
Section 2. Diagnostics

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About This Section

This section contains descriptions of the diagnostic programs available on the IBM RT PC diagnostics diskettes and a description of the service request number.

Section 3 directs you in the use of these programs during problem isolation.

Use the contents list on the previous page to find information about the diagnostic programs or the service request number.

Introduction to Diagnostics

Note: Some system unit components do not cool properly and may fail intermittently when covers are off. For this reason do not power the system unit on longer than 10 minutes with the covers off.

The diagnostic programs are divided into six types:

- The **Resident Power-On Self-Test (POST)** programs are in **Read-Only Memory (ROM)** modules on the processor board. These programs run when the system unit is first powered on.

The Resident POST programs check the system unit components needed to load programs from the fixed disk or diskette. See page 2-6 for more information about the Resident POST programs.

- The **Loadable POST** programs load from the fixed disk or the diagnostics diskettes. These programs run when the Resident POST programs complete.

The Loadable POST programs first sense the adapters and options installed in the system unit and build an **Installed Features List**. Before any checkout routines are run, the installed features list is compared to the **Configuration Record** on the fixed disk. See page 2-6 for more information about the Loadable POST programs.

Pressing the **Ctrl-Alt-Pause** keys cause the Loadable POST programs to run.

- The **Diagnostic Routines** are on the diagnostics diskettes. The **Problem Determination Guide** directs the system user to run the Diagnostic Routines to check the system unit during problem determination. See page 2-12 for more information about the Diagnostic Routines.

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- The **Utilities** are on the diagnostics diskettes. They provide utility functions such as exercising communication links, and displaying special information.

The Utility programs are used in a non-directed manner to provide control and information to the system user or service technician. See page 2-14 for more information about the Utilities.

- The **Advanced Diagnostic Routines** are on the diagnostics diskettes. They are used by the service technician to isolate failures to a **Field-Replaceable Unit (FRU)**.

The Advanced Diagnostic Routines do the same tests as the Diagnostic Routines plus additional tests that require action by the service technician. The additional tests may require the use of wrap plugs, keying certain patterns on the keyboard, or answering questions about displayed information. See page 2-17 for more information about the Advanced Diagnostic Routines.

- The **Installation Verification** option compares the installed features list built by the Loadable POST programs to the configuration record on the fixed disk. See page 2-18 for more information about the Installation Verification option.

When a problem is detected, the **Problem Determination Procedures (PDPs)** in the *Problem Determination Guide* direct the system user in a checkout of the IBM RT PC System Unit. The PDPs ask the system user to record a **Service Request Number (SRN)** and provide it to the service organization. The service technician uses the SRN to determine which FRU is needed to repair the system. See page 2-20 for more information about the SRNs.

Power-On Self-Test

The resident Power-On Self-Test (POST) programs are in Read-Only Memory (ROM) modules on the processor board. These programs run when the system unit is first powered on. When the resident POST programs complete, additional POST programs load from the fixed disk or from the diagnostics diskettes.

Numbers display on the *two-digit display* to track the progress of the POST programs. Some tests may run so quickly that the numbers may not be visible.

Notes:

1. The following chart is for "steady" numbers only. Flashing (about one second) numbers are for software failures. See "Two-Digit Display Codes During Diagnostic Programs" on page 2-19 for flashing numbers during the diagnostic checkouts.
2. When **u** is shown in the following chart, it is displayed using the upper-half of the two-digit display character.

Number	Test description
88	Displays for one second to provide a lamp test. If "88" is displayed steady, the 32-bit processor has stopped. :
00, 0c, 0u	If installed, this test resets the IBM Monochrome Display and Printer Adapter.
01, 1c, 1u	Tests the ROM modules on the processor board.
02	Tests for correct communication between the 32-bit processor and the system board.
03, 3c, 3u	Tests the memory controller on the processor board and the system memory boards in slots C and D.
04, 4c, 4u	Tests the processor board.
05, 5c, 5u	Tests the processor board.
07, 7c, 7u	Tests the I/O channel controller on the system board.
08, 8c, 8u	Tests the I/O channel controller on the system board.
09	Tests the keyboard adapter on the system board and the indicators on the keyboard.
99	Shows testing was stopped because the keylock is in the Locked position.
10	Tests the interval timer on the system board.
11	Tests the interrupt controller on the system board.
12	Tests the direct memory access controller on the system board.
13	Tests the built-in serial ports.
14	Tests the fixed-disk drive adapter.
15	Tests the fixed-disk drive adapter.
16	Tests the diskette drive adapter.
17	Tests the diskette drive adapter.
Beep	Tests the speaker in the keyboard.
20	Tests the battery-powered memory on the system board.

Number	Test description
21	An attempt is being made to do an IPL, using the devices specified in the battery-powered memory.
22	An attempt is being made to do an IPL, using the default devices specified in the ROM on the processor board.
23	None of the IPL devices specified in the battery-powered memory or the ROM default list could be identified.
25	An error occurred during IPL. The system unit must be powered off to clear this error.
26	An IPL operation is in progress.
27	The memory capacity was exceeded during IPL.
29	The IPL operation is beginning.
30 - 87	Individual adapter or device tests.
89	A machine or program check was detected.
Blank	This is the normal condition after the POST programs complete.

Standalone Diagnostic Program Descriptions

Note: Before loading the diagnostic programs, all other programs and operating systems must be stopped to prevent loss of data.

The RT PC diagnostics diskettes contain the diagnostic programs used to check out and test the system. The diskettes are provided in the *Problem Determination Guide*. The RT PC Diagnostics 1 diskette is inserted in diskette drive A before the system unit is powered on. After the diagnostic programs load, you are instructed when to change diskettes.

The diagnostic programs do not require an *Operating System* or any other *Licensed Program*. Loading the diagnostic programs removes all other programs from memory.

Loading Additional Device Drivers

The RT PC diagnostic programs provide the capability to load additional device drivers while loading the diagnostic programs. For example, if the device driver for an installed display is not present on the RT PC diagnostics diskettes, a two-digit code of 94 displays. This code identifies the need for a display device driver. Other codes identify the other types of devices.

When an additional device driver is needed, do the following:

1. Remove the RT PC diagnostic diskette.
2. Depending on the two-digit code, obtain the correct diskette containing the device driver needed. Insert it into the diskette drive. The driver will load without any additional action.
3. Follow the instructions displayed or instructions with the device driver diskette. If a flashing two-digit code displays, the diskette failed to load. See the information with the device driver.

Loading a Diagnostics Diskette

Do the following to load the diagnostic programs:

1. Be sure that all programs or operating systems are stopped (get help if needed).
2. Set the power switch on the system unit to Off.
3. If present, remove the write-protect tab from the diagnostics diskettes.
4. Insert the RT PC Diagnostics 1 diskette into the diskette drive and close the drive.
5. Set the keylock to Unlock.
6. If attached, set the power switch for the RT PC 6192 to On.
7. If an IBM 6156 is attached, install any portable disk drive modules you want to test; then set the power switch on the IBM 6156 to On.
8. Set the power switch on the IBM RT PC system unit and display to On.
9. Wait for the DIAGNOSTIC OPERATING INSTRUCTIONS to display (this may take up to 4 minutes).
10. Read and follow the displayed instructions. If needed, use the program descriptions in this section for information.

Key Descriptions

The key descriptions provided here are from the DIAGNOSTIC OPERATING INSTRUCTIONS displayed when the diagnostic programs load. Use them to control the diagnostic programs.

Key	Function
Enter	Signals the program to continue
End	Stops the test or action
F10	Return to the previous menu
Esc	Returns to the DIAGNOSTIC OPERATING INSTRUCTIONS
Page Down	Scrolls forward in a list
Page Up	Scrolls backward in a list
Backspace	Allows keying errors to be corrected
Ctrl-Alt-Pause	Does an <i>initial program load (IPL)</i> .

Diagnostic Routines

The Diagnostic Routines allow the system user to checkout the system with minimum action. These routines are used during problem determination to determine if the system hardware has a problem and provide a Service Request Number (SRN) for the service organization.

The Diagnostic Routines run more extensive tests on the adapters and options than the Power-On Self-Test (POST) programs. The checkout options displayed are from the configuration record on the fixed disk. If the configuration record on the fixed disk does not match the installed features list, the program displays the TEST OPTION or the DIAGNOSTIC TEST LIST menu.

When an option is listed in the configuration record but is not sensed by the Loadable POST programs, the TEST OPTION menu displays. This menu indicates either the option has been removed from the system, the option is failing, the switch settings have been changed, or the option has been moved to another slot.

When the Loadable POST programs sense an option that is not in the configuration record, the DIAGNOSTIC TEST LIST menu displays. This menu indicates an option has been added to the system. When an option is deleted from the DIAGNOSTIC TEST LIST menu, that option is not tested until added to the list using the Show and Change Diagnostic Test List Utility.

To run the Diagnostic Routines:

1. Press **Enter** after reading the DIAGNOSTIC OPERATING INSTRUCTIONS.
2. Choose Diagnostic Routines on the FUNCTION SELECTION menu.
3. Choose a checkout option on the DIAGNOSTIC SELECTION menu. An * (asterisk) by the ID number shows that the test has been run.

The Diagnostic Routines options and their functions are:

System Checkout

The System Checkout option checks all the installed features to the extent that they can be tested without special actions.

Keyboard Checkout

The Keyboard Checkout option checks the keyboard adapter and keyboard.

Display Checkout

The Display Checkout option checks the display adapter and the attached display. The Display Checkout displays a pattern. Follow the instructions displayed for that pattern.

Diskette Drive Checkout

The Diskette Drive Checkout option checks the diskette adapter and the diskette drives. A formatted blank Double Sided diskette is required to check the ability of the drive to read a double sided diskette.

Fixed-Disk Drive and Media Checkout

The Fixed-disk Drive and Media Checkout option checks all the fixed-disk drives installed in the system unit. This option does a function test of each drive and provides for selection of a read test to check all sector addresses.

Other Checkout Options

The other device checkout options check the adapters and devices installed in the system unit. Your system displays the checkout options for the devices installed.

Utilities

The Utility programs are on the RT PC diagnostics diskettes. They provide utilities to:

- Format a fixed disk
- Copy the diagnostics diskette
- Exercise the Ethernet¹ Network
- Display the installed features list
- Change the diagnostic test list
- Format the fixed disks on the IBM 9332
- Download microcode to the IBM 9332
- Display and alter the Vital Product Data record on the IBM 9332 fixed disk.

To run the Utilities:

1. Press **Enter** after reading the DIAGNOSTIC OPERATING INSTRUCTIONS.
2. Choose Utilities on the FUNCTION SELECTION menu.
3. Choose the type of utilities on the UTILITY SELECTION menu.

The following topics describe the different types of Utilities and their options:

¹ Ethernet is a trademark of Xerox, Inc.

Fixed Disk Utilities

Note: The Format Fixed-Disk utility erases all data on the fixed disk and reformats the fixed disk. Before using this utility, backup all data on the fixed disk being formatted.

Use the Format Fixed-Disk utility only when intermittent read or write errors have occurred on the fixed disk or the diagnostic programs instruct you to use this utility. The Format Fixed-Disk utility formats the fixed disk and writes new addresses on it.

Diagnostics Diskette Copy Utility

The Diagnostics Diskette Copy Utility provides a program to copy the diagnostics diskettes. The utility provides the following:

- A message when the **source** diskette is needed
- A message when the **target** diskette is needed
- A warning message to tell the system operator that the data on the target diskette will be destroyed
- Formatting of the target diskette
- Copying of the data from the source diskette to the formatted target diskette.

You may have to change the source and target diskettes during the copying procedure. A message displays to inform you when to change the diskettes.

Utilities for Use with ETHERNET

The Utilities for Use with ETHERNET provide a means to exercise the IBM RT PC Baseband Adapter and part of the Ethernet Network. The utility transmits a block of data addressed to itself. The utility then checks the response of the adapter and the network status to determine if it is operating correctly. This utility works with either the wrap plug or with a functioning Ethernet Network.

The result of the test is displayed in the UTILITIES FOR USE WITH ETHERNET SELECTION menu.

Show Installed Options Utility

The Show Installed Options Utility displays the installed features list created by the Loadable POST programs. All IBM adapters and devices installed in the system unit and recognized by the Loadable POST program are displayed. Use this list to check the configuration of the system.

Show and Change Diagnostic Test List Utility

The Show and Change Diagnostic Test List Utility displays the diagnostic test list. Menus guide you in changing the list. Only options that are installed in your system can be added to the list.

IBM 9332 Utilities

The IBM 9332 Utilities provide the following:

- A utility to download microcode to the IBM 9332 from a diskette.
- A utility to display and alter the Vital Product Data record on the IBM 9332 fixed disk.
- A utility to format the fixed disk on the IBM 9332. This utility erases all data and formats the fixed disk.

Advanced Diagnostic Routines

The Advanced Diagnostic Routines options allow the service technician to perform tests on the system unit that require special action such as installing wrap plugs or keying certain responses. The **Problem Isolation Charts (PICs)** use the Advanced Diagnostic Routines to perform the additional tests and repair checkouts.

The Advanced Diagnostic Routines run more extensive tests on the adapters that can be tested with wrap plugs than the Diagnostic Routines. If the configuration record on the fixed disk does not match the installed features list, the program displays the TEST OPTION or the DIAGNOSTIC TEST LIST menu.

When an option is listed in the configuration record, but is not sensed by the Loadable POST programs, the TEST OPTION menu displays. This menu indicates that either the option has been removed from the system, the option is failing, the switch settings have been changed, or the option has been moved to another slot.

When the Loadable POST programs sense an option that is not in the configuration record, the DIAGNOSTIC TEST LIST menu displays. This menu indicates an option has been added to the system. When an option is deleted from the DIAGNOSTIC TEST LIST menu, that option is not tested until added to the list using the Show and Change Diagnostic Test List Utility.

To run the Advanced Diagnostic Routines:

1. Press **Enter** after reading the DIAGNOSTIC OPERATING INSTRUCTIONS.
2. Choose Advanced Diagnostic Routines on the FUNCTION SELECTION menu.
3. Choose a checkout option on the ADVANCED DIAGNOSTIC SELECTION menu. An * (asterisk) by the ID number shows that the test has been run.

Installation Verification

The Installation Verification program compares the installed features list created by the Loadable POST programs to the configuration record on the fixed disk.

The Installation Verification program is run during installation and setup to check all the adapters and options after shipment. The program assumes the Diagnostic Routines were run after the last change to the system unit. Running the Diagnostic Routines updates the configuration record on the fixed disk.

To run the Installation Verification:

1. Press **Enter** after reading the DIAGNOSTIC OPERATING INSTRUCTIONS.
2. Choose Installation Verification on the FUNCTION SELECTION menu.
3. If the installed features list and configuration record do not match, follow the displayed instructions.

Two-Digit Display Codes During Diagnostic Programs

The following chart is for flashing (approximately one second) numbers displayed in the two-digit display while running the standalone diagnostic programs.

Number	Description of the Problem
02	A read error occurred while using the diskette drive.
99	A program check or a machine check occurred.
c6-xx	An undetermined error occurred.
c6-20	<p>Out of memory space.</p> <p>This can be caused by one of the following things on a system unit with 1M byte memory:</p> <ul style="list-style-type: none">• Diagnostic programs were ran following a utility program.• Diagnostic programs ran with the "Run Multiple Times" option selected.• Multiple diagnostic selections made. <p>To continue, insert RT PC Diagnostics 1 and press the Ctrl-Alt-Pause keys.</p>

Service Request Number Description

When a problem is detected with system operation, the Problem Determination Procedures (PDPs) in the *Problem Determination Guide* are used to determine the cause and corrective action. If the PDPs determine the failure is in the hardware, the system user is given a Service Request Number (SRN) to record for use by the service organization.

The SRN is used by the service technician to determine which field-replaceable unit (FRU) is needed to repair the system. The SRN contains from one to four **Service Repair Action (SRA)** numbers. Each SRA number represents a FRU or a special repair action.

The Problem Isolation Charts (PICs) in Section 3 use the SRA numbers to isolate the failure to a failing FRU. Appendix B contains an SRA to FRU Cross-Reference List to provide the service technician with the part number of the failing FRU.

An SRN always contains a **Source Number** and at least one SRA. See the following pages for a description of the source number and the SRA numbers. The following example of an SRN contains a source number and four SRA numbers.

1 3 - 2 3 4 - 1 0 0 - B 3 4 - D 6 4

Source Number

The left two digits of the SRN is the source number. The left digit of the source number identifies the device for the first SRA number. The FRUs for the other SRA numbers may be located in other devices. The right digit of the source number identifies the procedure that produced the SRN. The following table identifies the devices and procedures. Use the following SRN for an example.

13 - 234 - 100 - B34 - D64

Device	Procedure
1 - System unit	1 - Resident POST program
2 - Display	2 - Loadable POST program
3 - Keyboard	3 - Standalone diagnostic program
4 - Tape drive	4 - Licensed program product
5 - Printer	5 - Support center
6 - Plotter	6 - Problem determination procedures
7 - Expansion unit	7 - The device was not found when the diagnostic programs loaded
8 - Mouse	8 - Reserved
9 - Attached communications device	9 - Reserved
0 - Reserved	0 - Reserved
A - Tablet	
B - Dials Feature	
C - LPFK Feature	
E - Portable disk drive	

Service Repair Action Number

The remaining digits of the SRN are divided into three-digit SRA numbers. The left two digits of the SRA number is the FRU/PIC code. The right digit of the SRA number is the location number. Use the following SRN for an example.

1 3 - 2 3 4 - 1 0 0 - B 3 4 - D 6 4

FRU/PIC Code	Location
See the "Service Repair Action Number Chart" in Section 3 or Appendix B for more information.	1 - Adapter slot 1 2 - Adapter slot 2 3 - Adapter slot 3 4 - Adapter slot 4 5 - Adapter slot 5 6 - Adapter slot 6 7 - Adapter slot 7 8 - Adapter slot 8 9 - Reserved 0 - System board A through R - Identifies system board slots, drive positions, switch banks, or memory module positions.