
Diagnostics

Z-200 PC Series

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Chapter 1

Introduction

Diagnostics for the Z-200 PC Series Computers are provided in two forms: ROM-based and disk-based.

These tests are designed to work with a minimum of operator interface and special test hardware. Ease of operation, consistency of screen messages, and clarity of information are the primary goals of this program. Information obtained from the tests can reduce service costs appreciably and minimize hardware downtime.

Goals

Malfunctions can happen with any type of equipment. The goal of these tests is to provide the user with the ability to detect and isolate the cause of faulty machine operation.

The tests outlined here are designed to resolve 90% of detected faults to one subassembly and another 5% of all faults to a maximum of two subassemblies. Whenever possible, faults are resolved to the most likely Large-Scale Integration (LSI) and supporting Integrated Circuits (ICs). Random Access Memory (RAM) and Read-Only Memory (ROM) errors are always resolved to the IC level by disk-based diagnostics. Another goal is to make maximum use of existing hardware to minimize requirements for special test hardware.

Some tests, such as Input/Output (I/O) port diagnostics require special test plugs for complete testing.

Hardware Requirements

NOTE: Before performing any test using newly installed diagnostic disks, or when hardware changes have occurred, the diagnostic monitor and several of the diagnostic tests need to be configured for the system being tested. Failure to do so may result in incomplete testing or inaccurate failure messages. Refer to the Configuration section in Chapter 3 for information on how to configure the diagnostic monitor and diagnostic tests.

Hardware requirements for both the ROM-based and disk-based diagnostics consist of the minimum hardware requirements for a Z-200 PC Series Computer. The disk-based diagnostics can be configured to test most additional hardware available for the system. Minimum hardware consists of the following:

- Power supply
- 80286 Central Processing Unit (CPU)
- 256K of system memory (RAM)
- Video controller and display
- Floppy disk controller and at least one disk drive
- Keyboard

The disk-based diagnostics will operate on any Z-200 PC series machine without hardware modification. The tests must be configured properly for the machine being tested.

Although not necessary for test operation, the Microsoft serial mouse is supported and may be used for input to the diagnostic monitor and many of the tests. The diagnostic tests contain a mouse driver and do not require any additional programs for mouse operation. If a mouse is used, it must be configured for the desired port.

Many of the screens displayed by the diagnostic tests contain graphics information. To print these screens, a printer capable of graphics operation must be used and the appropriate print screen (PSC) utility program from MS-DOS must be loaded. If this equipment is not available, only the text information will be printed.

Features

The features of the ROM-based and disk-based diagnostics may vary from system to system, depending upon the hardware configuration.

ROM-Based Diagnostic Features

Power indication — Power indication lamps on the backplane indicate the presence or absence of correct power delivered from the power supply.

Diagnostic LEDs — LEDs positioned on the I/O card indicate success or failure of the ROM-based tests. This feature keeps the diagnostic core to a minimum and allows resolution of basic system faults without the need for a functioning display and/or keyboard.

Two levels of ROM-based tests — ROM-based tests are done at powerup and also through menu selection. Since time is not a critical factor when accessing the tests in the menu, these diagnostics provide a high degree of confidence in system integrity.

Coverage — ROM-based tests are available to test all circuits necessary to read and execute programs from the mass storage device. This results in considerable reduction of the time required to detect and correct faults that may occur in the basic system.

Disk-Based Diagnostic Features

Automatic tests — All portions of the machine that can be accessed without operator input are tested with a single keystroke.

Audible and visual error indicators — Errors are indicated by an audible alarm and distinct display easily recognizable and consistent for all tests.

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On-screen fault information — The screen displays information required to correct detected errors. Information included in the display are the function that failed, the most likely hardware causing the problem, and when the fault occurred.

Consistent test information — Because of the diagnostic monitor approach, test modes, error counters, and other features are available for all tests. These features and their screen displays are consistent from test to test.

Retention of configuration information — Mass storage media stores system configuration information with the diagnostic tests. The system configuration is entered only once for any given computer system.

Test repetition — Tests may be run from 1 to 99 times, from 1 to 23 hours, or continuously. This feature makes it convenient to uncover intermittent faults or run long-term evaluation tests on hardware.

Help screens — Help screens may be accessed at most of the menus and fault displays, providing instant information on formats and options that are available. In addition, the bottom three lines of the screen normally display option information for the operator.

Error logging — Error and test completion screens may be discarded or logged on the system's printer or the diagnostic disk. This feature makes it easy to retain and transport fault information. All information logged is date-stamped and time-stamped for later reference.

Startup parameter configuration — Test startup may be configured to allow automatic execution using any set of parameters. This allows the user to generate special diagnostic disks to use in quality assurance testing.

Graphic display of information — The diagnostic monitor program provides the capability for tests to convey graphic information to the operator. This feature greatly enhances the scope of data that can be represented.

Simplified keyboard and mouse entries — Test selections may be entered from the keyboard or the Microsoft mouse during monitor operation. When the keyboard is used, all entries to the monitor program are made using the ENTER, END, and arrow keys.

Fast test — A “fast” test that takes ten minutes or less to execute is provided to detect a minimum of 70% of the possible faults in a system.

Error Messages

As you use the disk-based diagnostic programs to perform tests, any failure causes an error message to display on the screen. The message indicates the most likely cause and specific area of the fault. While the identified components may be at fault, bear in mind that the problem may also be in one of the components connected to the suspected one, the socket, or a foil on the circuit card.

Since there are several models of the Z-200 PC Series Computers that these tests may be run on, no illustrations for specific computers are provided in this manual. Refer to your computer's documentation for information on how the components in your system are organized.

Visual Checks

Unless you have a replacement part at hand, perform the following visual checks in the area of the suspected component before you remove the part.

NOTE: If you assembled your computer from a kit, make the following visual checks **very** carefully. Factory-assembled products are thoroughly tested prior to shipment so most of the checks will not be necessary.

Check the computer to see that:

- Circuit cards are properly seated in their connectors.
-

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- All cables are properly oriented and completely seated into their connectors.
- Integrated circuits are correctly installed in their sockets and bear the correct part number(s). **Be sure all pins are fully seated in their respective holes and none are bent under the IC.**
- Transistors and diodes are properly installed at their correct locations.
- Circuit card foil patterns (especially in the area of any suspected component revealed during the test) are not cracked or have any solder "bridges" between solder pads.
- There are no loose bits of solder or other metal particles lodged between component pins or leads which might cause a short circuit.

After you have made these visual checks, repeat the diagnostic test that revealed the component failure. You may have cured the problem simply by moving or cleaning a cable or connector. If the test still results in an error message, follow the instructions displayed on the screen.

CAUTION: Unless you are skilled at soldering and digital repair techniques, **do not** attempt to repair a damaged circuit card.

Diagnostic Approach

Diagnostics have been constructed so that all functions of the equipment required for loading and running disk-based tests can be checked using the ROM-based tests. The disk-based tests contain comprehensive routines to check both the system circuits and the interfaces required to operate peripheral devices. The following procedure is suggested for troubleshooting a Z-200 PC system.

1. Turn the system on and correct any faults detected by the power-up tests. If the monitor ROM prompt appears or the system starts to autoboot from the disk, proceed to the next step. If nothing happens or an error message is displayed on the Cathode-Ray Tube (CRT), correct the problem before proceeding. Error indications are provided on the screen, power supply LEDs on the backplane board, and the troubleshooting LEDs on the I/O card.
 2. Load the disk-based diagnostics disk #1. If the diagnostics load correctly and the opening display is shown, proceed to the next step. If the disk will not boot, return to the monitor ROM program by pressing the ESC key or the CTRL, ALT, and INS keys simultaneously. Next, type **TEST** and press the **RETURN** key to use the ROM-based tests to troubleshoot the problem.
 3. If your model number is not shown on the diagnostic monitor herald, select any of the models and continue to **CONFIGURATION** at the diagnostic test menu. Configure the hardware in your system and save it on the diagnostics disk for future use.
 4. Press the **ENTER** key to advance from the diagnostic monitor herald display to the fast/normal menu. Next, run the fast test by pressing the **ENTER** key. If no error message is displayed, proceed to the next step. If an error message is displayed, correct the problem before proceeding.
-

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5. If no problems are detected by the fast test but a fault is still suspected, select the normal test and run all of the automatic tests. This will check all portions of the machine that can be accessed without additional operator interface. If ALL TESTS COMPLETE, NO ERRORS FOUND is displayed, proceed to the next step. If an error message is displayed, correct the problem before proceeding.

6. If a problem is still suspected, run all manual tests by selecting each diagnostic individually, and running sections marked with either an M (manual) or C (combination requiring operator input). Additional actions are required to execute these tests, such as inserting blank disks in floppy disk drives or typing keys on the keyboard. Again, all available information on an error is supplied on the screen when the error is detected.

7. Repeat steps 2 through 6 using diagnostic disk #2.

Chapter 2

ROM-Based Diagnostics

The ROM-based diagnostics are resident in the system ROM and run each time the computer is turned on or reset. These routines include a set of detection tests that check all hardware needed to load programs from the floppy disk. No additional operator interface is required, unless an error is detected or a special operation is desired. This test executes in 4.5 seconds or less if no errors are detected.

Power-Up Checks

The following hardware checks are automatically made when the computer is turned on:

- CPU
- ROM
- User RAM
- Interrupt control and timer circuits
- Parity RAM
- Keyboard microprocessor
- Disk drive read
- Disk drive seek function
- Disk controller
- Disk Direct Memory Access (DMA) overrun
- Disk sector
- Disk Cyclic Redundancy Check (CRC)
- Disk address mark

ROM-Based Diagnostics

Error Messages

Table 2.1 describes possible screen error messages that may occur at power-up and what you can check to correct the problem.

Table 2.1. Possible Power-Up Diagnostic Messages and Explanations

```
+++ERROR: CPU failure!+++  
+++ERROR: ROM checksum failure+++
```

These two messages indicate that the CPU card may be malfunctioning. The checksum message is a result of a mismatch between a predetermined value and a value derived from the contents of system ROM. Turn the machine off, and then on again.

```
+++ERROR: RAM failure! Address:XXXX:YYYY, Bit:N,Chip:UXXX+++  
+++ERROR: Parity hardware failure! Address:XXXXX:YYYY, Chip:UXXX+++
```

These messages indicate that the CPU is unable to read or write to the RAM or video RAM memory. If the chip number displayed is a 200 number, the failure is on the CPU card. If the chip number is a 400 number, the failure is on the expansion card. Before replacing a card, check that the card is properly seated in the backplane slot.

```
+++ERROR: Timer interrupt failure!+++
```

This message indicates that the timing logic on the I/O card may have failed. Make sure that the card is properly seated and set up for the options installed. Also, check that all optional cards are set up correctly.

```
+++ERROR: Keyboard not responding or not connected!+++
```

A message of this type indicates that the keyboard did not send the code at powerup to indicate proper functioning. The most likely cause is a disconnected keyboard. Check the cable to make sure it is connected.

```
+++Divide by zero!+++  
+++Overflow!+++  
+++Wild interrupt!+++  
+++ERROR: Memory parity failure!+++  
+++Non-maskable interrupt!+++
```

Instructions or interrupts were generated by the computer or a peripheral causing this type of error.

Table 2.1 (continued). Possible Power-Up Diagnostic Messages and Explanations

+++ERROR: CMOS Memory Failure!+++

A memory test of the CMOS memory/clock chip on the I/O card indicates faulty memory within the chip.

+++ERROR: System Control Processor Failure!+++

The system control processor on the I/O card is not responding. This will effect the functioning of the keyboard as well as other vital system functions.

+++ERROR: Please replace the back-up battery!+++

The back-up battery used to keep CMOS memory valid when power is not applied to the system should be replaced.

+++ERROR: Bad configuration information found in CMOS!+++

The memory in the CMOS chip does not contain valid information. The system will automatically execute the SETUP command so the user may set up the CMOS correctly.

+++ERROR: Base memory size error! SETUP: XXXK ACTUAL: XXXK+++

+++ERROR: Expansion memory size error! SETUP: XXXK ACTUAL: XXXK!+++

The amount of memory specified in the SETUP command does not equal the amount of memory actually found by the system. Faulty or non-existent memory, or invalid SETUP information may be the cause.

+++DISK ERROR: Drive not ready!+++

+++DISK ERROR: Seek failure!+++

+++DISK ERROR: Cannot reset drive!+++

+++DISK ERROR: Invalid data read!+++

+++DISK ERROR: Data corrected!+++

These messages usually occur when you are attempting to boot an operating system. The cause is usually an open drive door or not having a disk properly inserted in the system.

ROM-Based Diagnostics

Table 2.1 (continued). Possible Power-Up Diagnostic Messages and Explanations

+++DISK ERROR: Disk not bootable!+++

This error message indicates that the floppy disk is fine but the boot code read from sector 0 is not a valid executable code.

+++DISK ERROR: Must run SETUP to boot from Winchester!+++

This error message is for Winchester only and indicates that an attempt was made to boot from a Wincehster drive for which no SETUP information was specified. Run SETUP and specify a Winchester drive type for that drive.

+++DISK ERROR: Bad disk controller!+++

+++DISK ERROR: DMA overrun!+++

Errors of this nature usually indicate a malfunction on the disk controller card, but may also be caused by other defective cards in the system. If any nonstandard cards have been installed, they should be suspected first in an error condition of this nature.

+++DISK ERROR: Sector not found!+++

+++DISK ERROR: CRC error!+++

+++DISK ERROR: Invalid address mark!+++

These errors normally indicate that an operating system was not found on the selected drive, or that you have a defective drive. First, try a different disk. If this error occurs often, it may be necessary to align the drive.

No error message — Occasionally, a malfunction may occur that, by its nature, prevents anything, including an error message, from being echoed to the monitor screen. Check to make sure that you are allowing enough time (up to thirty seconds for Winchester systems) for any disk I/O problems to “time out”.

User-Selected Tests

Several optional test routines are also available from the boot ROM program. On systems that do not have autoboot enabled, the monitor ROM prompt will appear when you turn on the system. The prompt can be accessed from the system programs by pressing the CTRL, ALT, and INS keys simultaneously. The prompt can be accessed from most ROM-based test menus by typing TEST and pressing the RETURN key. The following information will then be displayed.

CHOOSE ONE OF THE FOLLOWING:

1. DISK READ TEST
2. KEYBOARD TEST
3. BASE MEMORY TEST
4. EXPANSION MEMORY TEST
5. POWER-UP TEST
6. EXIT

ENTER YOUR CHOICE:

Now you can select one of the desired test sequences by number. The main advantage of testing in this fashion is that these sequences will run continuously until you stop them or an error is encountered. These routines are extremely useful if a malfunction is intermittent, time dependent, or a result of heat buildup. An onscreen count is displayed to keep track of the number of times the particular test has run. The possible error messages are the same as those described under Power-Up Checks.

After a test is selected, a second screen appears with the test name at the top of the screen and the message TYPE <ESC> TO ABORT in the bottom left corner of the screen. The test count is displayed in the center of the screen. To end the test, press the ESC key. The count will stop and the message TYPE <ESC> TO EXIT will appear at the bottom of the screen. Press the ESC key to return to the test menu.

If an error ends the test, an error message appears underneath the test name and the message TYPE <ESC> TO ABORT will appear at the bottom of the screen.

Chapter 3

Disk-Based Diagnostics

The disk-based tests are accessed by loading the diagnostic monitor program from floppy disk #1. This is done automatically when the diagnostic disk is booted. Type **DIAG** and press the **RETURN** key to start the diagnostic monitor program from the operating system.

When the diagnostic monitor program is loaded and running, you will see a display similar to that shown in Figure 3.1. This display provides the test name, copyright information, and a menu of model numbers. Use the arrow keys and the **ENTER** key to select the model of the machine you are using. An **X** in the model number normally stands for a "don't care" value. For example, ZF241-22, ZF241-32, and ZF241-52 would all be chosen by selecting ZF241-X2 on the menu.

If your model number is not shown on the diagnostic monitor herald, select any of the models and continue to **CONFIGURATION** at the diagnostic test menu.

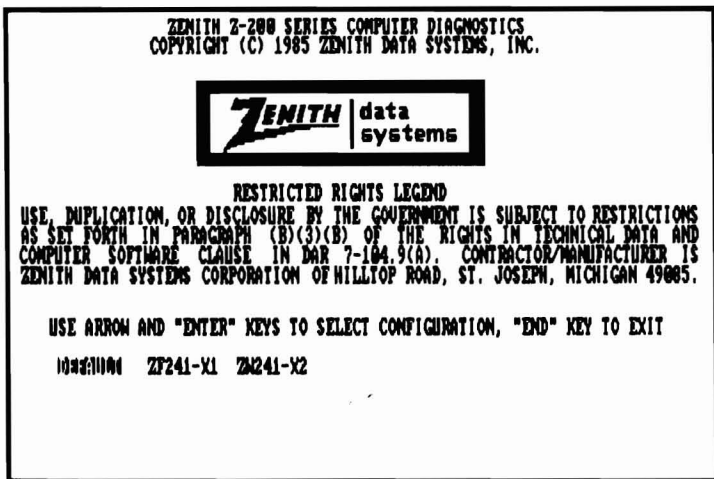


Figure 3.1. Diagnostic Monitor Herald

Fast Test

After the model has been selected, the display shown in Figure 3.2 is displayed. At this time, the operator has the choice of entering the fast test or the normal test. The fast test detects a minimum of 70% of the possible faults in the system, requires no additional operator input, and will be completed in less than ten minutes. Press the **ENTER** key to select this test.

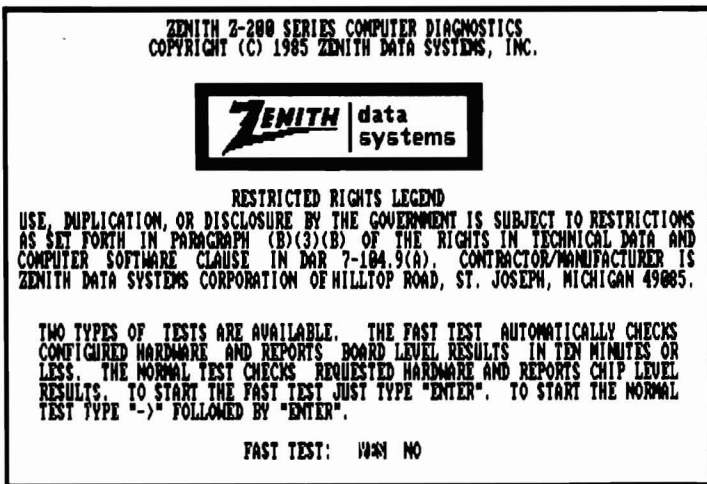


Figure 3.2. Fast/Normal Test Menu

Disk-Based Diagnostics

If the fast test is selected, a display similar to Figure 3.3 is shown. One line of the output is associated with each test required on the model number selected. If the test passes, information on the hardware tested is normally displayed in the NOTES column. If the test fails, the NOTES column contains information on the card most likely to contain the faulty circuit.

HEATH/ZENITH DIAGNOSTICS REVISION R2.00		
TEST	RESULTS	NOTES
CPU DIAGNOSTIC-R2.0	PASSED	CPU TIMERS DMA.80287 INSTALLED
RAM DIAGNOSTIC-R2.0	PASSED	BANKS TESTED = 00 - 31
I/O PORT DIAGNOSTICS-R2.0	PASSED	PORT A SERIAL LOCAL LOOP
2409 VIDEO DIAGNOSTIC-R2.0	PASSED	VIDEO REGISTER TEST
KEYBOARD DIAGNOSTIC-R2.0	PASSED	KEYBOARD REGISTER TEST
FLOPPY DIAGNOSTIC-R1.0	PASSED	ONE DRIVE
WINCHESTER DIAGNOSTIC-R1.0	PASSED	ONE DRIVE
ALL TESTS COMPLETE		
TYPE "END" KEY TO CONTINUE		

Figure 3.3. Fast Test Display

Diagnostic Test Menu

If the fast test was not selected, then a display similar to that shown in Figure 3.4 will appear.

HEATH/ZENITH DIAGNOSTICS · REVISION R2.00		
STATUS: STOPPED	CURRENT DATE: 09/04/85	STARTS: 0
ACTION: STOP ON ERROR	CURRENT TIME: 15:31:47	PASSES: 0
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS: 0
DIAGNOSTIC TEST MENU		
CPU DIAGNOSTIC-R2.0(C) RAM DIAGNOSTIC-R2.0(A) I/O PORT DIAGNOSTICS-R2.0(C) 2409 VIDEO DIAGNOSTIC-R2.0(C) KEYBOARD DIAGNOSTIC-R2.0(C) FLOPPY DIAGNOSTIC-R1.0(C) WINCHESTER DIAGNOSTIC-R1.0(C)		
00000000000000000000 SINGLE TEST MISC CONFIGURATION HELP EXIT		

Figure 3.4. Diagnostic Test Menu

The various areas of the display correspond to the following:

Top line = Name and revision of current diagnostic monitor program

STATUS: The current state of the test

- STOPPED — test is not running
- RUNNING — test is running
- PAUSED — test is paused
- LOOPING — test is looping on an error
- LOADING — test is being loaded from disk

ACTION: The action to be taken if an error is encountered

- STOP ON ERROR — stops the test and waits for operator input
- CONTINUE ON ERROR — continues the test after saving error screen on the configured logging device
- LOOP ON ERROR — repetitively loops on the failure

FINISH: The number of times each test is run

n PASSES — where *n* may be from 1 to 99

n HOURS — where *n* may be from 1 to 23

CONTINUOUS — continue repeating test until stopped by the operator from the keyboard

CURRENT DATE: The current system date

CURRENT TIME: The current system time

TESTING TIME: A timer that is set to zero whenever a test is started and stopped when the test is stopped

STARTS: The number of times the test was started

PASSES: The number of times the test passed without error

ERRORS: The number of errors found since starting the test

The items on the bottom line of the screen are available for selection at this time. Use the arrow keys (or the mouse) to get the desired item into reverse video, then press the **ENTER** key to begin the function. The various selections result in the following actions:

ALL AUTOMATIC TESTS — Runs all sections of all tests that are indicated as automatic (A). This is the maximum test of the complete system that can be achieved without individually selecting each test section.

SINGLE TEST — Allows selection and expansion of an individual diagnostic test. This function is treated in more detail in a later section.

MISC — Allows changing the test action on error, finish parameters, system date, or system time. These parameters are displayed on the top of the screen. Press the **END** key to get back to the initial diagnostic test menu.

CONFIGURATION — Allows changing the diagnostic software and hardware configuration information.

Disk-Based Diagnostics

Selections from this menu are very similar to those in the diagnostic test menu. In this case however, operations are performed on a test section rather than the complete test. Selection of ALL AUTOMATIC SECTIONS results in immediate execution of all sections indicated as automatic. Selection of the SINGLE SECTION followed by selection of a section name results in the immediate execution of the section test code. Selection of MISC results in the same functions as at the diagnostic test menu. Selection of CONFIGURATION results in execution of the configuration code for the currently selected test. Selection of HELP results in an attempt to access the help file for the currently selected test. Selection of EXIT returns control to the diagnostic test menu.

Running Display

While a diagnostic test is running, a display similar to that shown in Figure 3.6 will appear.

HEATH/ZENITH DIAGNOSTICS				REVISION R2.00	
STATUS: RUNNING	CURRENT DATE: 06/28/85	STARTS:	1		
ACTION: STOP ON ERROR	CURRENT TIME: 00:50:04	PASSES:	0		
FINISH: 01 PASS	TESTING TIME: 00:02:53	ERRORS:	0		
I/O PORT DIAGNOSTICS-R2.5			LOCAL LOOP BACK SERIAL TEST		
PARAMETERS UNDER TEST					
MODE	BAUD RATE	# OF STOP BITS	PARITY	CHAR LENGTH	PORT
ASYN	110	1.0	NONE	8	B
TYPE "CTRL-BREAK" KEYS TO PAUSE TEST					

Figure 3.6. Diagnostic Running Display

The test and section names are automatically displayed at the beginning of each test. The center ten lines contain information displayed by the test to denote progress or request input from the operator.

Disk-Based Diagnostics

Pause/Continue Test

While holding the CTRL key down, press the **BREAK** key to pause a test that is running. The test may not pause immediately. Select the **CONTINUE** function on the screen to resume test execution.

Aborting a Test

Press the **CTRL** and **BREAK** keys and select the **ABORT** function from the menu to abort execution of a test that is running. Control is returned to the menu that was displayed prior to starting the test.

Test Complete Indications

When the test is complete, a display of the format shown in Figure 3.7 is displayed.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00
STATUS: STOPPED	CURRENT DATE: 06/28/85	STARTS: 1
ACTION: STOP ON ERROR	CURRENT TIME: 08:54:20	PASSES: 1
FINISH: 01 PASS	TESTING TIME: 00:06:00	ERRORS: 0
I/O PORT DIAGNOSTICS-R2.5		LOCAL LOOP BACK SERIAL TEST
ALL TESTS COMPLETE NO ERRORS FOUND		
TYPE "END" KEY TO CONTINUE		

Figure 3.7. Test Completion Display

The **NO ERRORS FOUND** message is displayed only if the error count is zero. If the error count is not zero, the message **ERROR DETECTED** is displayed.

Disk-Based Diagnostics

Two lines of data are used to display the contents of processor registers when the fault occurred if REGISTER DISPLAY AT ERROR is selected when configuring the monitor options. When this information contained in the registers is useful for correcting faults, it will be described in the error message. Always save this data for engineering when you need assistance.

Miscellaneous (MISC) Functions

Several miscellaneous functions are available for modifying run conditions. When you select MISC from the program menu, the menu in Figure 3.9 is displayed. After the function has been completed, press the END key to return to the main menu.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00	
STATUS: STOPPED	CURRENT DATE: 09/04/85	STARTS: 0	
ACTION: STOP ON ERROR	CURRENT TIME: 15:50:26	PASSES: 0	
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS: 0	
DIAGNOSTIC TEST MENU			
CPU DIAGNOSTIC-R2.0(C)			
RAM DIAGNOSTIC-R2.0(A)			
I/O PORT DIAGNOSTICS-R2.0(C)			
2409 VIDEO DIAGNOSTIC-R2.0(C)			
KEYBOARD DIAGNOSTIC-R2.0(C)			
FLOPPY DIAGNOSTIC-R1.0(C)			
WINCHESTER DIAGNOSTIC-R1.0(C)			
<table border="1"> <tr> <td> (A) (0) (0) (0) FINISH DATE TIME </td> </tr> </table>			(A) (0) (0) (0) FINISH DATE TIME
(A) (0) (0) (0) FINISH DATE TIME			
ALL AUTOMATIC TESTS	SINGLE TEST	MISC CONFIGURATION HELP EXIT	

Figure 3.9. Miscellaneous Function Menu Display

Action at an Error

If the ACTION function is selected from the miscellaneous function menu, then a display similar to Figure 3.10 will appear. Use the arrow keys and the ENTER key to select the desired action if an error is detected.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00
STATUS: STOPPED	CURRENT DATE: 09/04/85	STARTS: 0
ACTION: STOP ON ERROR	CURRENT TIME: 15:51:06	PASSES: 0
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS: 0
DIAGNOSTIC TEST MENU		
CPU DIAGNOSTIC-R2.0(C) RAM DIAGNOSTIC-R2.0(A) I/O PORT DIAGNOSTICS-R2.0(C) Z409 VIDEO DIAGNOSTIC-R2.0(C) KEYBOARD DIAGNOSTIC-R2.0(C) FLOPPY DIAGNOSTIC-R1.0(C) WINCHESTER DIAGNOSTIC-R1.0(C)		
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> (S) (D) (I) (M) (A) (R) (E) CONTINUE ON ERROR LOOP ON ERROR </div>		
ALL AUTOMATIC TESTS	SINGLE TEST	MISC CONFIGURATION HELP EXIT

Figure 3.10. Error Action Menu

Disk-Based Diagnostics

FINISH

If the FINISH function is selected from the miscellaneous function menu, then a display similar to Figure 3.11 is displayed. Use the arrow keys and the ENTER key to select the desired test finish criteria. Options include from 1 to 99 passes, from 1 to 23 hours, and continuous repetition. If either PASSES or HOURS is selected, the number for the finish function at the top of the screen will be highlighted; enter the correct value using the arrow and numeric keys, or the mouse.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00
STATUS: STOPPED	CURRENT DATE: 09/04/85	STARTS: 0
ACTION: STOP ON ERROR	CURRENT TIME: 15:52:15	PASSES: 0
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS: 0
DIAGNOSTIC TEST MENU		
CPU DIAGNOSTIC-R2.0(C) RAM DIAGNOSTIC-R2.0(A) I/O PORT DIAGNOSTICS-R2.0(C) Z489 VIDEO DIAGNOSTIC-R2.0(C) KEYBOARD DIAGNOSTIC-R2.0(C) FLOPPY DIAGNOSTIC-R1.0(C) WINCHESTER DIAGNOSTIC-R1.0(C)		
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> 1-99 HOURS CONTINUOUS </div>		
ALL AUTOMATIC TESTS	SINGLE TEST	MISC CONFIGURATION HELP EXIT

Figure 3.11. Finish Criteria Menu

Date and Time Functions

The date and time functions are used to set the system date and time that appear at the top of the display. It is very important that this is done before running continuous tests so the time recorded for failures is correct.

Select the appropriate function and the value to be set will be highlighted at the top of the screen. You may use either the arrow keys, numeric keys, or the mouse to set values. While using numeric keys, any non-numeric character may be typed to advance to the next field.

Configuration

Selecting CONFIGURATION at the diagnostic test menu results in a display of the form shown in Figure 3.12.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00
STATUS: STOPPED	CURRENT DATE: 09/04/85	STARTS: 0
ACTION: STOP ON ERROR	CURRENT TIME: 15:53:15	PASSES: 0
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS: 0
CONFIGURATION PROGRAM		
CPU DIAGNOSTIC-R2.0(C)		
RAM DIAGNOSTIC-R2.0(C)		
I/O PORT DIAGNOSTICS-R2.0(C)		
2409 VIDEO DIAGNOSTIC-R2.0(C)		
KEYBOARD DIAGNOSTIC-R2.0(C)		
FLOPPY DIAGNOSTIC-R1.0(C)		
WINCHESTER DIAGNOSTIC-R1.0(C)		
2329 VIDEO DIAGNOSTIC-R2.4		
2304 DIAGNOSTIC R2.5		
DON:00:00:00 DELETE TEST MOVE TEST CONFIGUR MONITOR HELP EXIT		

Figure 3.12. Configuration Display

CONFIGUR TEST

Add/Delete Test

To add or delete a test in the monitor configuration, use the arrow keys to select the desired test. If the test was configured, it will be deleted. If the test was not configured, it will be added. All configured tests have a (C) after the test name. Only configured tests can be accessed from the test menu.

Changing the Testing Sequence

Select MOVE TEST to change the order that tests are run. Next, select the test to be moved and then select the location of the desired test.

CONFIGUR MONITOR

Monitor options can be modified by selecting CONFIGUR MONITOR at the configuration menu. This results in the display shown in Figure 3.13.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00	
STATUS: STOPPED	CURRENT DATE: 06/28/85	STARTS:	0
ACTION: STOP ON ERROR	CURRENT TIME: 11:46:57	PASSES:	0
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS:	0
CONFIGURATION PROGRAM			
MONITOR OPTIONS:			
DELAY FOR OPERATOR INPUT:	YES	NO	
FAST TEST:	YES	NO	
ACTION AT ERROR:	STOP	CONT	LOOP
FINISH CRITERIA:	PASSES	HOURS	CONTINUOUS
TOTAL NUMBER OF PASSES:	01		
TIMES TO RUN EACH SECTION:	01		
LOGGING:	MON	PRINTER	DISK
ASSUME EQUIPMENT PRE-SETUP:	YES	NO	
AUTOMATIC RETURN TO SYSTEM:	YES	NO	
REGISTER DISPLAY AT ERROR:	YES	NO	
COLOR MONITOR AVAILABLE:	YES	NO	
SERIAL MOUSE PORT:	MON	COM1	COM2
CONFIGUR TEST	DELETE TEST	MOVE TEST	CONFIGUR MONITOR
			HELP EXIT

Figure 3.13. Diagnostic Monitor Configuration Display

The primary purpose of this configuration is to set up special disks for use in manufacturing burn-in and quality assurance testing. If a known configuration is to be tested, the disk can be configured to automatically start, run in a pre-specified manner, and return to the DOS when testing is complete.

Most parameters correspond to functions mentioned earlier. A brief explanation of the various selections follows:

DELAY FOR OPERATOR INPUT:

- YES — Wait for operator to select model at herald display
- NO — Run all automatic sections or fast test after starting

FAST TEST: (used only if DELAY FOR OPERATOR INPUT = NO)

- YES — Start fast test
- NO — Start running all automatic sections

ACTION AT ERROR:

- STOP — Wait for operator input if an error is detected
- CONT — Log error and continue test if an error is detected
- LOOP — Loop on the first error until cancelled by operator

FINISH CRITERIA:

- PASSES — Stop after total test has run the specified times
- HOURS — Stop after test has run for the specified hours
- CONTINUOUS — Run test until cancelled by operator

TOTAL NUMBER OF PASSES/HOURS: Sets initial value for finish criteria if passes or hours have been selected. Value may range from 1 to 99 for passes and 1 to 23 for hours.

TIMES TO RUN EACH SECTION: Number of times each section is run before starting the next section in tests (normally set to one).

LOGGING:

- NONE — Do not log errors
- PRINTER — Log errors on the system printer
- DISK — Log errors in disk file DIAG.RSL
Log test starts in file DIAG.LOG

Disk-Based Diagnostics

ASSUME EQUIPMENT PRESETUP

- YES — Run misc type sections as automatic
- NO — Run misc type sections as manual

AUTOMATIC RETURN TO SYSTEM:

- YES — Return to MS-DOS as soon as an error is detected or the finish criteria is met. This is a special option intended to be used when running the diagnostics in batch mode. It will work only if the delay for operator input option is set to NO and if LOGGING is not set to NONE.
- NO — Do not return to MS-DOS until requested by the operator

REGISTER DISPLAY AT ERROR

- YES — Display and log all error information including the value of the CPU registers
- NO — Do not display the values of the CPU registers and log only the first two lines of the error message

COLOR MONITOR AVAILABLE:

- YES — Display diagnostic screens in color
- NO — Do not use color for diagnostic screens

SERIAL MOUSE PORT:

- NONE — No mouse is used
- COM1 — Mouse is connected to the top serial port
- COM2 — Mouse is connected to the bottom serial port

To exit the monitor options menu press the **END** key.

Test Configuration

The diagnostic disks are shipped with pre-programmed configurations, listed by model number and selected through the monitor at the beginning of the diagnostics. If custom configurations are needed, most of the diagnostics have a configuration section available.

By using **CONFIGURATION**, tests may be configured either at the diagnostic test menu, Figure 3.4, or at the test section menu, Figure 3.5. If a configuration has not been entered prior to running a test, the test attempts to determine what hardware is present and checks accordingly. Once a configuration is entered, it is maintained on the disk until deleted by the operator.

Saving the Configuration

After all configuration information is correct and the display shown in Figure 3.13 is present on the screen, access the EXIT function and the display in Figure 3.14 will be shown.

HEATH/ZENITH DIAGNOSTICS		REVISION R2.00	
STATUS: STOPPED	CURRENT DATE: 06/28/85	STARTS: 0	0
ACTION: STOP ON ERROR	CURRENT TIME: 11:48:07	PASSES: 0	0
FINISH: 01 PASS	TESTING TIME: 00:00:00	ERRORS: 0	0
CONFIGURATION PROGRAM			
WRITE CONFIGURATION TO DISK: NO <input checked="" type="checkbox"/> YES			
MODEL NAME(I.E. ZM151-21):			
CONFIGUR TEST	DELETE TEST	MOVE TEST	CONFIGUR MONITOR
HELP	EXIT		

Figure 3.14. Configuration Exit Display

If YES is selected, then all information gained in the configuration session is saved on the disk. The next question asks for a file name containing up to eight characters to use for storing the information. In most cases the file name should correspond to the model number for the system. If no name is typed, the configuration is saved in a special file named DEFAULT.CFG. The configuration must be saved under the default file if a mouse or color option is used.

Return To System

The EXIT function at the main menu clears the display screen and returns back to the diagnostic monitor herald. Pressing the END key will return control to the operating system.

Chapter 4

Individual Tests

The following chapter explains all the individual tests found in the disk-based diagnostics as well as how to configure each test for proper operation.

CPU Diagnostic

The CPU diagnostic checks the timer chip, speaker and their associated circuitry, ROM, interrupt controller, CPU, system crystals, 80287 numeric processor extension, DMA controllers, and the real time clock. Also, it reads the system configuration, ROM version, and displays the results. It also compares the actual system configuration and ROM version against diagnostic configuration if running in the pre-setup mode.

NOTE: The CPU diagnostic assumes the system crystal on the I/O card is 14.314 MHz, the 80286 clock is 12 MHz on the CPU card, and that there are no open or shorted circuits on the printed circuit board.

Configuration

The CPU board diagnostic must be configured properly to ensure all hardware is tested and error messages result in the correct information. The following may be configured for this test:

TERMINAL TYPE	Z241	Z248
AUDIBLE SPEAKER TEST	YES	NO

Individual Tests

If ASSUME EQUIPMENT PRESETUP was configured as YES during CONFIGUR MONITOR, the following information may be changed:

TERMINAL TYPE	Z241	Z248		
ROM VERSION NUMBER	1.0			
NUMBER OF FLOPPY DRIVES	0	1	2	
NUMBER OF HARD DISK DRIVES	0	1	2	
DEFAULT DISPLAY TYPE	40 X 25	80 X 25	MONO	ENHANCED
80287 CO-PROCESSOR INSTALLED	NO	YES		
BASE MEMORY SIZE (IN KILOBYTES)	512	640		
EXPANSION MEMORY SIZE	0K BYTES			
DISPLAY FREQUENCY	60HZ	50HZ		
AUTO-BOOT	FLOPPY	WNCHSTR	FLPY/WIN	MFM-MONITOR

RAM Diagnostic

This test requires a Z-200 PC with 512K of RAM located on the CPU/memory card. Additional memory resides on optional RAM expansion cards. The first extended RAM card brings the system memory to 640K. The remainder of the card and additional cards provide memory in the protected memory range above the 1 megabyte boundary. This test does not require configuration or special hardware.

Special sections have been included in the RAM diagnostics to detect faults in the parity generation/detection circuits. The main types of RAM faults tested for and the associated tests are:

- Stuck bits — March II Test
- Address uniqueness — March II Test
- Write recovery — March II Test
- Sense Amplifier recovery — Diagonal (Barber Pole) Test
- Access Time — Address Complement (Ping-Pong) Test
- Adjacent Pattern Interference (Static) — Srinii's Test (AP14)
- Data Sensitivity — Moving Inversions (MOVI) Test
- Refresh — Refresh Test

Input/Output Port Diagnostics

The serial and parallel printer ports are located on the I/O card of the Z-200 computer. The I/O card uses jumpers to determine the base addresses and interrupt levels of the serial/parallel ports. Only those address combinations are available. The interrupt levels used by the serial and parallel ports are separated. Interrupt levels 4 and 3 are available for the serial port and levels 7 and 5 for the parallel printer port.

The loop back test plugs used for diagnostics are:

- External Loop Back Test — 438-73
- Parallel Port Interrupt Test — 438-64

Parallel port diagnostics check the parallel printer port.

The serial test displays special parameters used to operate the NS16450 ACE, in addition to those parameters displayed by the diagnostic monitor.

Configuration

A configuration is provided to indicate the base address and interrupts used by the I/O card.

PARALLEL/SERIAL PORT(S) TO TEST	A	B	NONE
INTERRUPT FOR THE SERIAL PORT	4	3	NONE
INTERRUPT FOR THE PARALLEL PORT	7	5	NONE

CGA Video Diagnostic

In the CGA video diagnostic, possible faults are assumed to exist in the display. The diagnostic tests the video controller, the composite or RGB video output, the video I/O circuits, and also provides video patterns for display adjustment.

This test requires a Z-200 PC and at least one color and/or monochrome video display. The video equipment test requires the usual TV alignment tools (i.e., small screwdrivers, etc.).

Individual Tests

Configuration

The diagnostic disks are shipped with pre-programmed configurations. The configurations are listed by model number and selected through the diagnostic monitor herald at the beginning of the diagnostics. If cursor configurations are needed, the CGA video diagnostic has a configuration section available for use. The operator needs to know which card the video is located on. An example of the configuration is shown below.

Board the video is located

Z140	Z150/Z200	OTHER
IO	Z309 (A)/Z409	VIDEO/FLOPPY OTHER

EGA Video Diagnostic

In the enhanced graphics display diagnostic, possible faults are assumed to exist in the display. The diagnostic tests the video controller, the RGB video output, the video I/O circuits, and also provides video patterns for display adjustment.

This test requires a Z-200 PC series computer with a minimum of 128K of RAM and at least one color and/or high-resolution monochrome video display. The video equipment test requires the usual TV alignment tools (i.e., small screwdrivers, etc.).

A fast test mode is available in diagnostics version 2.0 or higher. The fast test performs abbreviated tests of the automatic sections giving error result to the board level.

Configuration

The following can be configured for the EGA video diagnostic:

FIRMWARE VERSION OF EGA THAT IS USED

IBM EGA	ZDS EGA
---------	---------

ZDS Video Diagnostic

Since the video portion of this diagnostic depends on the integrity of the video RAM, that portion of the RAM diagnostic should be run and any faults detected should be corrected.

This test requires a Z-200 PC with at least 128K of memory, a Z-309A or Z-409 video card, and a Z-419 video card. The video alignment test requires the usual TV alignment tools.

Configuration

Prior to operating the display diagnostics on a new system, or whenever display hardware changes are made, the diagnostic configuration will usually need to be updated.

When the ZDS video diagnostic configuration is selected, the following display is shown. The current configuration is indicated by a box around one of the three options to the right of each color. If the diagnostic had previously been configured, the appropriate parameters will be displayed.

VIDEO PLANE	OPTIONS		
GREEN	NONE	32K	64K
RED	NONE	32K	64K
BLUE	NONE	32K	64K

ARE THE CURRENT SELECTIONS CORRECT? Y N

If the parameters are correct, select Y and the configuration session is ended.

If these are not the correct parameters, then select N and the cursor will move up to the options field and allow you to select the appropriate options. When the options are correct, press the **END** key and the cursor will return to the Y at the bottom of the screen.

Z-329 Video Diagnostic

In the Z-329 diagnostic, possible faults are assumed to exist in the display. The diagnostic tests video alignment, video focus, the Cathode-Ray Tube Controller (CRT), the video parallel/serial conversion logic, monochrome video output, monochrome display hardware, and the video port I/O circuits.

The goals of the diagnostic routines are to identify and isolate all detectable failures in the shortest period of time possible and to provide a means for adjusting the video monitor. Alignment patterns are included for monochrome displays and the complete character set can be displayed upon request.

This test requires a Z-200 PC with at least 512K of memory and a Z-329 monochrome video card. The video alignment test requires the usual TV alignment tools (that is, small screwdrivers, etc.).

Keyboard Diagnostic

The keyboard diagnostic tests the keyboard controller on the I/O board, the interface circuitry, the keyboard processor and the keyboard switch assembly.

Floppy Diagnostic

The floppy disk system in the Z-200 PC can consist of one controller with up to two 5.25-inch drives. This diagnostic test is designed to detect most faults in the drive(s) and controller, and to provide information required to repair or adjust them.

These tests require a Z-200 PC system with at least 512K of memory, and at least one 5.25-inch floppy disk drive. The drive test requires a scratch disk. The media test requires the media that is to be tested. The alignment test requires a digital alignment disk (Dysan 508-400 rev. B or equivalent for 360Kb drives, model 516-400 rev. A for 1.2 Mb drives).

This test will handle the disk formats listed in Table 4.1.

Table 4.1. Format Coverage

SIZE	SIDES	DENSITY	TPI	TRACKS/ SIDE	SECTORS/ TRACK	BYTES/ SECTOR
5.25-inch	1	Double	48	40	8 or 9	512
5.25-inch	2	Double	48	40	8 or 9	512
5.25-inch	2	Quad	96	80	15	512

Configuration

Prior to operating the floppy diagnostic on a new system, or whenever disk drive hardware changes are made, the floppy diagnostic configuration will usually need to be updated.

When the floppy diagnostic configuration is selected, the following display will appear. The current configuration is indicated by a box around one of the four options below each drive. If the floppy diagnostic had previously been configured, then the appropriate parameters will be displayed. The cursor will be on the Y at the bottom of the screen.

```

DRIVE NO. :           0 (A)           1 (B)
DRIVE TYPE           1.2 MB           1.2 MB
                   360 MB           360 KB
                   SINGLE SIDED     SINGLE SIDED
                   NONE             NONE

TO BE TESTED?:     YES  NO           YES  NO

      ARE ALL PARAMETERS CORRECT?     Y   N

```

If the selections are correct, choose Y and the configuration session is ended.

If you wish to change a selection, choose N and the cursor will move up to the selection menu.

Pick the appropriate type for each drive, or NOT PRESENT if the drive is not installed.

Individual Tests

Once you select a drive type other than NOT PRESENT, YES will be automatically selected for the TO BE TESTED? option. If you do not want this drive to be tested during automatic testing, then change the selection to NO. If NOT PRESENT is picked for a drive type, then NO will be picked automatically and YES cannot be picked for that drive.

When the options are correct, type the **END** key and the cursor will return to the Y at the bottom of the screen.

While the test is running, the following display is shown:

```

FLOPPY DIAGNOSTIC          DRIVE TEST

TEST:      .   WRITE DATA
                        CURRENT TOTAL
DRIVE:  0 (A) TRACKS (S)  20  70  ROTATIONAL SPEED:  299 RPM
SIDE:   0   SECTORS (S)  08  374

ERRORS:    RECOVERABLE  NONRECOVERABLE
DATA       1            0
SEEK       1            0
WRITE      2            0
READ       0            0
  
```

Counters on the screen are cleared whenever the test is aborted or when testing on a new drive begins. If an error is detected, two retries are made in an attempt to recover the data successfully. If one of the retries succeeds, then the appropriate recoverable error counter shows a positive increase. If all three tries fail, the nonrecoverable counter shows a positive increase and the test continues with the next sector.

Any nonrecoverable error, or a total of two recoverable errors of all types in any one pass (per pass, if the same drive is tested), will result in an error message. If CONTINUE is selected at the error message, the test continues and no additional error messages are displayed. After CONTINUE has been selected, the counters continue to record detected faults, regardless of the previous number of errors.

Errors recorded consist of the following:

- DATA:** Data read from a sector was incorrect but the “record not found,” “lost data,” or “CRC error” flags were not set by the controller. This error resulted from returning the wrong sector, incorrect data that was not detected by the CRC and lost data circuits, or data that was corrupted after passing through the disk error detection circuits.
- SEEK:** The “record not found” flag was returned by the disk controller when attempting to read or write a sector. This error resulted from seeking the wrong track or from an incorrectly formatted disk.
- WRITE:** The “write protect,” “write fault,” or “lost data” flags were returned by the disk controller when it attempted to write a sector. This error resulted from a spike on the write protect sensor, an incorrectly formatted disk, or any malfunction that prevented the processor from loading data quickly enough to keep up with the disk controller.
- READ:** The “lost data” or “CRC error” flags were returned by the controller when it attempted to read a sector. This error is normally caused by reading incorrect data from the disk. It can, however, result from the processor not reading data quickly enough to keep up with the disk controller.

Alignment Test

Selection of the alignment test results in the following display:

```
FLOPPY DIAGNOSTIC      ALIGNMENT TEST
DRIVE TO TEST:  0  1
```

Individual Tests

After the drive has been selected, the following display is presented to request installation of the digital diskette. The model number of the required digital diagnostic diskette will depend on the configured drive type.

```
FLOPPY DIAGNOSTIC      ALIGNMENT TEST

INSERT DIGITAL ALIGNMENT DISK INTO DRIVE 0 (A)

THIS TEST REQUIRES A DYSAN MODEL 508-400 REV. B DISK

TYPE ANY KEY TO CONTINUE:
```

After the test begins, the following display is presented:

```
FLOPPY DIAGNOSTIC      ALIGNMENT TEST

DIGITAL ALIGNMENT TEST - TESTING DISK 0 (A)

MARGINS:                SIDE 0    SIDE 1    MINIMUM VALUES
RADIAL ALIGNMENT:      13><12   13><11    08><08 M"
HEAD HYSTERESIS:      13><12   *13><12   08><08 M"
LINEARITY-INSIDE:     12><12   13><11    08><08 M"
                      OUTSIDE:  12><12   13><12    08><08 M"
CLAMPING ACCURACY:    09><09   09><09    08><08 M"
HEAD AZIMUTH:         42><42   42><42    30><30 M"
```

----- TYPE SPACE BAR TO LOOP ON MARGIN -----

*** CONSISTENTLY INCORRECT VALUES SHOULD BE VERIFIED USING A ***

*** STANDARD ANALOG ALIGNMENT DISK BEFORE DRIVE REPLACEMENT. ***

The digital alignment test depends upon correct seating of the disk in the drive. Parameters often change from pass to pass and several runs of the test should be made to verify results. All tests automatically repeat until stopped by the BREAK key or space bar. An asterisk is placed next to the value currently being computed so that the operator may track the progress of the test. If the space bar is pressed, an individual margin test can be selected and only that margin test will be repeated. Pressing the space bar again will stop this feature and all tests will again execute.

The X><Y values displayed are arranged as follows:

- X — indicates the maximum amount that data can be off track center-line **toward the spindle** and still be read reliably.
- Y — indicates the maximum amount that data can be off track center-line **away from the spindle** and still be read reliably.

To provide readings for Radial Alignment, Head Hysteresis, and Linearity, data is read from a single track which has records written off centerline by progressive amounts. Clamping accuracy is determined by reading tracks where all data is written off centerline **by the same amount**. For Head Azimuth, data has been recorded on the disk with a head **adjusted at various angles from the perpendicular**. X indicates the maximum amount (in minutes) that data can be off in a clockwise direction and still be read; Y indicates the maximum amount, in the counterclockwise direction. The alignment section requires a digital alignment disk and is used, primarily, to determine and display head alignment parameters. Computer parameters include radial alignment, head hysteresis, positioner linearity, clamping eccentricity, and head azimuth.

These parameters are defined as follows:

Radial alignment — The program steps from track 0 (outside of disk) to the middle progressive offset track and determines the last even-numbered sector and the last odd-numbered sector that can be read. The offsets of these sectors is then computed and displayed. Sector pairs are written with offsets of 6-13 milli-inches.

Head hysteresis — The head is moved to the inside track on the disk and then brought back to the middle progressive offset track and the radial alignment is repeated.

Positioner linearity — The alignment test is repeated on the progressive offset tracks that reside on the inside, and on the outside of the disk. Results are displayed for each case.

Clamping eccentricity — The head is positioned over an alternate offset track with an offset of 7 milli-inches (all odd sectors are offset +7 milli-inches; all even sectors are offset -7 milli-inches) and all data on the track is verified. This test is repeated on alternate offset tracks with offsets of 8 and 9 milli-inches. The offsets of the last even-numbered sector and the last odd-numbered sector that can be read are displayed.

Head azimuth — The head is positioned over the azimuth rotation track (sector pairs written with head azimuth angles of 21, 24, 27, 30, 33, 36, 39, and 42 minutes) and sector pairs are checked for mismatched data. The angles of the last even sector and the last odd sector that can be read are displayed.

Winchester Diagnostic

The disk controller card can have one, two, or three Winchester drives connected to it. The drives are numbered 0 through 2.

Each Winchester drive can contain more than one hard disk with a read/write head for each surface of each disk. By rotating these disks at a relatively high velocity and “flying” the heads very close to the surface of the disk, the capacity and performance of the disk is much improved over floppy disks. Each read/write head is located at the end of a “finger” long enough to reach from the edge of the disk to the center. The other end of each of these fingers is attached to a single swing arm. Therefore, positioning one head over a certain track on one disk surface, positions all the other heads over a related track on all the other surfaces. This set of tracks is referred to as a “cylinder.”

The data on each disk surface is formatted into sectors, much as is the data on floppy disks. Sector addressing starts with Cylinder 0, Head 0, Sector 1, and progresses, **by sectors** through the heads, and then the cylinders.

Since the data transfer portions of this diagnostic depend on the integrity of the RAM, it is assumed that the RAM diagnostic has first been run and that any faults detected have been corrected before executing this diagnostic.

It is also assumed that the system is operational enough to enable the operator to interact with the diagnostic software.

Configuration

Prior to operating the Winchester diagnostic on a new system, or whenever Winchester hardware changes are made, the Winchester diagnostic configuration should be updated. When the Winchester diagnostic configuration is selected, the following display is shown. The cursor will be on the Y at the bottom of the screen. If the Winchester diagnostic had previously been configured, then the appropriate parameters will be displayed.

Individual Tests

WINCHESTER CONFIGURATION SUMMARY

DRIVE NO.	TYPE (0-15)	TO BE TESTED?	
0:	2	YES	NO
1:	NOT PRESENT	YES	NO
2:	NOT PRESENT	YES	NO

ARE ALL PARAMETERS CORRECT? Y N

If the parameters are correct, pick Y and the configuration session is ended.

If the parameters are not correct, pick N and the cursor will move up into the TYPE column of selection menu, and the display will appear as shown below.

WINCHESTER CONFIGURATION SUMMARY

DRIVE NO.	TYPE (0-14)	--DRIVE TYPE 02--			
0	2	CYLINDERS:	615	HEADS:	04
1	NOT PRESENT	SHIP ZONE:	615	SECTORS:	17
2	NOT PRESENT	PRECOMP:	300	CAPACITY:	20M

ARE ALL PARAMETERS CORRECT? Y N

To enter a drive type number, position the cursor over the drive type number next to the appropriate drive number and, press the **RETURN** key. The drive type selected in the SETUP program will be displayed. If this is incorrect, use the up and down arrow keys to increment and decrement the drive type, or you may enter a number directly from the keyboard and then press the **ENTER** key. As different numbers are entered, the parameters for that type drive will appear on the right side of the screen to help identify the drive. Type 0 indicates that the drive is not present.

If you do not want a drive to be tested during automatic testing, then change the TO BE TESTED? selection to NO. If NOT PRESENT is picked for a drive type, then NO will be picked automatically and YES cannot be picked for that drive. After all configuration information is correct, press the **END** key and the cursor will return to the Y at the bottom of the screen.

Individual Tests

Error Codes

Each entry in the error log begins with a description of the error type followed by a code. Usually, the Winchester Controller BIOS generates these codes. See Table 4.2 for code definitions.

Table 4.2. Error Code Tables

CODE	DEFINITION
00	Undefined
01	Command not recognized by BIOS
02	Address mark not found
03	Write protect
04	Requested sector not found
05	Reset failed
06	Cartridge changed
07	Drive parameter activity failed
08*	Faulty I/O port on Winchester controller
09	Attempt to DMA across a 64K boundary
0A*	Controller RAM error
0B	Bad track flag detected
0C*	Bad sector table not readable
0D*	Data read from sector is incorrect
0E*	CMOS RAM does not match configuration
0F	Undefined
10	ECC check error on data in the sector
11	Data was corrected via the ECC
12-1F	Undefined
20	Miscellaneous controller error
21-3F	Undefined
40	Seek operation failed
41-7F	Undefined
80	Controller failed to respond before time-out
81-BA	Undefined
BB	The BIOS detected an undefined error
BC-BE	Undefined
CC	Write fault
CD-FE	Undefined
FF	The controller would not return failure data

NOTE: Codes followed by an asterisk () are created by the diagnostic. All other are generated directly by the Winchester Controller BIOS.

Error Display

If the established error rates are exceeded, the following error message is displayed. If CONTINUE is selected at the error screen, or the monitor's ACTION is configured to CONTINUE ON ERROR, no further error messages are generated, but testing will continue and errors will be entered in the error log.

WINCHESTER DRIVE 0 ERROR

THE ESTABLISHED ERROR RATE HAS BEEN EXCEEDED

CHECK DRIVE, THEN CHECK CONTROLLER

THE LAST THREE ERRORS WERE:

TYPE: CODE	DRIVE	CYLINDER	HEAD	SECTOR	TIME	DATE
SOFT WRITE: 02	1	133	3	7	23:02:33	02/06/83
SOFT READ: 10	1	22	0	3	03:59:02	02/07/83
HARD READ*: 11	0	100	2	10	13:22:21	02/07/83

NOTE: The established error rates are:

- 1 Soft error during each pass of the Drive Test.
- 1 Soft error during each pass of the Media Test.
After a total of 255 passes, no soft error are flagged.
- 0 Hard errors (not recoverable in 16 rereads).

Retries are performed as follows, until the command that caused the error executes without an error:

First, third, and so on through the fifteenth retry:

- Two seeks are performed, one to the next higher and one to the next lower cylinder.
- The command causing the error is retried.

Second, fourth, and so on through the sixteenth retry:

- A reset command is sent to the controller.
- A recal (recalibrate) command is sent to the drive.
- The command causing the error is retried.

Z-304 Diagnostic

The serial test checks the Multi-Protocol Serial Controller (MPSC) used on the Z-304 card.

NOTE: To perform the test, a special test connector must be installed.

The loop back connectors used for the diagnostics are:

- All Serial Port Tests — 438-67
- Parallel Port Interrupt Test — 438-64

Parallel port diagnostics check the parallel printer port.

The serial test displays special parameters used to operate the MPSC, in addition to those parameters displayed by the diagnostic monitor.

Configuration

The following may be configured for the Z-304 diagnostic:

PARALLEL PORT INSTALLED? YES NO

SummaSketch Graphics Tablet Diagnostic

The SummaSketch diagnostic can be used to test the echo mode. The self test functions automatically while the rest of the tests may be run manually by the user to ensure proper operation of the SummaSketch.

The SummaSketch Graphics Tablet tests have been designed to check as many modes of operation as practical. If the SummaSketch passes all the tests, the user can be reasonably certain that the graphics tablet is working correctly.

This diagnostic requires a Z-200 PC series computer with a minimum of 128K of memory. The serial cable must be connected to serial port 1 (address 3F8H) and the SummaSketch tablet must be configured for 9600 baud.

These diagnostics run under MS-DOS 1.0 or higher on a disk using the Z-150 Interpretive Exerciser under control of the Diagnostic Monitor Revision 2.0 or higher. They interface with the serial library (SERIAL.ECL) and the touch control library (TOUCH.ECL) routines. The monitor ROM in the computer must be version 1.0 or higher.

Configuration

The SummaSketch diagnostic requires no additional configuration to run. Verify that the SummaSketch is connected to serial port 3F8H and is set up for 9600 baud.

Tape Backup System Diagnostic

The tape backup system consists of the disk controller card, the tape drive, and the tape. This diagnostic test is designed to detect most faults in the controller, drive, or media, and to provide information required to repair or adjust them.

This test requires a Z-200 PC series computer with a minimum of 128K of RAM and a tape backup system. The drive test requires a scratch tape and the media test requires the media to be tested.

Since the data transfer portions of this diagnostic depend on the integrity of the RAM, it is assumed that the RAM diagnostic had first been run and that any faults detected have been corrected before executing this diagnostic. It is also assumed that the system is operational enough to enable the operator to interact with the diagnostic software.

Individual Tests

Possible faults are assumed to reside in the disk controller, drive, or media. The types of errors to be detected and the associated tests are listed in Table 4.3.

Table 4.3. Tape Backup System Errors Checked

FAULT	TEST	SECTION
Floppy controller	Execute a NOP instruction	1
Track 0 detect logic	Toggle the track 0 line	1
Data access	Read various sections	2
Track selection	Access different tracks	2
Block selection	Access different blocks	2
Tape speed constancy	Write/read sector of FFH	2
Write protect sensor	Use protected/unprotected tapes	1
Tape interchange error	Verify data from another drive	3

In Table 4.3, under the "Section" column head, 1, 2, and 3 correspond to the selections on the section menu. They are 1, controller test, 2, drive test, and 3, media test. The media test provides a method of checking data on a user tape and also has utilities that may be used to read sector information for data error analysis.

Configuration

Prior to operating the tape backup system diagnostic on a new system, or whenever display hardware changes are made, the tape backup system configuration will usually need to be updated.

When the tape backup system diagnostic configuration is selected, the following display will appear. The current configuration is indicated by a box around one of the two options to the right of the tape drive capacity. If the tape backup system diagnostic had previously been configured, then the appropriate parameters will be displayed. The cursor will be on the Y at the bottom of the screen.

TAPE BACKUP SYSTEM CONFIGURATION SUMMARY

TAPE DRIVE CAPACITY: 10 MB 20 MB

DRIVE SELECT NUMBER: 0 1 2 3

WRITE BEFORE EACH READ PASS? Y N

(ALWAYS WRITES BEFORE FIRST READ PASS)

IS THIS THE CORRECT CONFIGURATION? Y N

If the parameters are correct, press the **ENTER** key and the configuration session is ended.

If these are not the correct parameters, select **N** and the cursor will move up to the tape drive capacity and allow you to select the appropriate type for your system.

When the options are correct, press the **END** key and the cursor will return to the **Y** at the bottom of the screen.