switch-register settings or by an auto-select mode. In auto-select, although any number of tape units up to four may be on-line, the program will begin with the 0-unit and select the first one found to be actually on-line. If all units are off-line or busy, the program will try the select sequence twice before printing out a not-ready indication. In the switch-register control mode, only the unit specified will be selected.

Table MTD-1 lists diagnostic switch-control settings, table MTD-2 lists test-stop numbers and the associated test, table MTD-3 lists program halts, and table MTD-4 lists operator service routines with switch settings and functions.

PROGRAM ORGANIZATION

This diagnostic program performs the tests listed under succeeding paragraph headings.

SELECT

The select test is begun by setting one of the computer-console switches (0-3) to the up position, thus determining the unit to be selected. This allows the program to test both controller and tape-unit select logic and circuitry. The test determines if the tape unit is on-line or has been selected or is unavailable--and a printout indicates status.

TIMING AND CONTROL, I/O CHANNEL

Test No. 1. The maximum time allowed to clear the controller is tested by issuing a Clear (CLR) command to the controller and waiting a fixed time for the controller-busy status bit to be set.

2. The minimum time allowed to clear the controller is tested by using the same operation in Test No. 1, except that the fixed time period is set so that the controller-busy status bit is tested just prior to being set at the end of the clear operation.

3. The status is tested to assure that the controller has been cleared. There should be no status indication.

4. The data channel flag is set by the computer and then tested to assure that the flag is set.

5. The data channel flag is cleared by the computer and then tested to assure that the flag is clear.

6. The command channel flag is set by the computer and then is tested to assure that the flag is set.

7. The command channel flag is cleared by the computer and then is tested to assure that the flag is clear.

8. An interrupt condition is set up for the data channel to test the flag control and interrupt logic for that channel.

9. This test is similar to Test No. 8 except the command channel is tested.

INITIAL MOTION AND WRITE/READ

Test No. 10. A Write Characters (WCC) command is issued to the controller. The minimum start time is tested by waiting a fixed time period before checking the data channel flag. The flag should still be clear.

11. The maximum start time is tested in the same operation as Test No. 10. The only difference is that after another short, fixed time the data channel should be set.

12. The record that was written during the previous two tests is a two-byte, all "1's" record. The status is tested after the record is written, to check if there were any parity or timing errors during the write operation.

13. The backspace record is tested by issuing a back space record (BSR) to the controller. A fixed time period is allowed to elapes before the controller busy status is checked.

14. The previously written and backspaced record is read in. A byte-by-byte comparison is made to test for read errors.

15. A two byte record, with "0's" in the data tracks, is written. The status of the operation is tested for parity or timing errors.

16. The record written in Test No. 15 is backspaced using the same test as in Test No. 13.

17. The record written in Test No. 15 is read back. A byte-by-byte comparison is made to test for read errors.

18. A 200-byte record is written with a single rotating bit as the data pattern. At the end of the write operation the status is checked for parity and data timing errors.

19. The 200-byte record written in Test No. 18 is backspaced using the same test as in Test Nos. 13 and 16. If the test fails, the FAILED BACK SPACE message is printed on the teleprinter and the computer halts.

20. The record written in Test No. 18 is read back. A byte-by-byte comparison is made to test for read errors.

FILE MARK AND REJECT

Test No. 21. A Gap and File Mark (GFM) command is issued to the controller-drive. A fixed time period is waited before the command channel flag is checked, which indicated that the operation was finished.

22. A Write File Mark command is issued to the controller and the Control flip-flop is set. A Backspace command is then issued and the status is checked to assure that the reject bit has been set.

23. After the write file mark operation in Test No. 22 has been completed, the controller is checked to assure that the file mark has been detected. This test is done by waiting a fixed time period for the Command channel to be set.

WRITE

Test No. 24.   The parity channel is tested by writing all "0's" in the data
               tracks.   In this test the record is 1000 bytes long.

        25.   A test record is written. At the end of the write operation,
               status is taken and checked for parity errors. If a parity error
               is detected the record is backspaced and a gap is written, before
               the record is rewritten. Ten retries are allowed before the com-
               puter is halted. The record length in this test is 16 bytes, and
               all the bytes have only "1's" written in channel 7 (IBM).

        26.   This test is the same as Test No. 25 except that only channel 6
               is written, and the record length is 18 bytes.

        27.   The test is the same as Test No. 25 except that only channel 5
               is written, and the record length is 20 bytes.

        28.   The test is the same as Test No. 25 except that only channel 4
               is written, and the record length is 22 bytes.

        29.   The test is the same as Test No. 25 except that only channel 3
               is written, and the record length is 26 bytes.

        30.   The test is the same as Test No. 25 except that only channel 2
               is written, and the record length is 46 bytes.

        31.   This test is the same as Test No. 25 except that only channel 1
               is written, and the record length is 62 bytes.

        32.   This test is the same as Test No. 25 except that only channel 0
               is written, and the record length is 388 bytes.

        33.   This test is the same as Test No. 25 except that instead of writing
               a single channel, a checkerboard data pattern is written. The
               record length is 12 bytes.

34. This test is the same as Test No. 25 except that all channels are written. The record length is 2 bytes.

35. This test is the same as Test No. 34 except that the record length is 10K bytes.

RECORD AND FILE SPACING

Test No. 36. A file mark has previously been written and a Backspace File (BSF) command is issued to the controller-drive. A fixed time period is waited before the command channel flag is checked. If the flag was set, the operation has been completed.

37. This test is the same as Test No. 36 except that the file mark is treated like a record and a Forward Space Record (FSR) command issued to the controller-drive.

38. This test is the same as Test No. 36 except that a Forward Space File (FSF) command is issued to the controller-drive.

READ

Test No. 39. This test reads the record written in Test No. 24. A byte-by-byte comparison is made to test for read errors.

40. This test reads the record written in Test No. 25. A byte-by-byte comparison is made to test for read errors.

41. This test reads the record written in Test No. 26. A byte-by-byte comparison is made to test for read errors.

42. This test reads the record written in Test No. 27. A byte-by-byte comparison is made to test for read errors.

43. This test reads the record written in Test No. 28. A byte-by-byte comparison is made to test for read errors.

44. This test reads the record written in Test No. 29. A byte-by-byte comparison is made to test for read errors.

45. This test reads the record written in Test No. 30. A byte-by-byte comparison is made to test for read errors.

46. This test reads the record written in Test No. 31. A byte-by-byte comparison is made to test for read errors.

47. This test reads the record written in Test No. 32. A byte-by-byte comparison is made to test for read errors.

48. This test reads the record written in Test No. 33. A byte-by-byte comparison is made to test for read errors.

49. A file mark is read and the status is checked to assure that the odd byte bit is set. Reading a file mark also generates timing and parity status.

50. A fixed time lag, analogous to the minimum gap distance, is waited before checking the data channel flag. A set flag means that the first byte of the next record has been read during gap time, and that the interrecord gap is thus below minimum tolerance.

51. This test is an extension of Test No. 50. An added fixed time is waited. The data channel flag should be set by this time in normal operation.

52. The read start time is measured by starting a read operation in the middle of an all "1's" record. This is done by, first, stopping in a previously-written record; second, by giving a read-forward (RRF) command to the controller. Then a fixed time is waited before testing the data channel flag.

53. This test is the same as Test No. 34 and is used to set up the CRCC tests.

54. This test is the same as Test No. 52 except that 6 bytes are written.

55. This test is the same as Test No. 52 except that 12 bytes are written.

56. The test of the CRCC is made by reading back the records written in Test Nos. 52, 53 and 54. The CRCC read from tape is the compared to a constant in core. This is done separately for each of the records and checks all possible combinations of the CRC hardware.

OPTIONAL TESTS

The optional tests are selected (or inhibited) by the switch register.

> *NOTE: These tests do not have consecutive Test Stop Numbers, because of program organization.*

When SW4 is reset (down) the following tests are run:

Test No. 57. A data pattern nearly representing a sawtooth is written as a record on tape. This pattern is 10 bytes long and is repeated 1000 times in the record. At the end of the write operation the status is tested for read after write parity errors.

58. The record written in Test No. 57 is backspaced and read. A byte-by-byte comparison is made to test for read errors.

59. A 2048 random word record is generated and written on tape. The status is tested at the end of the write operation for read after write parity errors. Four record rewrites are allowed before indicating on the teleprinter that parity errors occurred during the write operation.

60. The record that was written in Test No. 59 is backspaced and read. A byte-by-byte comparison is made from a core image of the record on tape. Any read errors are detected and printed on the teleprinter.

When SW5 is reset (down) the following test is run:

61. In this test a short record is first written. Then the next record of 1000 bytes is written and backspaced in the same location on tape, ten times. The gap between the short record and the rewritten record is measured in the same manner as in Test No. 50.

When SW6 is set (up) the following test is run:

62. In this test, status is tested after the write enable ring is removed from the tape spool and a Write Characters (WCC) command was issued to the controller. The file protect status bit should be set as well as the reject status bit.

When SW7 is reset (down) the following tests are run:

Test No. 70. A Rewind (REW) command is issued to the controller. Status is then tested for the presence of the rewind status bit and the controller busy bit.

71. After the rewind operation has been completed in Test No. 70, the status is tested for the load point status bit.

72. A Backspace Record (BSR) command is issued to the controller while the tape is at load point. The status is then tested to assure that the reject status bit was set.

When SW8 is set (up) the following tests are run:

80. A 388 byte record is written onto tape under DMA control. The status of the controller-drive is tested when the write operation is finished. None of the status bits should be set.

81. The record written in Test No. 80 is backspaced and then read back into core under DMA control. The status is tested when this operation is finished. All status bits should be clear.

82. A word by word comparison is made on the data read back to core in Test No. 81.

When SW9 is set (up), the rewind off-line test is run. This test has no Test Stop No. but prints the message: SELT'D T.U. OFF LINE, when the operation is complete. The T-register will contain 102010, and the tape drive will be in the reset condition.

OPERATING INSTRUCTIONS

a. Load the teleprinter SIO driver using the basic binary loader.

b. Load address 000002.

c. Load the I/O select code of the teleprinter in the switch register.

d. Press PRESET and RUN.

e. Load the 13020   Diagnostic Tape using the basic binary loader.

f. Load address 100_8.

g. Set the switch register, switches 0 - 4, with the I/O select code of the Mag Tape 1 board.

h. Press PRESET and RUN.

i. Set the switch register with the computer type and tape drive speed as follows:

   (1) Set switch 15 (up) if using a 2114 or 2115 computer.

   (2) Set switches 0 - 3 with the tape drive speed; if 12.5 ips, set 0; if 25 ips, set 1; if 37.5 ips, set 2; if 45 ips, set 3.

j. Press PRESET and RUN.

k. Select the desired options controlled by the switch register; refer to Table MTD-1.

l. Press PRESET and RUN. The program is now entered automatically and can still be altered by using switch control; refer to Table MTD-1.

m. It is possible to change the tape speed requirement and I/O configuration after the program has been running. First halt the program, then return to address 100_8 and start the initialization cycle over, including the desired changes.

OPERATOR SERVICE ROUTINES

Three separate operator-service routines of the diagnostic allow the operator, using various combinations of the routines, to perform certain checkout and verification procedures. The three routines are: Write Tape Byte from Switch Register (WTBSR), Command Exercise (CE), and Write Computer Word from Switch Register (WCWSR). The routines are described below, and the descriptions are followed by a list of setup and verification procedures.

WRITE TAPE BYTE FROM SWITCH REGISTER (WTBSR)

This routine has a starting address of 1000 octal. Two types of records can be written, depending upon the use of the switch registers. Table MTD-4 provides switch settings for different lengths of records, as well as switch settings for use during write and termination-of-write operation. Switches 0 thru 7 determine the bit pattern of the bytes to be written.

When switch 15 is set (up position) during the infinite length mode, the record is terminated with normal CRC and LRC. Placing switch 15 in the up position also halts the fixed length record operation at the end of the record being written. WBTSR also permits all "1's" to written, detects end-of-tape, and causes automatic tape rewind to load point, with subsequent writing restart.

COMMAND EXERCISE (CE)

This routine starts at 1100 octal and outputs individual commands (Table MTD-4) to controller and tape unit. Any of the first six commands in Table MTD-4 can be combined with any of the last six, or with any single command. The routine has the option of using the flags for termination of operations or as a timer.

In the timer operations, three fixed time periods are available. These are 10 milliseconds, 15 milliseconds, and 30 milliseconds.

Normal termination of operations in this routine is achieved by setting switch 15 to the up position.

WRITE COMPUTER WORD FROM SWITCH REGISTER (WCWSR)

This routine starts at 1200 octal, and allows the operator to write a computer word on tape, as well as allowing alternating bit patterns. The higher eight bits represents the first byte that will go on tape, and the lower eight the second. The routine continues to write the alternating bytes (computer word) until terminated by setting all switches to the up position.

The WCWSR routine does not permit all "1's" writing, but does contain the same end-of-tape provision as WTBSR.

SETUP AND VERIFICATION PROCEDURES

Among the setup and verification procedures that can be accomplished with the operator-service routines are the following: start/stop time, instantaneous speed variations and dynamic skew, read preamplifier gain, read skew, write/ read phasing and write reset, erase write phasing, and write cross-talk. Tape cleaning or bulk erase of tapes can also be accomplished.

> *NOTE: Electromechanical and electronic portions of the*
> *following procedures are listed in the Operating*
> *and Service Manual for the 7970 Digital Magnetic*
> *Tape Unit.*

START/STOP TIME. To check start/stop time, proceed as follows:

a. Forward Direction.

  (1) Using the WTBSR routine at 1000 octal, write an all "1's" tape.

  (2) At 1100 octal rewind the tape, using the CE routine.

  (3) Again using the CE routine at 1100 octal, combine the Read-Record-Forward and Clear commands with a timer.

  (4) Sync oscilloscope at TP9 on the tape unit motion-control card.

  (5) Connect the oscilloscope probe to the appropriate test point, and observe that the appropriate ramps are shown on the oscilloscope.

b. Reverse Direction.

  (1) Using the WTBSR routine at 1000 octal, write an all "1's" tape.

(2) Using the CE routine at 1100 octal, combine the Backspace-Record and Clear commands with a timer.

(3) Sync the oscilloscope at TP5 of the tape unit motion-control card and connect the probe to the appropriate test point.

(4) Observe that the appropriate ramps are shown on the oscilloscope.

INSTANTANEOUS SPEED VARIATIONS AND DYNAMIC SKEW. To check these, proceed as follows:

a. Using the WTBSR routine at 1000 octal, write an all "1's" tape.

b. Rewind and read the record forward again, using the CE routine. While checking for speed changes and skew per instructions listed in the tape unit operating and service manual.

READ PREAMPLIFIER GAIN. To check gain, proceed as follows:

a. Using the WCWSR routine, write an alternate "1" and "0" tape.

b. Using the CE routine, rewind the tape and re-read the record, checking gain per instructions listed in the tape unit operating and service manual.

READ SKEW. To check this, proceed as follows:

a. Obtain a test tape containing known skew.

b. Using the CE routine at 1100 octal, use RRF for forward and BSR for reverse.

c. Use the tape to check read skew per instructions listed in the tape unit operating and service manual.

WRITE/READ STATIC SKEW. To check skew, use WTBSR at octal 1000, start writing an all "1's" record, and check skew per instructions listed in the tape unit operating and service manual.

WRITE/READ PHASING AND WRITE-RESET. To check these, proceed as follows:

a. Use WTBSR routine to write a bit pattern on tape.

b. Manipulate the bit pattern so that an LRC bit is written in each tape track.

> *NOTE: Use a fixed-length record of four characters.*

c. Use the tape to check phasing and reset per instructions listed in the tape unit operating and service manual.

ERASE WRITE PHASING. To check this, proceed as follows:

a. Using the WTBSR routine, write an all "0's" tape.

b. Rewind the tape.

c. Remove the write card for the channel being tested from the card cage in the tape unit.

d. Use the CE routine to alternate between a RRF and WCC.

e. Check phasing per instructions listed in the tape unit operating and service manual.

CROSS TALK. To check this, proceed as follows:

a. Bypass the capstan with the tape, leaving tension on the tape.

b. Using WTBSR, start writing and all "1's" infinite record.

c. Check cross-talk per instructions listed in the tape unit operating and service manual.

CLEANING OR BULK ERASE OF TAPES. To do this, use the Gap command through the whole length of the tape.

MESSAGE ANALYSIS

When an error is detected the diagnostic program prints a message in the following format:

0001   S=0023   CR, TM, CB

The first four digits are the program cycle number, or the number of times the diagnostic has been repeated. This is followed by the Test Stop number (Table MTD-2). After the Test Stop number is the status, if any, of the controller and tape unit at the time the error was detected. The following status abbreviations could appear:

    OF: the selected tape unit is off line or in load.
    PT: A parity error was detected during data transfer.
    FP: File protect, no write ring on the tape spool.
    CR: The issued command was rejected.
    TM: Data timing error.
    ET: End-of-tape marker was sensed.
    LP: Load point marker was sensed.
    FM: A file mark was read.
    CB: Controller busy.
    TB: The selected tape unit was busy.
    RW: The selected tape unit was rewinding.
    OB: The last record read contained an odd byte.

Errors detected during read operations provide additional information with the error messages described above. In the same line as the Test Stop number, the number of the word in error is listed by:

    C=0156

The complete message above is then followed by a second and third line containing the good and bad computer word:

```
G=1010  1010  0000  0000
B=1010  1010  0000  0001
```

When the auto select mode is being used, all the error messages are proceeded by the unit number:

```
Unit No. 0000
0001   S=0040,  PT,  CB     C=0156
G=1010  1010  0000  0000
B=1010  1010  0000  0001
```

Other error indications may appear during the operation of a faulty unit or controller. These are:

```
S=00nn  PT,  CB,
NO  CMMD  CHNL  FLAG
```
Interpretation: During Test No. nn a command channel flag was expected within a fixed time period after a controller operation.

```
S=00nn  CR,  CB
CMMD  REJTD
```
Interpretation: During Test No. nn a command was issued to the controller and was rejected because the controller was still busy with the previous operation. This is also an indication that Test No. (nn-1) may be at fault.

```
S=00nn  CB,
NO  DATA  CHNL  FLAG
```
Interpretation: This message occurs during data transfer tests only and indicates that a data channel flag was expected within a fixed time during the transfer.

S=00nn PT, CB,

2 REWRITES

Interpretation: This message occurs during write operations only and indicates
that read after write parity errors, caused by bad tape, etc,
were detected, requiring the record to be rewritten.

S=00nn PT, CB

10 REWRITES

Interpretation: This message occurs during write operations only and indicates
that read after write parity errors, caused by faulty write-
read circuits, were detected. Ten rewrites of the record had
been attempted without success.

GAP TIME TOO LONG

Interpretation: This message indicates that the Gap command, issued to the
controller while that tape unit was at load point, was not
executed by the drive or the drive went into a tape run-away
condition.

FAILED BACK SPACE

Interpretation: This message indicates that the controller-drive was unable
to perform an initial reverse motion operation over a written
record in a fixed time period.

E.O.T.

000n CYCLES

Interpretation: An end-of-tape marker was detected during the nth cycle of the
diagnostic. The tape was rewound and the diagnostic cycling
was continued.

SELT'D T.U. OFF LINE

Interpretation: The message indicates that the tape unit that was selected
was off-line or in the case of auto select all tape units
were off-line or busy.

*NOTE: The status CB (controller busy) will appear in most
error print-outs and generally is the normal condi-
tion of the controller when the status was taken.*

TABLES

The remainder of this manual consists of tables. These are:

Table MTD-1. Main Diagnostic Switch Control Settings

Table MTD-2. Test Stop Numbers and Associated Tests

Table MTD-3. Program Halts

Table MTD-4. Switch Settings and Functions for Operator-Service Routines

Table MTD-1

Main Diagnostic Switch Control Settings

Switch	State	Function
0 - 3	Reset (down)	Auto select option.
0	Set (up)	Select Unit 0.
1	Set	Select Unit 1.
2	Set	Select Unit 2.
3	Set	Select Unit 3.
4	Set	Inhibits Data Test.
5	Set	Inhibits Interrecord Gap Creep Test.
6	Set	Execute Write Enable Test.
7	Set	Inhibits Rewind and Load Point Sense Tests.
8	Set	Executes DMA Write/Read Tests.
9	Set	Executes Rewind-Off-Line Test.
10		Not used.
11		Not used.
12	Set	Halts and prints diagnostic cycles complete.
13	Set	Loops on the last test completed and inhibits error message.
14	Set	Halts the diagnostic program on errors and prints error message.
15	Set	Halts after current test.

NOTES: 1. *If more than one of the select control switches (0-3) are set, only the first one (starting with 0) is used to select the unit.*

2. *When errors occur, while in the auto select mode and multi-unit operation, the diagnostic program will indicate which unit caused the errors.*

3. *The optional tests are controlled by switches 4-9.*

4. *Switch 8 is not used for systems without the DMA option.*

Table MTD-2

Test Stop Numbers and Associated Tests

Test Stop No.	Diagnostic Test
S=0001	Maximum controller clear time.
S=0002	Minimum controller clear time.
S=0003	Test all status to be clear.
S=0004	Set data channel flag test.
S=0005	Clear data channel flag test.
S=0006	Set command channel flag test.
S=0007	Clear command channel flag test.
S=0008	Test valid data channel interrupt.
S=0009	Test valid command channel interrupt.
S=0010	Minimum write start time test.
S=0011	Maximum write start time test.
S=0012	Writes two bytes all "1's."
S=0013	Back space record.
S=0014	Reads 2 bytes all "1's."
S=0015	Writes 2 bytes all "0's."
S=0016	Backspace record.
S=0017	Reads 2 bytes all "0's."
S=0018	Writes 200 bytes rotating bit record.
S=0019	Backspaces record.
S=0020	Reads record.
S=0021	Gap and file mark test.
S=0022	Test command reject condition when controller busy.
S=0023	File mark detection test.
S=0024	Test parity track, writes all "0's" record.
S=0025	Test channel 7, writes all "1's" in 7 only.
S=0026	Test channel 6, writes all "1's" in 6 only.
S=0027	Test channel 5, writes all "1's" in 5 only.
S=0028	Test channel 4, writes all "1's" in 4 only.

Test Stop Numbers and Associated Tests

Test Stop No.	Diagnostic Test
S=0029	Test channel 3, writes all "1's" in 3 only.
S=0030	Test channel 2, writes all "1's" in 2 only.
S=0031	Test channel 1, writes all "1's" in 1 only.
S=0032	Test channel 0, writes all "1's" in 0 only.
S=0033	Writes checkerboard pattern.
S=0034	Writes two character record, all "1's."
S=0035	Writes 10K byte record all "1's."
S=0036	Test backspace file.
S=0037	Forward space record test.
S=0038	Forward space file test.
S=0039	Reads parity channel, all "0's."
S=0040	Reads channel 7.
S=0041	Reads channel 6.
S=0042	Reads channel 5.
S=0043	Reads channel 4.
S=0044	Reads channel 3.
S=0045	Reads channel 2.
S=0046	Reads channel 1.
S=0047	Reads channel 0.
S=0048	Reads checkerboard pattern.
S=0049	Odd byte record test.
S=0050	Minimum inter-record gap.
S=0051	Maximum inter-record gap.
S=0052	Read start time test.
S=0053	Write test, two bytes all "1's."
S=0054	Write test, six bytes all "1's."
S=0055	Write test, twelve bytes all "1's."
S=0056	CRCC test of 2, 6, and 12 byte records.

Table MTD-2 (Cont.)

Test Stop Numbers and Associated Tests

Test Stop No.	Diagnostic Test
S=0057	Saw tooth pattern write test.
S=0058	Saw tooth pattern read test.
S=0059	Random data write test.
S=0060	Random data read test.
S=0061	Inter-record gap creep test.
S=0062	Write enable-file protect test.
S=0070	Rewind test.
S=0071	Load point sense test.
S=0072	Load point reject test.
S=0080	DMA write test.
S=0081	DMA read test.
S=0082	DMA data test.

Table MTD-3

Program Halts

T-Register	Halt
102000	Initialization halt.
102010	Rewind/off-line halt.
102011	Select halt, selected tape unit not on-line.
102055	Error halt.
102056	File protect test halt.
102076	Normal halt after current test.
102077	Normal halt after complete program cycle.

Table MTD-4

--- Switch Settings and Functions for Operator-Service Routines ---

1000_8

Switch	State	Function
0 - 7	-----	Defines the tape byte that is written, depending upon the state of the switch; set = 1, reset = 0.
8*	Set	Fixed length record of 4 bytes.
9*	Set	Fixed length record of 6 bytes.
10*	Set	Fixed length record of 10 bytes.
11*	Set	Fixed length record of 18 bytes.
13*	Set	Fixed length record of 34 bytes.
14*	Set	Fixed length record of 66 bytes.
8 - 14	Reset	Infinite length record.
15	Set	Terminates infinite length record normally then halts and halts after current fixed length record.

NOTE: *Any combinations of switches 8 - 14 may be set resulting in different lengths than stated above. If 8, 9, and 10 were all set and the rest reset, the length of the record would be 16 bytes. The length is determined by the sum of the BCD weights (SW 8=1, SW 9=2, SW 10=4 ·, ·, ·, SW 14=32) multiplied by 2 plus 2.

Table MTD-4 (Cont.)

```
┌────────────── Switch Settings and Functions for Operator-Service Routines ──────────────┐
│                                                                                          │
│   ┌──────────────────────────────────────────────────────────────────────────────────┐ │
│   │                                    1100₈                                           │ │
│   └──────────────────────────────────────────────────────────────────────────────────┘ │
```

Switch	State	Function
0	Set	Write command is issued (WCC).
1	Set	Write file marks (WFM).
2	Set	Read Record command is issued (RRF).
3	Set	Forward space record command is issued (FSR).
4	Set	Forward space file commands is issued (FSF).
5	Set	Clear command is issued (CLR).
6	Set	Gap command is issued (GAP).
7	Set	Back space record command is issued (BSR).
8	Set	Back space file command is issued (BSF).
9	Set	Rewind command is issued (REW).
10	Set	Rewind off line command is issued (RWO).
11	Set	Clear command is issued (CLR).
12	Set	Allows approximately a 10 ms time period after the command is issued before issuing the next command.
13	Set	Same as SW 12 except the time period is 15 ms.
14	Set	Same as SW 12 except the time period is 30 ms.

Switch Settings and Functions for Operator-Service Routines

1100_8

Switch	State	Function
15	Set	Terminates the operation except when SW 0 is set. (If switch 0 is set, program must be restored from 1100_8.)

NOTE: *Any of the first 6 commands (0 - 5) may be combined with any of the last 6 commands (6 - 11), or any of the commands may be used alone.*

If more than one control switch is set in either of the groups, only the first switch command will be issued, starting with SW 0 in the first group and SW 6 in the second.

If no switches are set when computer is in a run mode, program will become uncontrollable.

If the operation becomes uncontrollable from the switch register, the routine may be stopped by halting the computer and pressing PRESET. Operation may be restarted by loading address 1100_8.

1200_8

Switch	State	Function
0 - 15		Define 2 consecutive tape bytes, 8-15 the first, and 0-7 the second. (SW set=1, SW reset=0)

NOTE: *An all "1's" record cannot be written with this routine. The record length is infinite and normal termination (CRC, LRC) of the record is accomplished by setting all switches. An all "1's" record can be written with the first (1000_8) operator service routine.*