

# **MEMOREX**

## **800 Disc Storage Subsystem Tester Operator's Manual**

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## SECTION 1 GENERAL DESCRIPTION

The Memorex 800 Disc Storage Subsystem Tester, Figure 1, is a portable test unit designed to test the functions of Memorex disc drives and identify failing areas. The unit assists in servicing a Memorex disc drive while the drive is off-line.

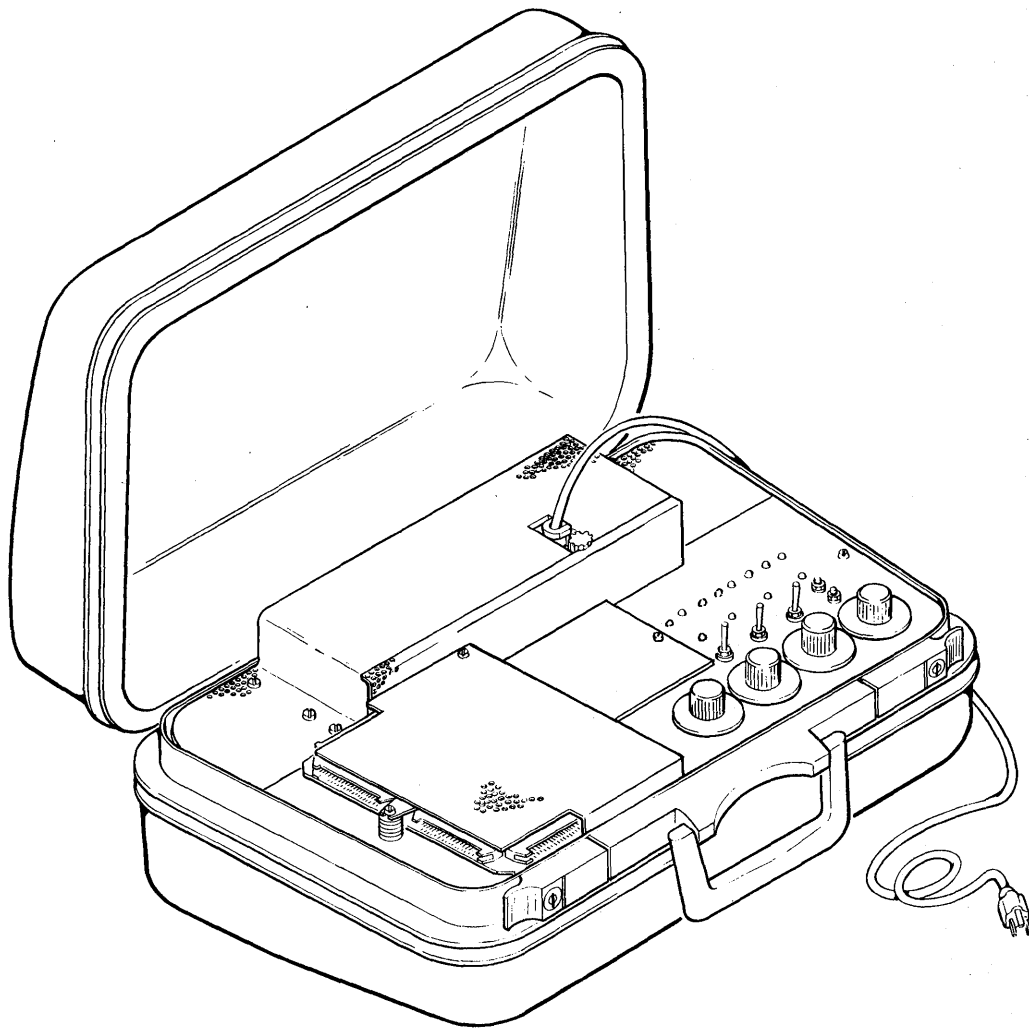


FIGURE 1. 800 DISC STORAGE SUBSYSTEM TESTER

## 1.1 PHYSICAL CHARACTERISTICS

Each tester is packaged in a suitcase designed for easy portability and protection of the components. Overall package dimensions are:

Width	14½ inches (hinge-to-handle)
Length	21½ inches
Depth	7¼ inches

The major components packaged in the carrying case are:

**Power Supply**—The 115 VAC externally supplied power is converted by a self-contained power supply to +5 VDC and ground for use by the tester logic.

**Cooling Fan**—A 1/250 horsepower fan, which operates from the 115 VAC power, cools the components whenever the tester is powered on by plugging the power supply cord into a 115 VAC power source.

**Interface**—Communication with the drive is conducted through four I/O cables, labeled A, B, C, and D, which are semipermanently connected to the I/OP printed circuit board (PCB) in the tester (Figure 2). For example, cables A and B of the tester are connected respectively to the A and B edge-contractor locations on the IPUT PCB of a 677 OEM Disc

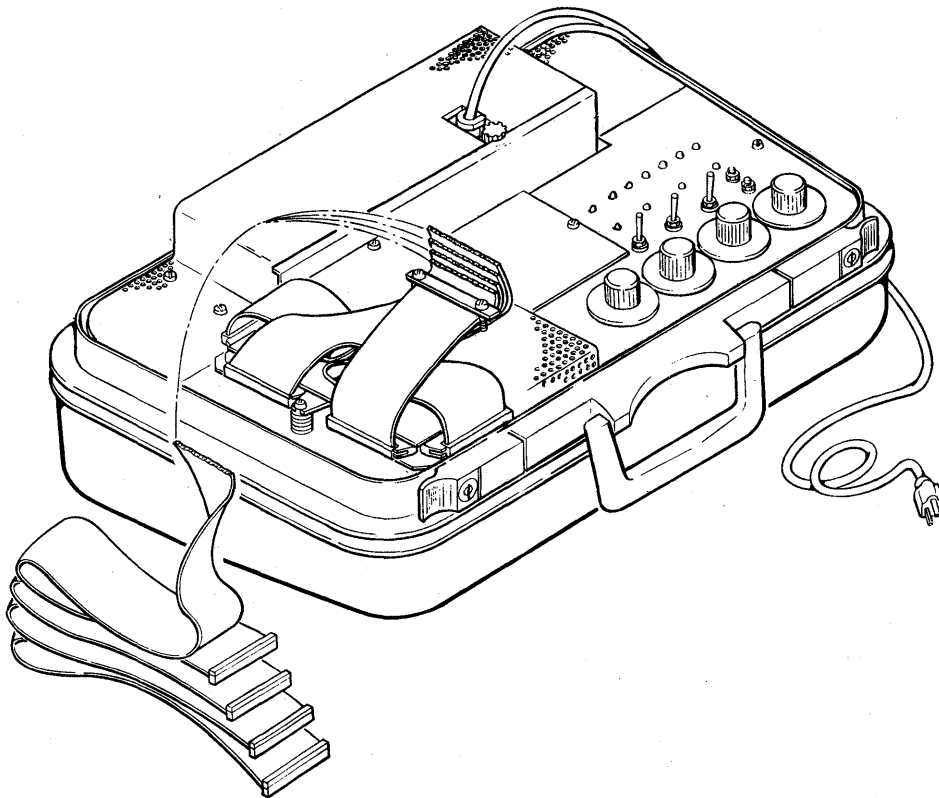
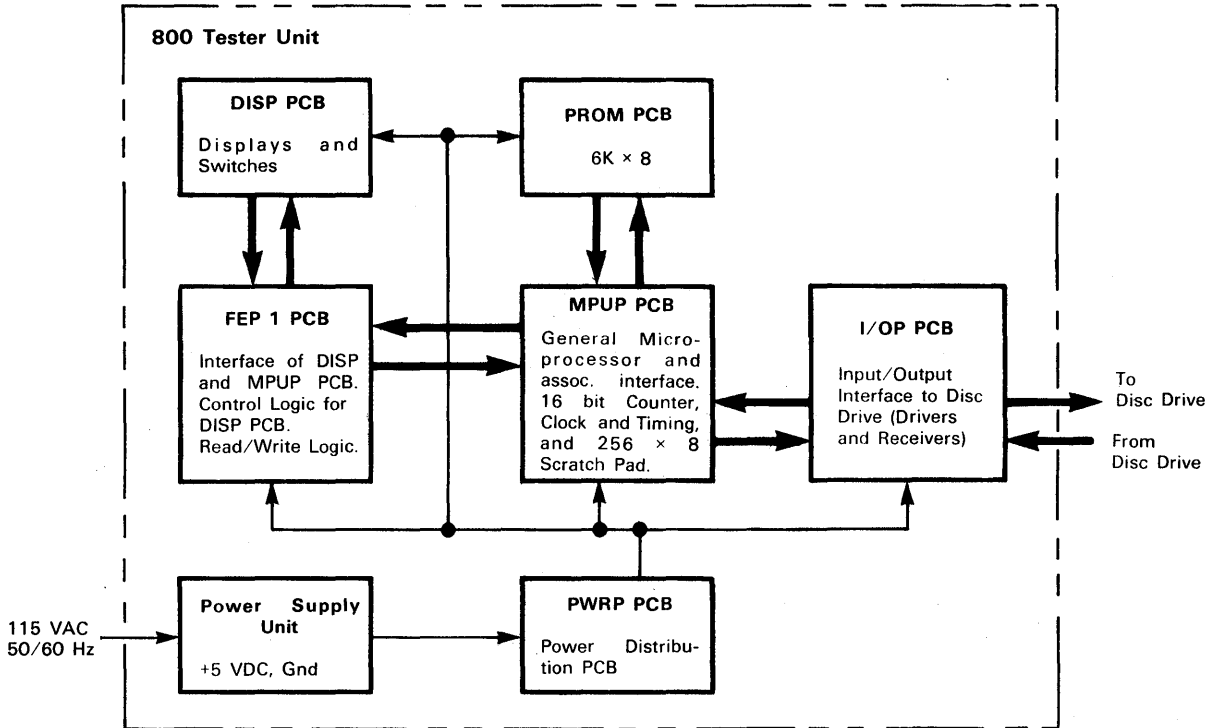


FIGURE 2. 800 TESTER WITH INTERFACE CABLES



Drive. Cables C and D of the tester are connected respectively to the C and D edge-connector locations on the OPUT PCB of a 677 drive. (Note: Methods of interface connection may vary with individual disc drive products depending on their interface requirements.)

**Logic Cards**—All logic functions performed by the tester are provided by six PCBs. Figure 3 is a block diagram showing the relationship of the six PCBs. Five PCBs are located in the logic gate and one PCB is located behind the control panel.



**FIGURE 3. BLOCK DIAGRAM OF THE TESTER UNIT**

PCB Location	PCB Name
A01	I/O PCB
A02	FEP 1
A03	MPUP
A04	PROM 1
A05	(Spare)
A06	PWRP
Mounted behind the Control Panel	DISP

**Control Panel**—All switches necessary for performing operations are located on the control panel. A complete list of the switches and their functions follows in Section 1.2.

## 1.2 CONTROL PANEL SWITCHES

Figure 4 shows an operator's view of the control panel.

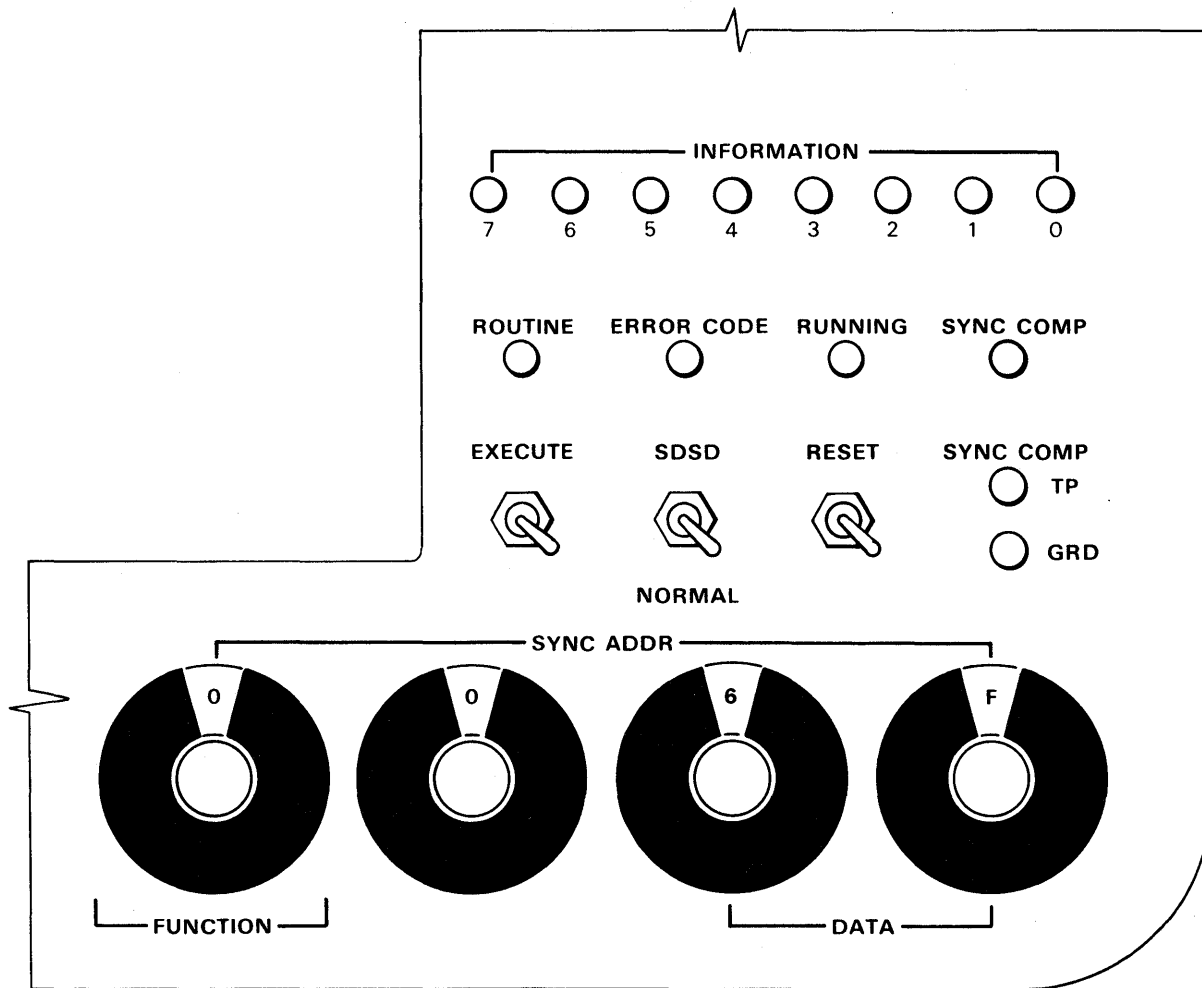


FIGURE 4. OPERATOR CONTROL PANEL

### 1.2.1 RESET—Momentary Switch

This switch causes a re-initialization of the tester; any diagnostic routine in progress will be terminated and forced to the monitor mode. Further use of the tester for diagnostic verification of the disc drive will require operator intervention.

### 1.2.2 DATA Switches

Two 16-position rotary switches labeled DATA provide multiple data entry usage. They are used to enter routine numbers, diagnostic parameters, run options, or write data patterns (also for comparative read data patterns) depending on the function selected with the FUNCTION switch described below.

### 1.2.3 FUNCTION Switch

The FUNCTION Switch is a 16-position rotary switch which is operated in conjunction with the EXECUTE switch. Selectable functions are defined as follows (see Table 1 also):

- Position 0 **Run**—Allows running of microdiagnostic routine.
- Position 1 **Routine**—Allows the desired routine number to be selected and set with the DATA switches.
- Position 2 **Data**—Allows input parameters to be set with the DATA switches.
- Position 3 **Byte**—Allows the parameter byte, to be operated on by the diagnostic routine, to be set with the DATA switches if the byte is required.
- Position 4 **Display Parameter Byte**—Displays the parameter byte that is defined when the FUNCTION switch is set to position 3. The byte is displayed in the INFORMATION Display area of the control panel. (Automatically increments to the next byte after execution.)
- Position 5 **Error Control**—Depending on the option selected with the DATA switches, this function allows the routine to Run Continuously and Stop on Error, or Loop on Error.
- Position 6 **Advance Head**—May be activated only when the Head Alignment feature is installed in the 800 Tester and the Head Alignment routine is running.

### 1.2.4 SYNC ADDR (Address) Switches

Four 16-position rotary switches are used to enter the 16-bit Sync Compare address. The Sync Compare address is selected by the operator from the routine's microcode for comparison with the contents of the 16-bit address register in the internal microprocessor as the routine is executed. When the addresses compare, an indicator lights (see SYNC COMP indicator) to signify that the diagnostic is executing correctly. The two rightmost switches are also labeled DATA and are used as described in Section 1.2.2. The leftmost switch is also labeled FUNCTION and serves to define the entry in the DATA switches or the function to be performed by the routine as described in Section 1.2.3.

**TABLE 1. FUNCTION SWITCH OPERATIONS**

<b>FUNCTION POSITION</b>	<b>FUNCTION OPERATION</b>	<b>DATA SWITCH ENTRY</b>	<b>COMMENTS</b>
0	Execute routine	YY (See Note)	The number of the routine to be executed, along with its parameters, is entered prior to this action.  Error Control run options are optional.
1	Enter routine to be run	XX	XX = the number of the routine to be run. Example: To run routine 01, XX = 01.
2	Enter parameter data	XX	XX = Parameter data byte automatically increments to the next byte after execution.
3	Enter parameter byte	XX	XX = parameter byte to be operated on.
4	Display parameter byte	YY (See Note)	Parameter byte to be displayed is defined by setting FUNCTION switch to 3. Automatically increments to the next byte after execution.
5	Error control	XX	XX = 01 Run continuously and stop on error XX = 02 Loop on error
6	Advance head	YY (See Note)	May be selected only when the Head Alignment feature is installed in the tester and the Head Alignment routine is running.
F	Display routine number	YY (See Note)	Display the number of the routine just executed.

**Note:** All of the above functions are executed only after the FUNCTION switch is set to the desired position and the EXECUTE switch is pressed.

YY = the DATA switch entry is not significant.

### **1.2.5 EXECUTE—Momentary Switch**

The EXECUTE switch is used in conjunction with the FUNCTION switch or with both the FUNCTION and DATA switches to communicate with the resident Diagnostic Monitor and establish the diagnostic routines for the disc drive.

### **1.2.6 SDSD/NORMAL—Toggle Switch**

When the SDSD/NORMAL switch is in the NORMAL position, the INFORMATION Display area of the control panel displays either the number of the routine entered for execution or the error code if the disc drive fails when running a diagnostic routine.

In the SDSD (Sample Display Sync Data) position, the eight-bit contents of the data destination bus in the internal microprocessor will be displayed whenever the microcode address for the routine that is executing passes through and compares with the Sync Address set in the four SYNC ADDR switches. During this comparison, the data bus is strobed into the INFORMATION Display indicators and the SYNC COMP indicator comes on for approximately 1.5 seconds.

## **1.3 CONTROL PANEL INDICATORS**

### **1.3.1 INFORMATION Display (8 LEDs)**

This eight-bit light emitting diode (LED) display normally shows the routine number entered for execution (the SDSD/NORMAL switch is in the NORMAL position). It also displays the error code generated by the diagnostic routine when an error condition is detected during the execution of the routine.

When the SDSD/NORMAL switch is in the SDSD (Sample Display Sync Data) position, the INFORMATION Display area contains information strobed from the data destination bus of the internal microprocessor at the moment the contents of the internal address bus (16 bits) compare with the contents set in the SYNC ADDR switches (4 hex switches, 16 bits). The SYNC COMP light comes on to indicate that the addresses compared. The SYNC COMP indicator lights for approximately 1.5 seconds each time an address compare occurs.

### **1.3.2 ROUTINE Indicator**

This light is activated by the microcode in the diagnostic routine to indicate that the content of the INFORMATION Display area identifies the number of the diagnostic routine being executed. The SDSD/NORMAL switch must be in the NORMAL position for this indicator to light.

### **1.3.3 ERROR CODE Indicator**

This light is activated by the microcode in the diagnostic routine to indicate that the content of the INFORMATION Display area displays the error code if the SDSD/NORMAL switch is in the NORMAL position.

### **1.3.4 RUNNING Indicator**

This light is activated by the output of a 1.5 second one-shot that is controlled by a microcode control statement. When the light is on it indicates to the operator that the tester is executing a set of diagnostic routine instructions in the sequence defined in the routine. The light goes off whenever a program hangup occurs (indefinite loop), a hardware malfunction (fault) is detected, or there is an unexpected termination of a diagnostic loop.

### **1.3.5 SYNC COMP Indicator**

This indicator lights for approximately 1.5 seconds whenever the contents of the SYNC ADDR switches (4 hex switches) compare with the contents of the 16-bit address register in the internal microprocessor. The indicator is activated by the output of the Sync Pulse test point.

## **1.4 SCOPE TEST POINTS**

### **1.4.1 SYNC COMP Test Point**

This test point is a less-than-one-microsecond positive sync pulse which indicates that the contents of the SYNC ADDR switches (4 hex switches) compare with the contents of the 16-bit address register in the microprocessor.

### **1.4.2 GRD Test Point**

This test point is logic ground for the tester unit relative to +5 volts.

## **SECTION 2 OPERATING PROCEDURES (APPLICABLE FOR THE 677 OEM DISC DRIVE)**

The Memorex 800 Tester is designed to verify the following functions of the 677 OEM Disc Drive.

- Wrap
- Incremental Seek
- Alternate Seek
- Random Seek
- Tachometer Gain
- Head Alignment
- Head Alignment Verification
- Write
- Read and Read with Maximum Offset
- Incremental Offset Read
- Read Continuously
- Read/Write Safety
- Velocity Curve
- Offset
- Index

### **2.1 INSTALLATION**

Before connecting the tester to a 677 drive, insert the tester's power cord into a 115-VAC 50/60 Hz power source and run the tester's internal diagnostics (Routine 00) to ensure that the tester is operating correctly. The following procedure outlines the steps required to connect the 800 Tester to the 677 OEM Disc Drive.

1. Disconnect the 677 drive from the DCL by removing the four (4) flat input/output cables marked A, B, C, and D from the IPUT and OPUT PCBs in the 677 drive. Cables A and B from the tester are then connected to edge-card connectors A and B of the IPUT PCB; cables C and D are connected to edge-card connectors C and D of the OPUT PCB.
2. Mount a CE disc pack on the drive.
3. If the Head Alignment feature is installed in the tester, insert the Head Alignment cable into the drive in connector location B04 (see Appendix A) before running Head Alignment diagnostic routines.
4. Apply power to the 677 drive. Set the DC and AC power circuit breakers in the drive to the ON position.
5. Press the RESET switch on the tester. All LED displays should come on.
6. Release the RESET switch and note that all LED displays are off.
7. Ensure that the drive indicates Standby mode.
8. Press the START switch on the drive.

## **2.2 OPERATION**

The 800 Microprocessor Tester provides the user with a variety of diagnostic routines to test the 677 drive.

### **2.2.1 Wrap Test—Routine 00**

The purpose of the Wrap routine is to check the I/OP board on the tester and the connector cables from it to the drive.

The routine can be run with the following run options.

Error Control = 01 Loop on pass.

= 02 Loop on error.

1. Set 00 in the DATA switches.
2. Select 1 on the FUNCTION switch.
3. Press the EXECUTE switch. (No LEDs should be on in the INFORMATION Display area of the control panel.)
4. Set the desired run option (01 or 02) in the DATA switches.
5. Select 5 on the FUNCTION switch.
6. Press the EXECUTE switch.
7. Select 0 on the FUNCTION switch.
8. Press the EXECUTE switch.
9. The microdiagnostic routine will now run as specified by the selected run option (step 4).

If no error occurs, the INFORMATION Display area will indicate "FF" (SDSD/NORMAL switch must be in the NORMAL position) and the ERROR CODE indicator will come on since "FF" is the error code indicating "test completion". If an error occurs, an error code in the range "10" to "1F" is displayed in the INFORMATION Display area and the ERROR CODE indicator will light.

### **2.2.2 Incremental Seek—Routine 01**

The purpose of the Incremental Seek routine is to verify that the drive can seek incrementally from cylinder zero to cylinder 814 and then back to cylinder zero. This cycle is repeated until stopped by the operator.

The routine can be run with the following run options.



Error Control = 01 Run continuously and stop on error (default).

= 02 Loop on error.

1. Set 01 in the DATA switches.
2. Select 1 on the FUNCTION switch.
3. Press the EXECUTE switch. The 0 bit on the INFORMATION Display should light indicating Routine 01.
4. Set the desired run option (01 or 02) in the DATA switches.
5. Select 5 on the FUNCTION switch.
6. Press the EXECUTE switch.
7. Select 0 on the FUNCTION switch.
8. Press the EXECUTE switch.
9. The microdiagnostic routine will seek back and forth incrementally.

If no seek error occurs, the INFORMATION Display area continues to indicate the routine number (SDSD/NORMAL switch in NORMAL position) and the RUNNING LED is on. If an error occurs, the error code is displayed in the INFORMATION Display area and the ERROR CODE LED comes on.

#### NOTE

This is an example of a routine which uses run options that are entered with the FUNCTION and DATA switches. The procedure given above should be used to execute any other routines which require run options to be entered.

### 2.2.3 Alternate Seek—Routine 02

This microdiagnostic routine performs alternate seeks between any two cylinders from cylinder zero to cylinder 814 decimal (0000-032E Hex).

The routine has the following run options:

Error Control = 00 Seek to inner cylinder and stop (default).

= 01 Alternate seek; Stop on error.

= 02 Loop on error.

The cylinder addresses are selected by entering the parameter data byte in the DATA switches with the FUNCTION switch set to 2. Bytes are defined as follows.

Byte No.

- 00 High order inner track 00-03 (Hex Range)
- 01 Low order inner track 00-FF (Hex Range)
- 02 High order outer track 00-03 (Hex Range)
- 03 Low order outer track 00-FF (Hex Range)

1. Set 02 in the DATA switches.
2. Set the FUNCTION switch to 1.
3. Press the EXECUTE switch. The 1 bit of the INFORMATION Display area should be on.
4. Set the DATA switches to YY (YY is the high order byte of the first cylinder to be selected as defined above for Byte No. 00).
5. Set the FUNCTION switch to 2.
6. Press the EXECUTE switch.
7. Set the DATA switches to ZZ (ZZ is the low order byte of the first cylinder to be selected as defined above for Byte No. 01).
8. Set the FUNCTION switch to 2.
9. Press the EXECUTE switch.
10. Repeat steps 4 through 9 to select the second cylinder address.

**EXAMPLE:** If YY = 01 and ZZ = 02, the selected cylinder address is 258.

$$YY = \underbrace{0}_{0000} \quad \underbrace{1}_{0001} \quad ZZ = \underbrace{0}_{0000} \quad \underbrace{2}_{0010}$$

Binary Bit  
Significance  
Values

32K	16K	8K	4K	2K	1K	512	256	128	64	32	16	8	4	2	1
0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0
0				1				0				2			

Cylinder address = 256 + 2 = 258

11. Set the DATA switches to 01 or the desired Error Control run option as defined above.
12. Set the FUNCTION switch to 5.
13. Press the EXECUTE switch.
14. Set the FUNCTION switch to 0.
15. Press the EXECUTE switch.
16. The routine will start to execute and cause the drive to seek between the cylinder addresses defined in the above procedure. To stop the test, press the EXECUTE switch. To change cylinder addresses for the seek operation, repeat the procedure from the beginning.

#### **2.2.4 Random Seek—Routine 03**

This microdiagnostic routine performs random seeks.

The following run options apply:

Error Control = 01 Run continuously and stop on error (default).

= 02 Loop on error.

The procedure to initiate the Random Seek test is identical to the procedure given in *Section 2.2.2, Incremental Seek—Routine 01*, except that 03 is set in the DATA switches (step 1).

#### **2.2.5 Tach Gain—Routine 04**

This microdiagnostic routine performs seeks between cylinder zero and cylinder 600 (decimal range).

The following run options apply:

Error Control = 00 Verify Tach Gain (default)

= 01 Adjustment Mode.

= 02 Loop on error.

With the exception of the routine number and the error control options, the procedure to initiate this routine is the same as the procedure given in *Section 2.2.2*.

## 2.2.6 Head Alignment—Routine 05

### NOTE

A Head Alignment Unit or the Head Alignment feature on the tester is required to run this routine (see Appendix A).

The Head Alignment microdiagnostic routine seeks to the head alignment cylinder defined by the operator (seeks to cylinder 496 by default) and then gates the alignment signal to the Head Alignment Unit.

The run options for this routine are:

Error Control = 01 Run continuously and stop on error (default)  
= 02 Loop on error.

Byte No.

00 High order cylinder address. 00-03 (Hex Range)  
01 Low order cylinder address 00-FF (Hex Range)

This routine is initiated in the same manner as the procedure given in *Section 2.2.3, Alternate Seek—Routine 02*, except that only one cylinder address is required.

### NOTE

Head zero (Display 00) is selected at the end of the execution of this routine. Heads can be advanced by positioning the FUNCTION switch to position 6 and pressing the EXECUTE switch.

## 2.2.7 Head Alignment Verification—Routine 06

### NOTE

A Head Alignment Unit or the Head Alignment feature on the tester is required to run this routine (see Appendix A).

The Head Alignment Verification routine verifies the alignment of all heads.

The following run options apply:

Error Control = 00 Verify mode (default).  
= 01 Run continuously and stop on error.  
= 02 Loop on error.

To initiate this routine, use the procedure in *Section 2.2.2*.

#### NOTE

Before running Routine 06, execute Routine 02, Alternate Seek, to seek to the head alignment cylinder (496 decimal (01F0 Hex) for CE disc pack). Warm up the drive for 30 minutes to stabilize the heads and then run Routine 06.

### 2.2.8 Write—Routine 07

The Write routine writes a one-byte data pattern with all heads of a cylinder or with a single head defined by the operator.

The following run options apply:

- Error Control = 00 Write all heads of cylinder and then stop (default).
- = 01 Write continuously and stop on error
- = 02 Loop on error.

Byte No.

- 00 High order cylinder 00-03 (Hex Range)
- 01 Low order cylinder 00-FF (Hex Range)
- 02 Head to be selected 00-12 (Hex Range)
- 03 Data pattern to be written 00-FF (Hex Range)
- 04 Head select option
  - 00 = All heads starting from the head specified in Byte No. 02.
  - 8X = Fixed head specified in Byte No. 02.

To initiate this routine, use the procedure given in *Section 2.2.3*.

### 2.2.9 Read and Read with Maximum Offset—Routine 08

The Read and Read with Maximum Offset routine reads the one-byte data pattern defined in Routine 07 with all heads of a cylinder defined by an operator.

The following run options apply:

- Error Control = 00 Read all heads and then stop (default).
- = 01 Read continuously and stop on error.
- = 02 Loop on error.

Byte No. entries are the same as those for the Write routine (see *Section 2.2.8*).

The procedure to initiate this routine is the same as the procedure given in *Section 2.2.3*.

### **2.2.10 Incremental Offset Read—Routine 09**

The Incremental Offset Read routine reads data with a head specified by the operator and compares this data with the expected data pattern. The routine then increments offset and reads again up to cylinder address 814 (decimal range).

The following run options apply:

- Error Control = 00 Read once and then stop (default).
- = 01 Read continuously and stop on error.
- = 02 Loop on error.

Byte No.

- 00 High order cylinder 00-03 (Hex Range)
- 01 Low order cylinder 00-FF (Hex Range)
- 02 Head to be selected 00-12 (Hex Range)
- 03 Data pattern to be compared 00-FF (Hex Range)

Use the procedure in *Section 2.2.3* to initiate this routine.

### **2.2.11 Read Continuously (Errors Monitored)—Routine 0A**

This routine performs 65,535 reads of one track with a specified head. It also monitors read errors if any occur.

The following run options apply:

- Error Control = 01 Read 65,535 times and then stop (default).
- = 02 Loop on error.

Byte No.

- 00 High order cylinder 00-03 (Hex Range)
- 01 Low order cylinder 00-FF (Hex Range)
- 02 Head to be selected 00-12 (Hex Range)
- 03 Data pattern to be compared 00-FF (Hex Range)
- 04 Amount of offset desired  $\pm$  775 microinches (Decimal Range)

Use the procedure in *Section 2.2.3* to initiate this routine.

### **2.2.12 Read/Write Safety—Routine 0B**

This routine sets and resets the safety latches to ensure that they are functioning correctly.

The following run options apply:

- Error Control = 00 Check latches once (default).
- = 02 Loop on error.

Use the procedure in *Section 2.2.2* to initiate this routine.

### **2.2.13 Velocity Curve—Routine 0C**

This routine monitors the velocity curve and verifies that the curve is within the required tolerance.

The following run options apply:

- Error Control = 00 Plot the velocity curve once (default).
- = 01 Run continuously and stop on error.
- = 02 Loop on error.

Use the procedure in *Section 2.2.2* to initiate this routine.

### **2.2.14 Offset—Routine 0D**

This routine commands the drive to offset and then checks the signal ON TRACK to ensure that it goes away after the offset operation.

The following run options apply:

- Error Control = 00 Run once and stop (default).
- = 01 Run continuously and stop on error.
- = 02 Loop on error.

Use the procedure in *Section 2.2.2* to initiate this routine.

### **2.2.15 Sequence Up—Routine 0E**

This routine checks the sequence up functions by sending the control signals out to the disc drive one at a time. The routine then monitors the corresponding feedback signals from the disc drive.

Use the procedure in *Section 2.2.1* to initiate this routine.

### **2.2.16 Read Drive Switches—Routine 0F**

This routine reads the states of the switches on the disc drive and then sends the results to the INFORMATION Display area on the tester's control panel.

To initiate this routine, use the procedure given in *Section 2.2.1*.

### **2.2.17 Index—Routine 10**

This routine checks for the period of index on track and also in offset.

The following run options apply:

- Error Control = 00 Run once (default).
- = 01 Run continuously and stop on error
- = 02 Loop on error.

Use the procedure in *Section 2.2.2* to initiate this routine.



# APPENDIX A

## HEAD ALIGNMENT CHECKS

### A.1 HEAD ALIGNMENT CHECK PREREQUISITES

#### A.1.1 Tools Required

1. CE Disc Pack
2. Head Alignment Unit (PN 211292) or Head Alignment feature installed on tester. (See Figure A-1.)
3. Head Alignment Tool (PN 210106).
4. Head Torque Wrench (PN 210109).

#### A.1.2 Preliminary Steps

1. On the disc drive select READ ONLY drive mode, and install CE Disc Pack.
2. Slide logic assembly fully forward.
3. Turn off drive dc power.
4. Connect Head Alignment Unit (PN 211292) interface cable or tester's Head Alignment cable to B04 slot of logic assembly.
5. Turn on dc power.
6. Press the CALIBRATE switch on the Head Alignment Unit or the tester's control panel.
7. Verify that the head alignment unit's DATA INVALID lamp is lit.

### A.2 THERMAL EQUILIBRIUM REQUIREMENTS

Thermal equilibrium requirements must be established before head alignment or head alignment verification is attempted. Minimum requirements are as follows:

1. With the wind tunnel in the closed position, the drive must operate in a track-following or seek mode for at least 20 minutes. Any disc pack may be used for the first 15 minutes; however, the CE pack must be used during the last 5 minutes.
2. The CE pack must reach thermal equilibrium by either being in the computer room for one hour, or by being used during the entire 20 minute stabilization described in step 1 above.

### **A.3 ALIGNMENT VERIFICATION AND DATA INTERPRETATION**

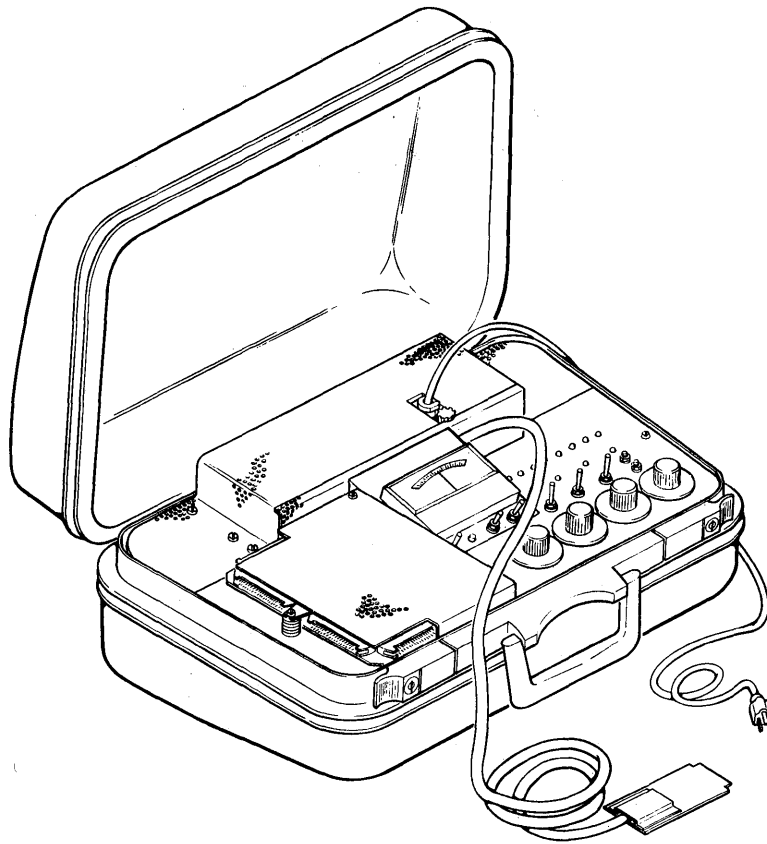
At the tester's operator panel, load Head Alignment Routine 05 or 06 (see *Sections 2.2.6 or 2.2.7*), with default parameters to seek to cylinder 496. Execute Routine 05 or 06.

The Head Alignment Unit or the Head Alignment feature on the tester indicates the presence or absence of valid data and the magnitude and direction of misalignment when valid data is present. The DATA INVALID indicator lamp indicates the former, and the MICROINCHES indicator, the latter.

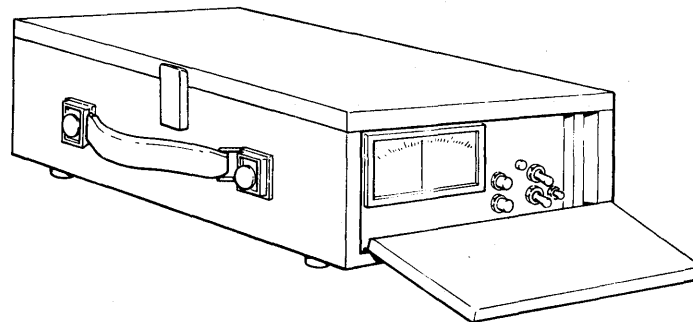
When the DATA INVALID lamp is out, valid data is present. The MICROINCHES indicator indicates the selected data head alignment with respect to the servo head. An indication of 0 means the two heads are in perfect alignment. Deflection of the indicator in either direction indicates the number of microinches of misalignment. The direction of deflection indicates the direction in which the data head is misaligned with the servo head. A positive (right hand) indicator deflection means the data head is ahead of the servo head (offset toward spindle centerline), and a negative (left hand) deflection means it is behind the servo head (offset away from spindle centerline).

When the DATA INVALID lamp is lit, valid data is not present for one of the following reasons:

1. Fine Track signal is false.
2. Alignment Carrier signal is not present because:
  - a. CE disc pack is not loaded.
  - b. Head is grossly misaligned beyond carrier area.
  - c. A Device Check has prevented head selection.
  - d. Heads are not at Alignment Carrier signal cylinder due to FE procedural error or Seek Error.
  - e. The Head Alignment Unit or the Head Alignment feature on the tester is faulty and must be replaced.



**TESTER WITH HEAD ALIGNMENT FEATURE**



**HEAD ALIGNMENT UNIT (PN 211292)**

**FIGURE A-1. HEAD ALIGNMENT UNITS**



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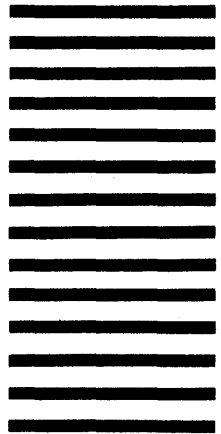
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