USER'S GUIDE

ROM Loader

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TEXAS INSTRUMENTS

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The computers, as well as the programs that TI has created to use with them, are tools that can help people better manage the information used in their business; but tools—including TI computers—cannot replace sound judgment nor make the manager's business decisions.

Consequently, TI cannot warrant that its systems are suitable for any specific customer application. The manager must rely on judgment of what is best for his or her business.

Preface

This manual describes the operation of the read-only memory (ROM) loader for the Models 990/5, 990/10, 990/12, 990/10A Computers, and the Business Systems 300 (S300), Business Systems 300A (S300A), Business Systems 600 (S600), and Business Systems 800 (S800) Computers. The manual is directed to the individual who initially loads the operating system on one of these Texas Instruments computer systems.

The manual consists of the following sections and appendix:

Section

1 Introduction — Describes the ROM loader.

2 Operation — Explains how to perform the initial program load (IPL), and how to load from different devices.

3 Errors — Describes the loader error displays.

Appendix

A S300 and S300A Loader Error Code Display — Describes the method of displaying loader error codes.

The following Model 990 Computer manuals contain information related to the ROM loader:

Title	Part Number
Model 990/5 Computer Hardware User's Manual	946294-9701
Model 990/10 Computer System Field Maintenance Manual	945402-9701
Model 990/10A Computer General Description	2302633-9701
Model 990/12 Computer Hardware User's Guide	2264446-9701
Model 990A13 Chassis, General Description	2308774-9701
Model 990A13 Programmer Panel, Operation and Maintenance	2308789-9701
Business System 300 System Description Manual	2533308-9701
Business System 300 Operator's Guide	2533318-9702

Title	Part Number
Business System 300A Operator's Guide	2240275-9701
Business System 300A System Description Manual	2240276-9701

The following Model 990 Computer manuals contain information about the devices from which the ROM loader can load the system:

Title	Part Number
Model DS31/32 Disk Systems Installation and Operation	945260-9701
Model DS10 Cartridge Disk System Installation and Operation	946261-9701
DS25/DS50 Disk Systems Installation and Operation	946231-9701
Model DS80 Disk System Installation and Operation	2302629-9701
Model DS200 Disk System Installation and Operation	949615-9701
Model DS300 Disk System Installation and Operation	2302631-9701
Model FD1000 Flexible Disk System with International Chassis Installation and Operation	2250698-9701
Model 979A Magnetic Tape System Installation and Operation	946229-9701
Model FD800 Floppy Disk System Installation and Operation	2250697-9701
Model 733 ASR/KSR Data Terminal Installation and Operation	945259-9701
Operator's Guide, WD500/WD500A Disk Unit	2533269-9701
Operator's Guide, WD800 Disk Unit	2533319-9701
Model MT1600 Magnetic Tape System Installation and Operation	2302642-9701
Model CD1400 Disk System Field Maintenance Manual	945419-9706

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Introduction

1.1 GENERAL INFORMATION

The read-only memory (ROM) loader consists of a set of ROM integrated circuits that contain the loader, the self-test routine, and the front panel control routine for the following computers: Models 990/5, 990/10, 990/12 LR, 990/10A, and the Business Systems 300 (S300), Business Systems 300A (S300A), Business Systems 600 (S600), and Business Systems 800 (S800) Computers.

The loader performs the following functions:

- Executes a self-test routine for the computer
- Controls the front panel
- Transfers code (usually an operating system) from the load medium to computer memory
- Transfers control to the loaded code

1.2 LOADING DEVICES

The set of devices from which you can load an operating system for Models 990/5, 990/10, 990/12, 990/10A, 990/12 LR, and the Business Systems 600 and 800 includes the following:

- TILINE™ disk units
- An FD1000 diskette unit
- An FD800 diskette unit
- A Model 733 ASR cassette unit
- A magnetic tape unit
- A maintenance diagnostic unit (MDU) cassette

The set of devices from which you can load an operating system for the Business System 300 or the Business System 300A includes:

- PBUS disk units (such as WD500, WD500A, and WD800 disk units)
- A WD800 magnetic tape unit
- An MDU cassette

Prior to loading, the loader executes a self-test routine appropriate for the computer involved. Next, the loader transfers the code from the load medium into computer memory. The loader then transfers control to the code it has loaded.

2

Operation

2.1 ROM LOADER OPERATION

The following paragraphs describe the various operations of the ROM loader.

When loading from a hard disk or from a double-sided, double-density (DSDD) diskette, the loader loads memory image code. Track 0, sector 0 contains the following three parameters for the loader:

Parameter	Byte Address	Contents
Track number	>0E, >24	Each contains the memory image track number. (Address >0E is relative to the start of sector 0.) The track number occupies one full word.
Entry point	>18	Contains the address in memory to which the loader transfers control.
Length of block	>1A	Contains the length of the block of code (in bytes).

NOTE

A right angle bracket (>) preceding a value indicates a hexadecimal value.

The ROM loader also allows you to load an alternate program when loading from a hard disk or from a DSDD diskette. To load an alternate program one time, place the loader parameters for that program in track 0, sector 0 as follows:

- Place the track number at byte address >0E.
- Place the entry point at >1C.
- Place the length at >1E.

The contents of addresses >18, >1A, and >24 (normal program load point, length, and track address, respectively) remain unaltered.

When loading from a single-sided, single-density (SSSD) diskette (on an FD800 unit), the loader loads memory image code from track 0. The last word of each sector is a flag, not code. When the last word of a sector is not equal to >FFFF, loading continues. When the last word of a sector is equal to >FFFF, the loader moves the device number into the load address, >A0, and transfers control to the instruction loaded into address >A2.

The loader loads object code when loading from a magnetic tape or cassette, either from a 733 automatic send/receive terminal (ASR) or the MDU cassette unit.

2.2 LOAD OPTIONS

Load options depend on the type of front panel or control unit you use. Types of front panels are the programmer panel, the operator panel, and the control/display module (CDM). The MDU is a control unit.

The 990/5, 990/10, and 990/12 computers can use a programmer panel, an operator panel, or an MDU.

The 990/10A, S600, and S800 computers use a CDM. The 990/10A, S300, S300A, S600, and S800 computers can also use an MDU to load a routine from the MDU cassette unit. An optional programmer panel is available for these computers.

The S300 and S300A use a video display terminal (VDT) to monitor and control loader operation. The S300 and S300A also provide a programmer panel connector for connecting a programmer panel or MDU.

The load medium is the disk, diskette, magnetic tape reel, magnetic tape cartridge, or cassette that contains the software you plan to load. This manual refers to the device in which you mount the load medium as the *load device*.

2.3 LOAD PROCEDURES FOR 990/5, 990/10, AND 990/12 COMPUTERS

You can load a routine from a load device by using a programmer panel, an operator panel, or an MDU.

2.3.1 Using the Programmer Panel

When the programmer panel is connected, the ROM loader loads a routine from disk unit 0 on the controller at TILINE address >F800 by default. You can alter the contents of addresses in memory to select another disk unit, a magnetic tape unit, or another device. When the specified disk unit or tape unit is not ready, the loader waits continuously for the device to be made ready.

You can use the switches on the programmer panel to select the load device. The programmer panel indicators display any error codes that the self-test or the loader issues.

2.3.1.1 Loading From a Default Disk Unit. The default disk unit is unit 0 of the disk controller at TILINE address >F800. Although you can select write protection for the disk, the software that you load often requires that the write protection be off.

This load procedure applies to DSDD diskettes mounted in diskette units connected to a TILINE controller, and to various types of hard disks used with 990 computers.

To load a routine from a default disk unit, perform the following steps at the programmer panel:

1. Press the HALT/SIE switch.
2. Press the RESET switch.
3. Press the LOAD switch.

2.3.1.2 Loading From a Specific Disk Unit. This procedure applies when the load device is a disk unit other than unit 0 on the disk controller at TILINE address >F800. Although you can select write protection for the disk, the software that you load often requires that the write protection be off.

This load procedure applies to DSDD diskettes mounted in diskette units connected to a TILINE controller, and to various types of hard disks used with 990 computers.

To load a routine from a specific disk unit, perform the following steps at the programmer panel:

1. Press the HALT/SIE switch.
2. Press the RESET switch.
3. Press the CLR switch.
4. Set the data switches to >0084.
5. Press the MA switch under ENTER.
6. Press the CLR switch.
7. Set the data switches to the select code shown in Table 2-1 for the load device.
8. Press the MDE switch.
9. Press the LOAD switch.

Table 2-1. Disk Unit Select Codes

Disk Unit	Select Code
0	>0800
1	>0400
2	>0200
3	>0100

2.3.1.3 Loading From a Different Controller Address. This procedure applies when the disk controller that you desire is not at TILINE address >F800. Although you can select write protection for the disk, the software that you load often requires that write protection be off.

This load procedure applies to DSDD diskettes mounted in diskette units connected to a TILINE controller, and to various types of hard disks used with 990 computers.

To load a routine from a different controller address, perform the following steps at the programmer panel:

1. Press the HALT/SIE switch.
2. Press the RESET switch.
3. Press the CLR switch.
4. Set the data switches to >0082.
5. Press the MA switch under ENTER.
6. Press the MDD switch.
7. Set the data switches to the TILINE address of the disk controller that you desire.
8. Press the MDE switch.
9. Press the MAI switch to increment the memory address.
10. Set the data switches to the select code shown in Table 2-1 for the load device.
11. Press the MDE switch.
12. Press the LOAD switch.

2.3.1.4 Loading From Magnetic Tape. You must perform the following steps before loading a routine from magnetic tape:

1. Mount the load magnetic tape reel.
2. Position the tape at the load point.
3. Make the tape unit ready.

To load a routine from magnetic tape, perform the following steps at the programmer panel:

1. Press the HALT/SIE switch.
2. Press the RESET switch.
3. Press the CLR switch.

4. Set the data switches to >0082.
5. Press the MA switch under ENTER.
6. Press the MDD switch.
7. Set the data switches to the TILINE address of the magnetic tape controller that you desire (typically, >F880).
8. Press the MDE switch.
9. Press the MAI switch to increment the memory address.
10. Set the data switches to the select code shown in Table 2-2 for the load device.
11. Press the MDE switch.
12. Press the LOAD switch.

Table 2-2. Tape Unit Select Codes

Disk Unit	Select Code
0	>0800
1	>0400
2	>0200
3	>0100

2.3.1.5 Loading From an SSSD Diskette. Before attempting to load from a diskette, perform the following steps:

1. Verify that the diskette controller is installed at CRU address >0080.
2. Ensure that the load diskette is mounted.
3. Verify that the diskette unit is in the ready state.

If diskette unit 0 is not the load device, the units with numbers lower than the load device must not be ready.

To load a routine from an SSSD diskette, perform the following steps at the programmer panel:

1. Press the HALT/SIE switch.
2. Press the RESET switch.
3. Press the CLR switch.

4. Set the data switches to >0080.
5. Press the MA switch under ENTER.
6. Press the MDE switch.
7. Press the LOAD switch.

2.3.1.6 Loading From a Cassette. Before loading software from a cassette, perform the following steps:

1. Ensure that the 733 ASR is at CRU address >0000 (for a 990/10 or 990/12 computer) or at CRU address > 1700 (for a 990/5 computer).
2. Verify that the cassette is mounted in the playback cassette unit (determined by the position of the RECORD/PLAYBACK switch on the 733 ASR switch panel).
3. Ensure that the cassette tape is positioned at the load point; if necessary, move it to this point by rewinding to the beginning of the tape and pressing the LOAD switch for the cassette unit.
4. Verify that the TAPE FORMAT switch on the switch panel is set to the LINE position.

To load a routine from a cassette, perform the following steps at the programmer panel:

1. Press the HALT/SIE switch.
2. Press the RESET switch.
3. Press the CLR switch.
4. Set the data switches to >0080.
5. Press the MA switch under ENTER.
6. Press the CLR switch.
7. Press the MDE switch.
8. Press the LOAD switch.

2.3.2 Using the Operator Panel

When the operator panel is connected, the loader attempts to load a routine from the magnetic tape unit on a controller at TILINE address >F880, or from a disk unit at TILINE address >F800. A search algorithm performs the following steps to determine the sequence of units from which the loader attempts to load the system:

1. It searches for the lowest-numbered and ready magnetic tape unit at >F880. If it finds the unit, it loads from it.

2. It searches for the lowest-numbered, ready, and write-protected disk unit at >F800. If it finds the unit, it loads from it.

3. It searches for the lowest-numbered, ready, and not write-protected disk unit at >F800. If it finds the unit, it loads from it.

If no device is ready, the loader returns to step 1 and continues to attempt to locate a ready device. If you mount a tape or disk and make it ready, the loader loads from that tape or disk.

2.3.2.1 Loading From a Disk. The operator panel does not provide any means of selecting the load device. The processor selects the load device using the preceding search algorithm.

These load procedures apply to DSDD diskettes mounted in diskette units connected to a TILINE controller, and to various types of hard disks used with 990 computers.

The default disk unit is unit 0 of the disk controller at TILINE address >F800. Although you can select write protection for the disk, the software that you load often requires that the write protection be off.

To load a routine from a write-protected disk unit, perform the following steps at the operator panel:

1. Ensure that no ready magnetic tape unit is connected to the controller at TILINE address >F880.

2. Ensure that the lowest-numbered, ready, and write-protected disk unit on the controller at TILINE address >F800 is the load device.

3. Turn the key switch on the programmer panel to the LOAD position and release it.

To load a routine from a disk unit that is not write-protected, perform the following steps at the operator panel:

1. Ensure that no ready magnetic tape unit is connected to the controller at TILINE address >F880.

2. Ensure that no ready and write-protected disk unit is on the controller at TILINE address >F800.

3. Ensure that the lowest-numbered and ready disk unit on the controller at TILINE address >F800 is the load device that you desire.

4. Turn the key switch on the operator panel to the LOAD position and release it.

2.3.2.2 Loading From Magnetic Tape. You must perform the following steps before loading a routine from magnetic tape:

1. Mount the load magnetic tape reel.

2. Position the tape at the load point.

3. Make the tape unit ready.

The operator panel provides no means of selecting the load device. Therefore, selecting the load device requires that lower-numbered magnetic tape units not be ready. The load device must be connected to the controller at TILINE address >F880.

To load a routine from magnetic tape, perform the following steps at the operator panel:

1. Ensure that all magnetic tape units on the controller at TILINE address >F880 with numbers lower than that of the load device you desire are not ready.

2. Turn the key switch on the operator panel to the LOAD position and release it.

2.3.3 Using the MDU

To load software from the MDU, verify that the MDU is connected in place of the computer's programmer panel. Mount the load cassette in the MDU cassette unit. The loader attempts to load a routine from the MDU cassette unit whenever the MDU is connected. The *Model 990/10 Computer System Field Maintenance Manual* describes the MDU in detail.

To load a routine from the MDU cassette, perform the following steps:

1. Press the RESET switch on the MDU.

2. Press the REWIND switch on the MDU.

3. Press the HALT/SIE switch on the MDU programmer panel.

4. Press the RESET switch on the MDU programmer panel.

5. Press the LOAD switch on the MDU (*not on the MDU programmer panel*).

2.4 LOAD PROCEDURES FOR 990/10A, 990/12 LR, S600, AND S800 COMPUTERS

The CDM is normally used as the front panel to load a routine from a device for the S600 and S800. However, the loader attempts to load a routine from the MDU cassette unit whenever the MDU is connected. An optional programmer panel is available for data entry or for modifying programs. For more information concerning the operation of the optional programmer panel, see the *Model 990A13 Programmer Panel Operation and Maintenance* manual. The programmer panel load procedures for the 990/5, 990/10, and 990/12 also apply to the 990/10A, 990/12 LR, S600, and S800 computers.

The CDM has four hexadecimal digits for displaying program data, and four light-emitting diodes (LEDs) for displaying the state of the system. Together, these indicators also display error codes.

The four hexadecimal digits are under program control when the central processing unit (CPU) is in the run mode. When you use the HALT switch to halt the CPU, the program counter for the next instruction appears. The POWER LED (green) lights to indicate that the computer chassis is receiving ac power. The FAULT LED (red), under program control, lights to indicate self-test, loader, or operating system errors. Section 3 explains the error codes that appear. The *Model 990A13 Chassis Maintenance Manual, General Description* describes the CDM provided with the computer chassis in detail.

2.4.1 Using the CDM

You can use the CDM to load from a default disk, or to load from a unit found by a search algorithm.

2.4.1.1 Loading From the Default Disk Unit. Before performing this loading procedure, be sure that the load disk is mounted and the load device is ready. This load procedure applies to DSDDs mounted in diskette units, as well as to the various types of hard disks connected to a TILINE controller.

To load a routine from the default disk (unit 0) at TILINE address >F800 using the CDM, perform the following steps:

1. Ensure that the disk unit at TILINE address >F800 is ready.
2. Press the HALT switch.
3. Press the LOAD switch.

2.4.1.2 Loading From a TILINE Device. The ALT LOAD (alternate load) switch commands the processor to load from the lowest-numbered and ready TILINE device found. When an MDU is not connected, a search algorithm performs the following steps to determine the sequence of units from which the loader attempts to load the system.

1. It searches for a ready magnetic tape or cartridge tape unit at >F880, units 0 through 3. If it finds the unit, it loads from it.
2. It searches for a ready disk unit at >F800, units 0 through 3, that is not write protected. If it finds the unit, it loads from it.

3. It searches for a ready disk unit at >F810, units 0 through 3, that is not write protected. If it finds the unit, it loads from it.

4. It searches for a ready disk unit at >F820, units 0 through 3, that is not write protected. If it finds the unit, it loads from it.

5. If it fails to find a ready and not write-protected load device, it returns to step 2 and begins the search for a ready and write-protected disk. If it finds a ready and write-protected disk unit, it loads from it.

6. If it fails to find a ready and write-protected disk unit, it returns to step 1 and restarts the search for a ready load device.

The following load procedure applies to DSDD diskettes mounted in diskette units connected to a TILINE controller, various types of hard disks used with 990 computers, and magnetic or cartridge tape units. The following steps detail how to load a routine from a ready device, at the TILINE address identified by the search algorithm:

1. Ensure that the load device is mounted, ready, and connected to the appropriate TILINE address.

2. Ensure that the load device you desire is the first, ready, and lowest-numbered load device that the search algorithm finds.

3. Press the HALT switch.

4. Press the ALT LOAD switch.

2.4.2 Using the MDU

To load software from the MDU, verify that the MDU is connected via the computer's CDM. Mount the load cassette in the MDU cassette unit. The loader attempts to load a routine from the MDU cassette unit whenever the MDU is connected. The *Model 990/10 Computer System Field Maintenance Manual* describes the MDU in detail.

To load a routine from the MDU cassette, perform the following steps:

1. Press the RESET switch on the MDU.

2. Press the REWIND switch on the MDU.

3. Press the HALT/SIE switch on the MDU programmer panel.

4. Press the RESET switch on the MDU programmer panel.

5. Press the LOAD switch on the MDU (*not on the MDU programmer panel*).

2.5 LOAD PROCEDURES FOR S300 AND S300A COMPUTERS

The S300 and S300A normally use a VDT to monitor and control loader operation. The S300 and S300A also provide an auxiliary programmer panel connector for connecting a programmer panel or MDU.

Either automatic or manual loading of system software can take place following a self-test. The following paragraphs describe automatic and manual loading operations using the VDT. Subsequent paragraphs describe the use of a programmer panel for loading operations.

2.5.1 Automatic Loading

The automatic self-test and load routine initiates when you first turn on the S300 unit. When the self-test successfully completes, automatic loading is attempted unless you select the manual load option mode (refer to paragraph 2.5.2 for the method of selecting this option). If a programmer panel or MDU is connected, automatic loading will not occur. If you use a write-protected disk as the source for the load, you must load the system from a programmer panel, or use the manual load option mode. A search algorithm performs the following steps to determine if automatic loading can occur, and it identifies the load device for automatic loading:

1. It loads from the device defined by using the progammer panel if a programmer panel is connected. (Operator intervention is required to load. See paragraph 2.5.3.)

2. It loads from the MDU load device if the MDU is connected. (Operator intervention is required to load. See paragraph 2.5.4.)

3. It searches units 0 through 3 at peripheral control space (PCS) >F880 for the lowest-numbered and ready magnetic tape unit (WD800 MTC). If it finds a unit, it loads from it.

4. It searches units 0 through 3 at PCS >F800 for the lowest-numbered and ready disk unit that is not write protected. If it finds a unit, it loads from it.

5. It searches units 0 through 3 at PCS >F820 for the lowest-numbered and ready disk unit that is not write protected. If it finds a unit, it loads from it.

6. If it fails to find a ready load device, it returns to step 3 and continues the search for a ready load device.

2.5.2 Option Mode Manual Loading

The option mode of operation allows you to use the VDT to:

- Designate the load device.
- Load from a write-protected disk.
- Select self-test and load.
- Enter the extended test mode of operation. (Section 3 explains this test mode in greater detail.)

You can enter the option mode in one of the following two ways:

- Press the ESC key during the five-second display of the SELF-TEST COMPLETE message (prior to initiating system load).
- Press the ESC key to exit the extended self-test function. Figure 2-1 shows a menu that appears when you enter the option mode on an S300 computer. Figure 2-2 shows a menu that appears when entering the option mode on an S300A computer.

```
F1 - SELECT LOAD DEVICE

F2 - SELF-TEST & LOAD

F3 - SELF-TEST

F4 - FAULT LIGHT TEST

F5 - KEYBOARD ECHO

F6 - BURST CHAR TO SCREEN

F7 - EXTENDED SELF-TEST

FUNCTION:
```

Figure 2-1. S300 Option Mode Menu

```
F1 - SELECT LOAD DEVICE

F2 - SELF-TEST & LOAD

F3 - SELF-TEST

F4 - DIAGNOSTIC LED TEST

F5 - KEYBOARD ECHO

F6 - BURST CHAR TO SCREEN

F7 - EXTENDED SELF-TEST

FUNCTION:
```

Figure 2-2. S300A Option Mode Menu

The S300 and S300A allow you to select option mode functions by pressing keys F1 through F7. The option mode functions and their corresponding keys are as follows:

- F1 — SELECT LOAD DEVICE

  Press function key F1 to display the select load device menu shown in Figure 2-3.

```
F1 - DISK @ >F800

F2 - DISK @ >F820

F3 - TAPE @ >F880

ENTER PCS <F-KEY>,UNIT <0-3> <CR>:
```

Figure 2-3. Select Load Device Menu

To return to the option mode menu, press the ESC key. To select a load device, perform the following steps:

1. Press function key F1, F2, or F3 to identify the PCS of the load device. The function key that you press and a comma will appear on the VDT.

2. Press number key 0, 1, 2, or 3 to select the unit number of the load device you desire. Table 2-3 lists the PCS address and unit number combinations you can select. If you have entered the load parameters, but have not pressed the RETURN key, you can select a different load device by pressing the ESC key to return to the select load device menu. You can return to the option mode menu by pressing ESC a second time.

3. Press the RETURN key to activate the load process.

The following message appears to indicate that you have activated the load process:

INITIATING LOAD

The loader attempts to load from the device you select if the device is ready and has the appropriate loadable code. The protection status of the device (write-protected or not write-protected) will not affect the load.

Table 2-3. Load Device Function Keys

Function Key	PCS Address	Unit No.	Device Type
F1	>F800	0	Disk
F1	>F800	1	Disk
F1	>F800	2	Disk
F1	>F800	3	Disk
F2	>F820	0	Disk
F2	>F820	1	Disk
F2	>F820	2	Disk
F2	>F820	3	Disk
F3	>F880	0	Tape
F3	>F880	1	Tape
F3	>F880	2	Tape
F3	>F880	3	Tape

- F2 — SELF-TEST & LOAD

  Press function key F2 to initiate a normal self-test and load sequence. The sequence used here is the same sequence used at power-up without operator intervention, except that the terminal electronics are not tested.

- F3 — SELF-TEST

  Press the F3 function key to display the following self-test prompt:

  LOOP ON SELF-TEST <Y/N>:

  You can respond in one of the following three ways:

  1. Press the Y key to initiate a continuous self-test loop. This self-test is the same self-test performed at power-up except that the terminal electronics are not retested. The bell sounds at the end of each pass and the following message appears for five seconds:

     SELF-TEST COMPLETE

     While the SELF-TEST COMPLETE message is present, press the ESC key to terminate the self-test loop. When you terminate the self-test loop:

     a. The loop pass count and number of errors logged appear in the upper right-hand corner of the display.

     b. The option mode menu appears.

  2. Press the N key to execute the self-test loop one time and then return to the option mode menu.

3. Press the ESC key to display the option mode menu. The self-test will not execute.

- F4 — FAULT LIGHT TEST (S300)

- F4 — DIAGNOSTIC LED TEST (S300A)

To verify that the processor self-test LED error indicators will light, perform the following:

1. Press function key F4. All eight LEDs blink continuously and one of the the following messages appears on the VDT screen.

   CHECK FAULT LIGHTS: (S300)
   CHECK DIAGNOSTIC LEDs: (S300A)

2. Press the ESC key to return to the option mode menu and to return the LEDs to their original state.

- F5 — KEYBOARD ECHO

Press function key F5 to erase the VDT screen. The following message appears in the upper left-hand corner of the screen:

KEYBOARD ECHO:

You can now press any key which represents a displayable character to make it appear on the VDT screen. Press the ESC key twice to return to the option mode menu.

CAUTION

Nondisplayable characters echoed to the screen may reconfigure the terminal logic to a state that requires you to cycle the power in order to recover; therefore, use only displayable characters in this test.

- F6 — BURST CHAR TO SCREEN

You can use the burst character feature to make CRT adjustments by performing the following steps:

1. Press function key F6 to erase the VDT screen. The following message appears in the upper left-hand corner of the screen:

   BURST CHAR:

2. Any displayable character key that you press now appears on the screen in a continuous character string.

3. Press the ESC key to stop the output to the screen and return to the option mode menu.

- F7 — EXTENDED SELF-TEST

  Press F7 to enter the extended self-test mode and display the extended self-test mode menu. Section 3 explains the extended self-test mode menu.

2.5.3 Using the Programmer Panel

The S300 or S300A programmer panel connector, located on the processor board (connector P22), provides a connection for a standard 990 computer programmer panel (part number 946712-0001). You can use the programmer panel to load the operating system, diagnostic operating control system (DOCS), or other software. The programmer panel controls the loader ROM to permit manual control by the operator.

When power is applied and a programmer panel is detected, the system causes a software halt, transfers control to the programmer panel, and waits for your action. The automatic search algorithm for a load device is not used when the programmer panel is attached. Instead, the system attempts to load from the device that the programmer panel selects. At this point, you can perform one of the following actions.

1. Initiate a load sequence from disk unit 0 at PCS address >F800 *without* running the self-test by pressing HALT/SIE, CLR, RESET, and LOAD.

2. Initiate a load sequence from disk unit 0 at PCS address >F800 *and* run the self-test before the load by:

   a. Pressing HALT/SIE and RESET.

   b. Entering a nonzero number on the data display and pressing LOAD.

3. Initiate a load sequence from a device other than disk unit 0. See Table 2-4 and Table 2-5 for a list of possible load device PCS addresses and unit select codes you need in this sequence, and perform the following steps:

   a. Press HALT/SIE, RESET, and CLR.

   b. Set the data switches to >0082.

   c. Press the MA switch under ENTER.

   d. Press MDD switch.

   e. Set the data switches to the PCS address of the load device that you desire.

   f. Press the MDE switch.

   g. Press the MAI switch.

   h. Set the data switches to the unit number code of the load device that you desire.

i. Press the MDE switch.

j. If you want the self-test to run prior to the load, enter a nonzero number on the data switches and press LOAD.

k. If you want only the load (no self-test), press CLR and LOAD.

NOTE

The load is attempted regardless of the load device status (for instance, whether or not the disk is write-protected).

Table 2-4. Load Device PCS Address

Load Device	PCS Address
Disk	>F800 (default address)
Disk	>F820
Magnetic Tape	>F880

Table 2-5. Load Device Unit Select Codes

Unit	Disk Unit Select Code	Tape Unit Select Code
0	>0800 (default unit)	>8000
1	>0400	>4000
2	>0200	>2000
3	>0100	>1000

2.5.4 Using the MDU

You can connect an MDU to the S300 or S300A programmer panel connector (P22). If you do connect an MDU, the automatic search algorithm for a load device is not used. On power-up the system causes a software halt, transfers control to the MDU, and waits for your action. The *Model 990/10 Computer System Field Maintenance Manual* describes the MDU in detail.

To load a routine from the MDU cassette, perform the following steps:

1. Press the RESET switch on the MDU.
2. Press the REWIND switch on the MDU.
3. Press the HALT/SIE switch on the MDU programmer panel.
4. Press the RESET switch on the MDU programmer panel.
5. Press the LOAD switch on the MDU (*not on the MDU programmer panel*).

3

Errors

3.1 INTRODUCTION

Two types of errors can occur when you use the ROM loader:

- Self-test errors
- Loader errors

The ROM loader contains a self-test routine that executes before the loader executes. The self-test exercises the computer to verify that it can load and execute software. If not, the self-test indicates an error and halts without completing the load operation. The error indications appear on the programmer panel, the CDM, or the VDT screen. Error indicators on the computer circuit boards supplement these error indications. The tests (and therefore the error indicators) differ for each computer. The following paragraphs describe self-test errors.

Loader error codes appear on the programmer panel for the 990/5, 990/10 and 990/12 computers. The S300 and S300A loader error codes appear on the self-test LEDs and on the VDT screen. The 990/10A, 990/12 LR, S600, and S800 loader error codes appear on the CDM.

3.2 SELF-TEST ERRORS

The following paragraphs discuss self-test errors.

3.2.1 Model 990/5 Computer Self-Test Errors

The self-test for the 990/5 computer includes the following tests:

- CPU test — Exercises CPU instructions
- Memory test — Checks all memory locations through >F7FE except for the workspace used by the self-test routine
- Input/output (I/O) port test — Exercises the TMS 9902 and TMS 9903 I/O ports in the test mode provided in the port circuits
- ROM checksum test — Verifies the integrity of the contents of the ROM loader

When the CPU test fails, the computer enters a loop. The display on the programmer panel is undefined and the RUN and FAULT indicators light. You cannot execute until you repair the CPU.

When the memory test fails, the self-test flashes the failing memory address on the programmer panel display. The address displays five times, with the FAULT indicator off. The IDLE, FAULT, and RUN indicators then light. Press HALT and RUN to execute the loader.

To display the failing memory address (in register R7 of the self-test workspace), press the HALT/SIE switch and the MA switch under DISPLAY on the programmer panel.

When the I/O port test fails, the self-test flashes the CRU address of the failing I/O port on the programmer panel display five times, with the FAULT indicator lit. The IDLE and RUN indicators also light. Press HALT and RUN to execute the loader.

To display the CRU address of the failing I/O port (in register R7 of the self-test workspace), press the HALT/SIE switch and the MA switch under DISPLAY on the programmer panel.

When the ROM checksum test fails, the computer enters a loop. The value >FFFF appears on the programmer panel, the RUN indicator remains illuminated, and the FAULT indicator flashes.

3.2.2 Model 990/10 Computer Self-Test Errors

The 990/10 computer self-test verifies the integrity of the contents of the ROM loader.

When the 990/10 computer self-test fails, the computer enters a loop. The value >FFFF appears on the programmer panel, the RUN indicator remains illuminated, and the FAULT indicator flashes.

3.2.3 Models 990/12, 990/12 LR, and S800 Computers Self-Test Errors

Table 3-1 lists the self-tests for the 990/12, 990/12 LR, and S800 computers.

The self-tests for the 990/12, 990/12 LR, and S800 computers perform the following tests:

- Microcode test — Executes an Execute Micro Diagnostic (EMD) instruction to test the hardware
- Assembly language instructions test — Exercises assembly language instructions (full /12 set — 144 instructions)
- TILINE operation test — Exercises the TILINE addressing and mapping circuits
- Memory test — Exercises locations >00000 through >000FE, >00120 through >0F7FE, and >10000 through >1FFFE.

Table 3-1. Self-Tests for the 990/12, 990/12 LR, and S800 Computers

Number	Description
1	Microcode
2	Assembly language instructions
3	TILINE operation
4	Memory
5	Level 2 (internal) interrupt
6	Levels 3 through 15 (external) interrupts

- Internal interrupt test — Checks that an interrupt actually occurs for each internal error condition and that the interrupt sets the error interrupt status register correctly

- External interrupt test — Verifies that the interrupt priority is observed and that lower-priority pending interrupts occur when higher-priority interrupt processing completes

The programmer panel and the fault indicators on the arithmetic unit (AU) and system memory interface (SMI) boards of the CPU indicate errors in executing the 990/12 or 990/12 LR self-tests. The CDM and the fault indicators on the AU and SMI boards of the CPU indicate S800 self-test errors. Table 3-2 lists the error codes appearing on the programmer panel or on the CDM, and the number of the test that failed. Refer to Table 3-1 for the test numbers.

When an error occurs in a test, the FAULT indicator on the programmer panel lights. Table 3-2 illustrates additional indicators that can light.

When the load device is the MDU cassette, the RUN indicator on the programmer panel remains off. The procedure for executing the loader without having successfully completed the self-test does not apply. Repairing the computer is the only recovery when loading from the MDU cassette.

To repair the computer, notice the FAULT indicators on the AU and SMI boards. If the FAULT indicator lights on only one board, replace that board. If both FAULT indicators light or are off, replace both boards.

Table 3-2. Models 990/12, 990/12 LR, and S800 Computers Self-Test Errors

Error Code (Hexadecimal)	RUN	AU Fault	SMI Fault	Lock-Up	Test Number(s)*
0000	Off	Off	Off	Yes	1
0000	Off	On	Off	Yes	1
0000	Off	Off	On	Yes	1
0100	On	Off	Off	Yes	2-6
xxxx (IDLE)	On	Off	Off	No	2-6
0400	On	Off	Off	No	2
0800	On	Off	Off	No	3
1000	On	Off	Off	No	4
2000	On	Off	Off	No	5
4000	On	Off	Off	No	6

Note:

* See Table 3-1 for a listing of the tests.

Some of the errors leave the computer locked up. In the lock-up condition, the computer executes microcode without returning to the instruction level. The HALT/SIE switch on the programmer panel cannot transfer control to the programmer panel routine. That is, none of the switches on the programmer panel affect the computer operation. To recover from a lock-up, turn the ac power to the computer off and then on. The ac power switch is at the back of the computer chassis.

CAUTION

To load software when the self-test fails, you can enter the loader routine at the starting address and execute the loader. However, the hardware failure that caused the self-test to fail may interfere with the loading or execution of the software. The failure may also destroy the software or other data on the load medium. Do not attempt to execute the loader following a self-test failure unless you can solve the problem or have a backup copy of the load medium.

3.2.3.1 Loading the 990/12 and 990/12 LR Computers When the Self-Test Fails. To load the 990/12 or 990/12 LR when the self-test fails, perform the following steps at the programmer panel. (This procedure does not apply when you are loading software from the MDU cassette or CDM.)

1. Press the HALT/SIE switch.
2. Press the CLR switch.
3. Set the data switches to >0080.
4. Press the MA switch under ENTER.
5. Press the MDD switch to display the contents of address >0080.
   a. When loading from a disk, DSDD diskette, or magnetic tape, skip to step 8 if the display shows a negative number.
   b. When loading from an SSSD diskette, skip to step 16 if the display shows a positive number.
   c. When loading from a 733 ASR cassette, skip to step 16 if the display shows zero.
6. Perform one of the following substeps that applies to the loading device:
   a. When loading from a disk, DSDD diskette, or magnetic tape, set the data switches to >8000.
   b. When loading from an SSSD diskette, press the MA switch under DISPLAY to enter a positive number (>0080) in the data LEDs.
   c. When loading from a 733 ASR cassette, press the CLR switch to clear the data LEDs.

7. Press the MDE switch. When loading from an SSSD diskette or a 733 ASR cassette, skip to step 16.

8. Press the MAI switch.

9. Press the MDD switch to display the TILINE address of the loading device. The typical TILINE address is >F800 for a disk or DSDD diskette and >F880 for magnetic tape.

10. If the TILINE address is correct, skip to step 12. If the address is not correct, set the data switches to the correct TILINE address.

11. Press the MDE switch.

12. Press the MAI switch.

13. Press the MDD switch to display the unit select code. Table 3-3 lists the correct codes.

14. When the unit select code is correct, skip to step 16. If the unit select code is not correct, set the data switches to the correct unit select code.

15. Press the MDE switch.

16. Set the data switches to >FC1C (>FC1A for the 990/12 LR, S800)

17. Press the PC switch under ENTER.

18. Press the RUN switch.

Table 3-3. Load Device Unit Select Codes

Disk or Tape Unit	Disk Unit Select Code	Tape Unit Select Code
0	>0800	>8000
1	>0400	>4000
2	>0200	>2000
3	>0100	>1000

3.2.4 Model 990/10A and S600 Computers Self-Test Errors

The 990/10A and the S600 computers contain a self-test routine to verify the proper operation of the processor before loading the operating system. The self-test normally executes on power-up, as well as before loading. When an error occurs, the self-test results appear on the CDM. The *Model 990/10A Computer, General Description* provides a flowchart of the 990/10A self-test code.

The CDM has four hexadecimal digits for displaying program data and four LEDs for displaying the system state. Together, these indicators also display error codes.

The POWER LED (green) lights whenever the computer chassis receives ac power.

The FAULT LED (red) lights while the self-test executes. The FAULT LED remains on or it flashes when self-test, loader, or operating system errors occur.

The loader/self-test code controls the RUN LED (green) after power-up. When you press the HALT switch, the processor operation halts and the RUN LED goes out. It lights again when the RUN switch restores processor operation.

The IDLE LED (green) lights whenever the processor executes the IDLE instruction. This LED generally either indicates processor activity or distinguishes types of error codes.

Additional LED indicators are on the top edge of the printed wiring board (PWB). To see these indicators, look into the chassis interior. The following paragraphs explain these indicators.

The MAJ FAULT LED, located on the PWB, lights at power-up and goes out after the kernel test portion of the self-test shows that no major fault exists within the microprocessor-ROM core of the board. The MAJ FAULT LED should light when you initially apply power to the board. If this LED fails to go out, the processor may have a failure that prohibits displaying other error indicators.

The FAULT LED, located on the PWB, is a duplicate of the FAULT indication on the CDM. It is software controlled to show a self-test, loader, or operating system fault.

The remaining LEDs on the PWB provide service personnel with indications of a failed memory component. This information is also available to software through the memory error log and it does not generally require your attention.

Some of the self-tests that the self-test routine performs are as follows:

- Self-test ROMs cyclical redundancy check (CRC)
- Scratch-pad random-access memory (RAM) test
- Representative sample instruction execution
- Map chip, address buffer, and address latch check
- RAM test
- TILINE test

- CRU and interrupt check
- Nonload path logic test
- Load device verification test (executes only before a load is attempted)

FFFF appears on the CDM when the self-test begins to execute. As each section of the self-test completes, the bit position corresponding to the completed section changes to 0 if the section completes with no errors. The bit position appears as a hexadecimal code on the CDM. Table 3-4 lists the self-test section results and the number of the LED that corresponds to each result.

NOTE

While the RAM test is executing, the front panel LEDs alternately display >0F0F and >F0F0. After the RAM test completes, the front panel display resumes its error information display. With a fully populated 990/10A board, the RAM test can take a full minute to complete.

If all sections of the general fault test execute successfully, the FAULT LED goes out and the RUN LED lights. If the general fault test is unsuccessful, the FAULT LED lights and the CPU remains idle, with the IDLE LED on.

The self-test error codes provide maximum visibility to the Field Service personnel using the 990 programmer panel. Figure 3-1 shows the programmer panel display and the CDM display together. Each hexadecimal display on the CDM corresponds to the four binary LEDs on the programmer panel.

At the beginning of the self-test, all of the programmer panel LEDs light (hexadecimal code >FFFF on the CDM). Each front panel bit corresponds to a particular section of testing. After each section of the self-test completes, the corresponding front panel LED goes out if no error occurs.

If a self-test executes successfully, >0000 appears on the CDM, the POWER and RUN LEDs light, and the FAULT and IDLE LEDs remain off.

Table 3-4. Self-Test Error Reporting Bit Assignment

Front Panel LED Lit	Self-Test Section Result
0	Microprocessor instruction set test failed
1	Loader/self-test ROM CRC test failed
2	Scratch pad RAM test failed
3	Interrupt logic test failed
4	Map chip test failed
5	Memory test failed
6	ECC logic test failed
7	Multiprocessing logic test failed
8	CRU chip test failed
9	EIA port test failed
10	TILINE time-out test failed
11	Write inhibit controller test failed
12	Could not find load device controller
13	Load device not online and ready
14	Load device did not execute Restore command
15	Could not load data from load device into memory

A failed self-test has the hexadecimally encoded display of the values of self-test errors that the self-test did not turn off. The POWER, FAULT, and IDLE LEDs also light. If more than one self-test error occurs, the CDM displays the sum of the self-test error values.

Table 3-4 lists the self-test section failures and the LEDs that light on the programmer panel when these failures occur. The bit position failure indication is converted to a hexadecimal number and displayed on the CDM. Each group of four-bit position indicators corresponds to one hexadecimal digit. Table 3-5 shows the hexadecimal conversions of the front panel LED positions for the first hexadecimal digit and the first four LED positions. You can use these conversions for each successive group of four LEDs.

For example, if the loader/self-test ROM CRC test, map chip test, ECC logic test, and TILINE time-out test all fail and the loader cannot find the load device controller, a load device is not online and ready, and the load device does not execute the Restore command, the front panel error indicators appear as the hexadecimal value >4A2E. Figure 3-1 illustrates this display.

Table 3-5. Bit Position (0 Through 3) to Hexadecimal Conversions

Programmer Panel Binary LED Lit	CDM Hexadecimal Number
1111	>F
1110	>E
1101	>D
1100	>C
1011	>B
1010	>A
1001	>9
1000	>8
0111	>7
0110	>6
0101	>5
0100	>4
0011	>3
0010	>2
0001	>1
0000	>0

Notes:

1 indicates a lit LED.

0 indicates an unlit LED.

The processor enters the idle mode (if possible) when a failure occurs in any of the first three sections of the self-test. Such a failure indicates that something major is wrong and further testing is probably not possible. You can bypass this self-test failure (like a self-test fault) to force the self-test to continue. Perform the following steps at the CDM:

1. Press HALT (the run and idle lights will go out).
2. Press HALT five times.
3. Press RUN.

CAUTION

Do not attempt to execute the loader following a self-test failure without repairing the CPU unless you have a backup copy of the load medium.

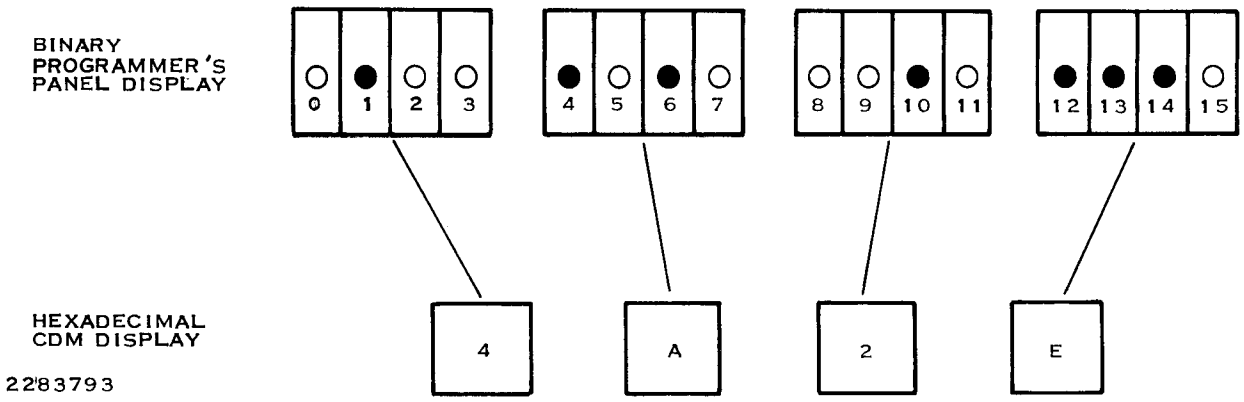


Figure 3-1. Programmer Panel and CDM Displays

Occasionally, a major fault condition is bypassed. In this case, the processor continues with the self-test. If the preload self-test fails, the processor continues with the load if possible. If the self-test is bypassed on power-up, the processor continues as if the self-test executed successfully (executing the front panel code, loading, or entering the idle mode, depending on the configuration).

3.2.4.1 Load Device Verification. Load device verification is the part of the self-test that executes only before load operations. It verifies that the 990/10A processor can communicate with the TILINE device that you plan to use for loading. If the processor cannot successfully complete the verification, the load will probably fail due to hardware malfunction or operator error.

Load device verification executes only on TILINE devices. Other devices skip these tests. The four tests performed during load device verification are as follows:

- Controller Present Test — Verify that the TILINE peripheral control space (TPCS) controller registers can be read. (No TILINE time-out occurs on a read from the controller address.)
- Unit Online Test — By reading the TPCS controller registers, verify that there is a unit online for that controller.
- Controller Operational Test — Issue a simple command to the controller and verify that it responds as expected.
- Data Transfer Test — Transfer data from the load device to memory.

The four least significant binary bits (rightmost hexadecimal digit on the CDM) report the results of these four tests. If a test fails, the remaining tests do not execute. At this point you can display the status of the failing TILINE controller, controller status register (R0) and unit status register (R7). To display R0 perform the following steps:

1. Press HALT

2. Press HALT three times

3. Press RUN

The front panel display now shows the contents of the controller status register.

To display R7 perform the following steps:

1. Press HALT

2. Press HALT four times

3. Press RUN

The front panel display now shows the contents of the unit status register.

The unit online test waits until a unit becomes online if no unit is online when you attempt a load. A seven as the least significant hexadecimal digit on the front panel (a hexadecimal F for an alternate load) indicates this process of waiting. This test waits for a maximum of five minutes before causing a time-out; then, it enters the idle mode to report a failure.

Pressing the HALT switch on the front panel at any time during load device verification terminates the verification and reports a failure. To ignore the failure, follow the preceding instructions to force the self-test to continue.

Although unlikely, the 990/10A or S600 can pass the load device verification portion of the self-test and still encounter an error during loading. Later paragraphs list disk and tape loader error codes. If a loader error occurs, the POWER and RUN LEDs light and the FAULT LED flashes. The flashing FAULT LED indicates a loader error (not a self-test error). Additionally, if the error is a system loader failure, the two leftmost hexadecimal digits flash >FF. If the failure is in the ROM loader code, the two leftmost hexadecimal digits do not flash.

3.2.5 Model S300 and S300A Self-Test Errors

During normal power-up of the S300 or S300A system, a 30- to 45-second delay occurs for warm-up and for executing the terminal and processor self-tests. The primary goals for field-level self-tests are as follows:

- System go/no-go
- Isolate malfunctions to field-replaceable assemblies

When all of the tests pass, the message SELF TEST COMPLETE appears on the VDT screen and the bell sounds. Figure 3-2 and Figure 3-3 show successful self-test indicators. After five seconds, the message INITIATING LOAD appears to indicate that the system is attempting to load.

The system brings the operating system from disk storage to the computer processor memory if the disk unit with the operating system is ready. The system displays an error code to the LEDs if it cannot load. During initialization, the disk unit lights flash. This is normal and does not indicate equipment problems.

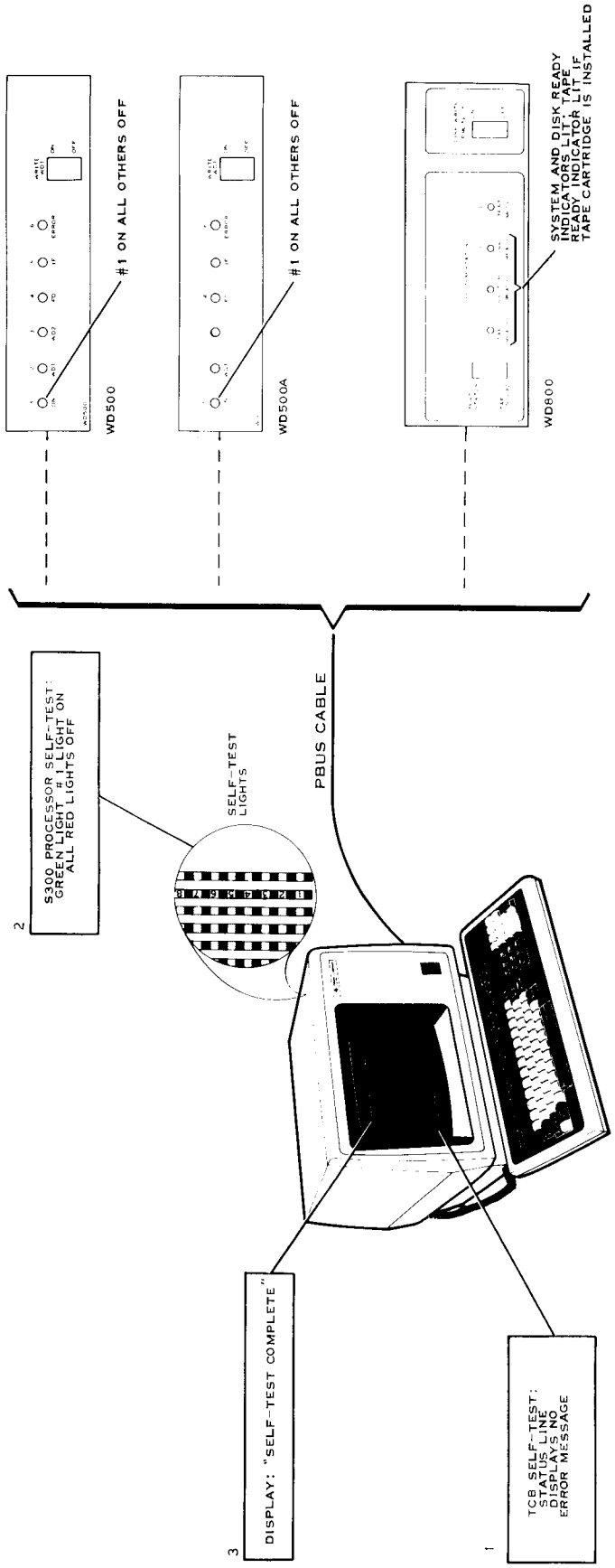


Figure 3-2. S300 Self-Test Indicators

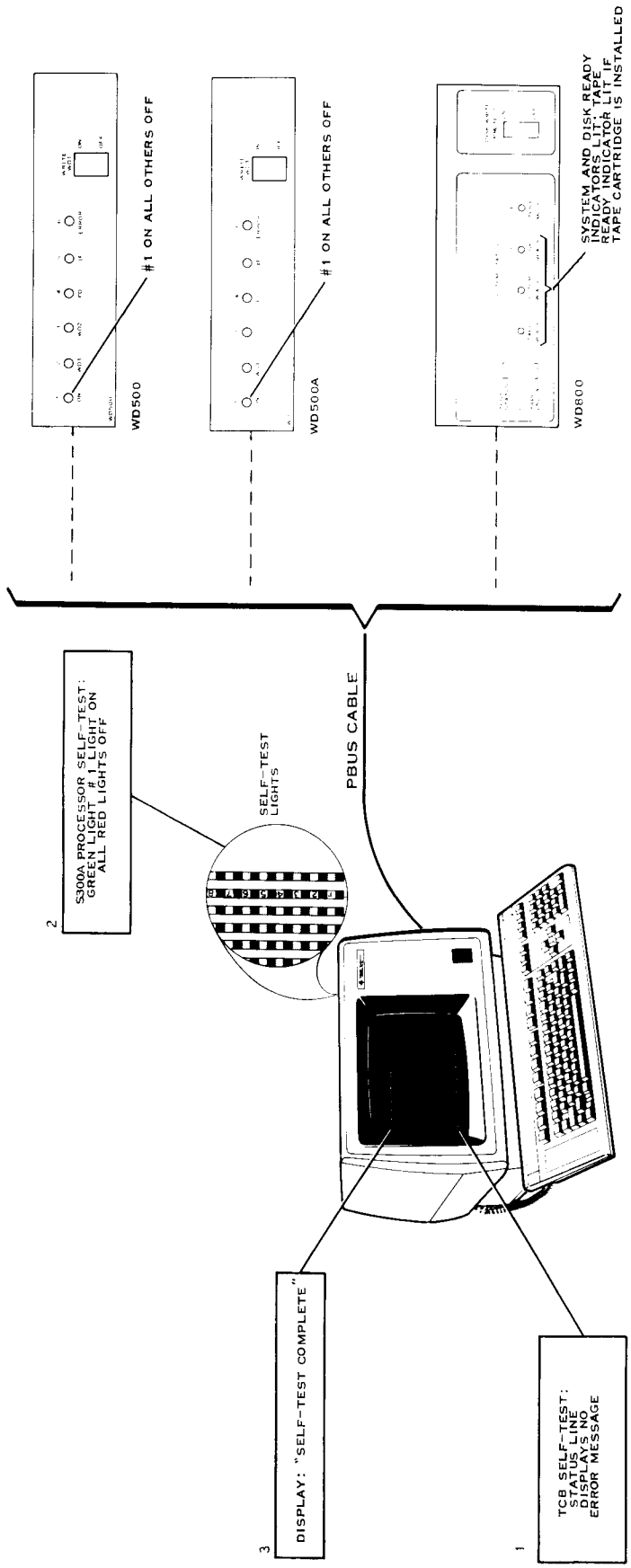


Figure 3-3. S300A Self-Test Indicators

3.2.5.1 Terminal Self-Test Failure Indications. The presence of a status line on the VDT screen is a go indication for the terminal. This indicates that the terminal control board, sweep board, screen, and keyboard are serviceable; however, this status line display does not provide any indication concerning the communication status between the terminal and the S300 or S300A processor board.

If one of the terminal self-tests fails, a message appears on the VDT screen.

On an S300 computer, the message SELF TEST FAILED appears, along with one of the following messages:

SM DME
SM TC
RAM TC
RAM AFM
ROM TC
PROM TC
CMOS TC
ROM LOAD
BTY TC
KBD ERROR

On an S300A computer, one of the following terminal error messages appears:

BTY FAILURE
ROM FAILURE
RAM FAILURE
KBD FAILURE
KBD ERROR

S300A terminal failure may also be indicaed by fault isolation LEDs. These are visible through the cooling vents located in the left rear on top of the computer cover. Refer to the *S300A Operator's Guide* for more information.

Service is required if one of the preceding messages appears. The messages identify terminal electronics that have failed and service personnel use them to identify which component needs repair. You can still use your system if it has additional terminals because the preceding errors indicate only that the terminal in the computer enclosure has failures.

3.2.5.2 Disk Drive Self-Test Failure Indications. The S300 and S300A processor boards do not directly poll the status of the WD500, WD500A, and WD800 disk drives during power-up self-tests. However, a go indication means the following:

- The interconnecting cabling is good.
- The disk drive can communicate with the processor PBUS controller.
- The disk drive unit has passed its self-test.

Following power-up, the front panel indicators on the disk drives display the status as described in the respective disk drive installation and operation manuals.

3.2.5.3 Processor Self-Test Failure Indications. Self-test error indications appear on the VDT screen, and on diagnostic LEDs on the S300 and S300A processor boards. The fault LEDs on the S300 and S300A processor boards are visible through the cooling vents in the top of the computer cover.

The S300 and S300A self-tests execute in two logically defined phases. The first phase or *kernel* executes to verify essential CPU functionality of the processor. The second or general phase executes on successful completion of the kernel phase and includes all remaining functional area tests.

Errors detected during execution are handled in accordance with the phase in which they occur. Later paragraphs explain the two types of faults that can occur during self-test, the expected system response of the given fault type, and user/operator action to effect repair.

Major Fault. A major fault prevents further testing of the system and prevents loading from the system mass storage.

Major faults occur when:

- An error is detected during the kernel portion of the self-test.
- A default error causes abnormal completion of the nonkernel portion of the self-test.

The self-test attempts to put the processor in an idle state and display the error indication on the diagnostic LEDs if it detects an error during the kernel test.

The diagnostic LEDs contain the major fault code for the functional area causing the failure if:

- The kernel portion of the self-test is complete.
- A subsequent portion of the self-test prevents normal completion.

A major fault implies catastrophic failure of the S300 or S300A processor, which should be replaced prior to any further maintenance or diagnostic effort.

Minor Fault. A minor fault is a fault detected after successful completion of the kernel portion of self-test.

The processor indicates on the diagnostic LEDs the first minor fault detected and proceeds with the self-test. Normal load sequencing begins when the self-test completes if no errors are detected.

You can investigate a minor fault failure on your system if the fault is not involved in the load path. If the fault does not allow the DOCS to be loaded from a mass storage device, then you must use an MDU.

Diagnostic LED Error Code Definition. The S300 diagnostic LEDs, visible through the cooling vents in the top of the computer cover, appear as in Figure 3-4. The S300A diagnostic LEDs appear as in Figure 3-5.

The self-test diagnostic lights consist of seven red LEDs and one green LED. The red LEDs indicate which part of the electronics is being tested. Upon successful self-test completion, all of the red LEDs are off and the green LED is on.

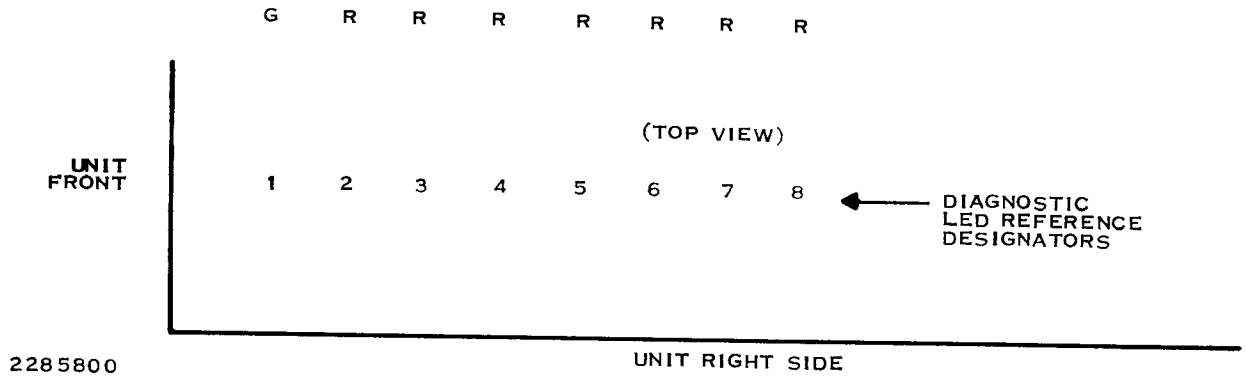


Figure 3-4. S300 Diagnostic LED Placement and Numbering

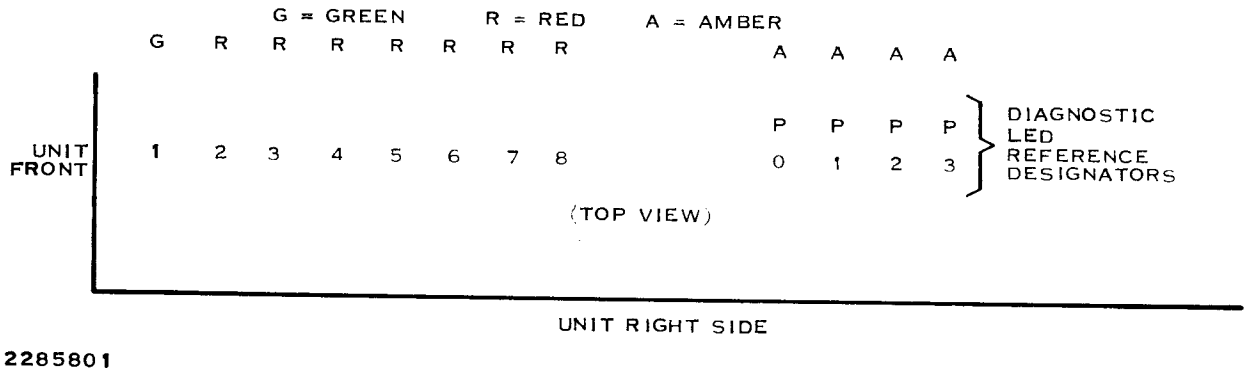


Figure 3-5. S300A Diagnostic LED Placement and Numbering

If any red LEDs remain on and the green LED is off, the self-test has found a failure. If the processor fails, the system is not usable until repairs are made. If the terminal fails but the processor functions correctly, you can operate the system from another terminal.

Table 3-6 and Table 3-7 show diagnostic LED codes used to determine which test or tests failed on the S300 and S300A processor boards. A diagnostic LED error code not shown in the tables is an illegal error code.

Should an illegal display occur, you can run the error light exerciser from the extended self-test menu (if the computer is otherwise functional) to verify that the diagnostic LEDs work.

The diagnostic LEDs are grouped to indicate system faults and minor faults. Diagnostic LED conditions are: 0 = off, 1 = on, X = don't care.

1. System diagnostic LEDs

   a. LED 1 — System load indicator
      0 — System load prevented
      1 — System load allowed (or initiated)

   b. LED 2 — Major fault indicator
      0 — No major fault detected (L1 = X)
      1 — Major fault detected (L1 = 0)

2. Minor diagnostic LEDs

   a. LEDs 3, 4, 5 — Functional area of failure

   b. LEDs 6, 7, 8 — Failed test

The presence of one or more minor faults may or may not prevent a system load. A minor fault that does not prevent a system load appears on LEDs 3 through 8 with LED 1 lit.

Table 3-6. S300 Self-Test Diagnostic LED Codes

Fault	Hex Code	Light Number and Indication 12345678[1] GRRRRRRR[1]	Interpretation of Codes	Operator Action[2]
	>80	10000000	No detected faults	1
	>7F	01111111	Major fault — kernel	2
	>40	01000000	Status request	2
Minor interrupt or CRU	>78	01111000	Major interrupt/CRU fault	2
	>B9	10111001	Error status register	3
	>BA	10111010	Level 2 interrupt	3
	>BB	10111011	100-Hertz system clock	3
	>BC	10111100	External instruction (SIE, IDLE)	3
	>BD	10111101	Unexpected NMI interrupt	3
Mapping functions	>70	01110000	Major mapping fault	2
	>B1	10110001	Control function	3
	>B2	10110010	Limit register	3
	>B3	10110011	Bias register	3
	>B4	10110100	Address adder	3
	>B5	10110101	Mapping functional	3
	>B6	10110110	Memory time-out error	3
Correction control	>68	01101000	Major correction control fault	2
	>A9	10101001	Control/interrupt	3
	>AA	10101010	Correction bit generation	3
	>AB	10101011	Single bit detect/correct	3
	>AC	10101100	Double bit detect	3
	>AD	10101101	Error logging/reporting	3
	>AE	10101110	Write inhibit error	3
Main memory	>60/61	0110000X	Major memory fault	2
	>A1	10100001	On-board memory	3
	>A2	10100010	Expansion memory board 1	3
	>A3	10100011	Expansion memory board 2	3
	>A4	10100100	Expansion memory board 3	3
	>A5	10100101	Refresh	3
	>A6	10100110	Single bit error warning	1
Mass storage interface	>58	01011000	Major MSIC fault	2
	>99	10011001	Internal self-test	3
	>9A	10011010	Memory write	3
	>9B	10011011	Level 9 interrupt	3
	>9C	10011100	Level 13 interrupt	3
	>9D	10011101	PBUS loopback	4

Table 3-6. S300 Self-Test Diagnostic LED Codes (Continued)

Fault	Hex Code	Light Number and Indication 1 2 3 4 5 6 7 8[1] G R R R R R R R[1]	Interpretation of Codes	Operator Action[2]
Internal terminal port	>50	0 1 0 1 0 0 0 0	Major terminal port fault	2
	>91	1 0 0 1 0 0 0 1	Internal loopback	1
	>92	1 0 0 1 0 0 1 0	Initialization	1
	>93	1 0 0 1 0 0 1 1	DSR/CTS offline error	1
	>94	1 0 0 1 0 1 0 0	Level 8 interrupt	1
	>95	1 0 0 1 0 1 0 1	Terminal in DC3 mode	1
2-Channel/4-Channel communication board	>48	0 1 0 0 1 0 0 0	Major 2-Ch/4-Ch comm fault	2
2-Channel communication board (tested only if present)	>81	1 0 0 0 0 0 0 1	Port 1 at >0B00 loopback	1
	>89	1 0 0 0 1 0 0 1	Port 1 level 3 interrupt	1
	>82	1 0 0 0 0 0 1 0	Port 2 at >0B80 loopback	1
	>8A	1 0 0 0 1 0 1 0	Port 2 level 4 interrupt	1
4-Channel communication board (tested only if present)	>83	1 0 0 0 0 0 1 1	Port 1 at >0400 loopback	1
	>8B	1 0 0 0 1 0 1 1	Port 1 level 6 interrupt	1
	>84	1 0 0 0 0 1 0 0	Port 2 at >0480 loopback	1
	>8C	1 0 0 0 1 1 0 0	Port 2 level 7 interrupt	1
	>85	1 0 0 0 0 1 0 1	Port 3 at >0500 loopback	1
	>8D	1 0 0 0 1 1 0 1	Port 3 level 10 interrupt	1
	>86	1 0 0 0 0 1 1 0	Port 4 at >0580 loopback	1
	>8E	1 0 0 0 1 1 1 0	Port 4 level 12 interrupt	1

Notes:

[1] G = green; R = red; 1 = on; 0 = off; X = don't care

[2] Operator Actions:
1 — Faults with a 1 in the System Load Possible column allow an automatic load to proceed.
2 — Faults with a 2 in the System Load Possible column allow diagnostic loads only from an MDU, and may or may not be successful. Loads from a PBUS device are not possible.
3 — Faults with a 3 in the System Load Possible column allow a manual load to be attempted using the option mode. A manual load can be attempted but may not be successful.
4 — These tests run only during extended self-test with the appropriate loopback connector installed.

Table 3-7. S300A Processor Self-Test Codes

Faults	Hex Code	Light Number and Indication 1 2 3 4 5 6 7 8[1] G R R R R R R R[1]	Interpretation of Codes	Operator Action[2]
	>80	1 0 0 0 0 0 0 0	Self-test passed	0
	>7F	0 1 1 1 1 1 1 1	Major processor fault	1
	>40	0 1 0 0 0 0 0 0	Status request	1
Minor interrupt or CRU	>78	0 1 1 1 1 0 0 0	Major interrupt/CRU fault	1
	>B9	1 0 1 1 1 0 0 1	Error status register fault	1
	>BA	1 0 1 1 1 0 1 0	Level 2 (system) interrupt	1
	>BB	1 0 1 1 1 0 1 1	100-Hertz system clock fault	1
	>BC	1 0 1 1 1 1 0 0	External instruction fault	1
	>BD	1 0 1 1 1 1 0 1	Unexpected NMI interrupt	1
Memory address mapping function	>70	0 1 1 1 0 0 0 0	Major address mapping fault	1
	>B1	1 0 1 1 0 0 0 1	Control function fault	1
	>B2	1 0 1 1 0 0 1 0	Limit register fault	1
	>B3	1 0 1 1 0 0 1 1	Bias register fault	1
	>B4	1 0 1 1 0 1 0 0	Address adder fault	1
	>B5	1 0 1 1 0 1 0 1	Mapping function fault	1
	>B6	1 0 1 1 0 1 1 0	Memory time-out error	1
Parity logic and memory controller	>68	0 1 1 0 1 0 0 0	Major fault	1
	>63	0 1 1 0 0 0 1 1	Major refresh fault	1
	>96	1 0 0 1 0 1 1 0	Control/interrupt fault	1
	>97	1 0 0 1 0 1 1 1	Parity error detection fault	1
	>98	1 0 0 1 1 0 0 0	Error logging/reporting fault	1
	>B7	1 0 1 1 0 1 1 1	Write inhibit error	1
	>B0	1 0 1 1 0 0 0 0	Refresh fault	1
Physical memory	>60	0 1 1 0 0 0 0 0	Major memory fault	1
	>61	0 1 1 0 0 0 0 1	Major memory fault	1

Table 3-7. S300A Processor Self-Test Codes (Continued)

Faults	Hex Code	Light Number and Indication 1 2 3 4 5 6 7 8[1] G R R R R R R R[1]	Interpretation of Codes	Operator Action[2]
			Memory parity error at physical memory location:	
Memory parity	>A0	1 0 1 0 0 0 0 0	>00000 - >0FFFF	
	>A1	1 0 1 0 0 0 0 1	>10000 - >1FFFF	2
	>A2	1 0 1 0 0 0 1 0	>20000 - >2FFFF	2
	>A3	1 0 1 0 0 0 1 1	>30000 - >3FFFF	2
	>A4	1 0 1 0 0 1 0 0	>40000 - >4FFFF	2
	>A5	1 0 1 0 0 1 0 1	>50000 - >5FFFF	2
	>A6	1 0 1 0 0 1 1 0	>60000 - >6FFFF	2
	>A7	1 0 1 0 0 1 1 1	>70000 - >7FFFF	2
	>A8	1 0 1 0 1 0 0 0	>80000 - >8FFFF	2
	>A9	1 0 1 0 1 0 0 1	>90000 - >9FFFF	2
	>AA	1 0 1 0 1 0 1 0	>A0000 - >AFFFF	2
	>AB	1 0 1 0 1 0 1 1	>B0000 - >BFFFF	2
	>AC	1 0 1 0 1 1 0 0	>C0000 - >CFFFF	2
	>AD	1 0 1 0 1 1 0 1	>D0000 - >DFFFF	2
	>AE	1 0 1 0 1 1 1 0	>E0000 - >EFFFF	2
	>AF	1 1 1 1 1 1 1 1	>F0000 - >FFFFF	2
Mass storage interface	>58	0 1 0 1 1 0 0 0	Major MSIC fault	1
	>99	1 0 0 1 1 0 0 1	MSIC internal self-test error	1
	>9A	1 0 0 1 1 0 1 0	Memory read/write self-test	1
	>9B	1 0 0 1 1 0 1 1	Level 9 interrupt fault	1
	>9C	1 0 0 1 1 1 0 0	Level 13 interrupt fault	1
	>9D	1 0 0 1 1 1 0 1	PBUS loopback test error	1
S300A terminal	>50	0 1 0 1 0 0 0 0	Major terminal port fault	5
	>91	1 0 0 1 0 0 0 1	Internal loopback fault	5
	>92	1 0 0 1 0 0 1 0	Initialization error	3
	>93	1 0 0 1 0 0 1 1	DSR/CTS offline error	5
	>94	1 0 0 1 0 1 0 0	Level 8 interrupt fault	5
	>95	1 0 0 1 0 1 0 1	Terminal is in DC3 mode	3
2 Channel/4-Channel communication or EI300 LAN board	>48	0 1 0 0 1 0 0 0	Major communications fault	4
2-Channel communication board	>81	1 0 0 0 0 0 0 1	Port 1 at >0B00 loopback	4
	>89	1 0 0 0 1 0 0 1	Port 1 level 3 interrupt	4
	>82	1 0 0 0 0 0 1 0	Port 2 at >0B80 loopback	4
	>8A	1 0 0 0 1 0 1 0	Port 2 level 4 interrupt	4

Table 3-7. S300A Processor Self-Test Codes (Continued)

Faults	Hex Code	Light Number and Indication 1 2 3 4 5 6 7 8[1] G R R R R R R R[1]	Interpretation of Codes	Operator Action[2]
4-Channel communication board	>83	1 0 0 0 0 0 1 1	Port 1 at >0400 loopback	4
	>8B	1 0 0 0 1 0 1 1	Port 1 level 6 interrupt	4
	>84	1 0 0 0 0 1 0 0	Port 2 at >0480 loopback	4
	>8C	1 0 0 0 1 1 0 0	Port 2 level 7 interrupt	4
	>85	1 0 0 0 0 1 0 1	Port 3 at >0500 loopback	4
	>8D	1 0 0 0 1 1 0 1	Port 3 level 10 interrupt	4
	>86	1 0 0 0 0 1 1 0	Port 4 at >0580 loopback	4
	>8E	1 0 0 0 1 1 1 0	Port 4 level 12 interrupt	4
EI300 LAN board	>90	1 0 0 1 0 0 0 0	EI300 LAN processor failure	1
	>9E	1 0 0 1 1 1 1 0	EI300 LAN board self-test error detected	1
	>9F	1 0 0 1 1 1 1 1	EI300 LAN off-board loopback failure	6
	>83	1 0 0 0 0 0 1 1	Port 1 at >0400 loopback	4
	>8B	1 0 0 0 1 0 1 1	Port 1 level 6 interrupt	4
	>84	1 0 0 0 0 1 0 0	Port 2 at >0480 loopback	4
	>8C	1 0 0 0 1 1 0 0	Port 2 level 7 interrupt	4
	>85	1 0 0 0 0 1 0 1	Port 3 at >0500 loopback	4
	>8D	1 0 0 0 1 1 0 1	Port 3 level 10 interrupt	4

Notes:

[1] G = green; R = red; 1 = on; 0 = off

[2] Operator actions:

0 — No action required; S300A processor passed all self-tests.

1 — Cycle ac power; if error occurs again, call for repair service.

2 — Note memory diagnostic light; cycle ac power; if error occurs again, call for repair service.

3 — Check S300A terminal Comm port configuration parameters and cycle ac power.

4 — Cycle ac power; if error occurs again, call for repair service. Only the ports reported by the self-test are affected.

5 — Cycle ac power; if error occurs again, call for repair service. Only the S300A terminal is affected; add-on terminals should be operational.

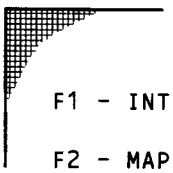
6 — Cycle ac power; if error occurs again, check LAN connection for proper installation. S300A and ports 1, 2, and 3 of EI300 should be operational. If error persists, call repair service.

3.2.5.4 Extended Self-Test Mode. The extended self-test mode allows you to loop on specific self-test routines individually or as part of a sequence you define. Use this mode as an aid for field diagnosis of intermittent failures.

You can enter the extended self-test mode in one of the following two ways:

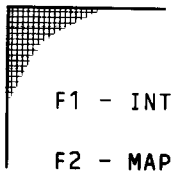
- Press function key F7 when in the option mode
- On completion of an extended self-test sequence

The extended self-test mode menu shown in Figure 3-6 appears on the VDT screen when you enter the extended self-test mode on an S300 computer. The menu shown in Figure 3-7 appears when entering the extended self-test mode on an S300A computer.



```
F1 - INTERRUPT/CRU

F2 - MAP

F3 - CCC

F4 - MEMORY

F5 - PBUS I/F

F6 - 2-CH COMM

F7 - 4-CH COMM

F8 - STATUS REQUEST

ENTER LOOP-COUNT,TEST-STRING <CR>:
```

Figure 3-6. S300 Extended Self-Test Mode Menu



```
F1 - INTERRUPT/CRU

F2 - MAP

F3 - MEMORY        CFG=* EXP=* BLKS=*

F4 - PMC

F5 - PBUS I/F

F6 - 2-CH COMM     NOT PRESENT

F7 - 4-CH COMM     NOT PRESENT

F8 - STATUS REQUEST

ENTER LOOP-COUNT,TEST-STRING <CR>:
```

Figure 3-7. S300A Extended Self-Test Mode Menu

NOTE

The asterisks (*) are replaced by actual values as follows:

Memory configuration (CFG)	0, 1, 2, or 3
Expansion boards present (EXP)	0, 1, 2, or 3
128K-byte blocks of RAM (BLKS)	02, 04, 06, 08, 0A, 0C, 0E, or 10

If the 2-channel or 4-channel communication boards are detected by the S300A, the corresponding NOT PRESENT message will be replaced by a blank space. If the optional EI300 LAN interface board is installed, line F7 will be replaced by: F7 - LAN/3-CH COMM.

The following procedure explains how to conduct tests when the extended self-test menu appears.

1. Enter the test loop count by typing a four digit hexadecimal number from >0000 to >FFFF (do not enter the > symbol). Place a comma (,) after the last digit of the hexadecimal number.

   a. The tests you specify will execute >FFFF times if you do not enter a loop count, or if you enter a count of 0 (followed by a comma).

   b. Press the ESC key to clear all information collected and restart the entry process. If there is no information in the test-string buffer, control is transferred to the option mode and the option mode menu appears.

2. Press a function key (F1 through F8) to place a test in the test string. The test string defines the tests you to plan to execute, and their execution sequence.

   a. You can place up to 12 tests on the test string. Tests can be in any sequence and they can be repeated.

   b. Tests F1 through F8 execute in sequence for each pass of the loop if you do not specify a test string (press RETURN after the comma separator).

   c. Tests F6 and F7 run only if the board they test is installed. The test loop executes if you specify F6 or F7 in the test string and the board is not installed; however, the test is treated as a don't care and the loop does not generate a test error.

3. Press the RETURN key to terminate the entry process and begin testing.

   a. The loop count and test numbers you select appear before the first test begins. The display appears after you press the RETURN key.

      The display format is as follows:

      nnnn * TESTS : test-list

      where:

      nnnn is the loop count (in hexadecimal).

      test-list is the list of the requested test numbers.

      For example, the following display appears on the VDT screen if you accept the default loop count and the default test sequence:

      FFFF * TESTS : F1 F2 F3 F4 F5 F6 F7 F8

      The first test in the sequence begins execution immediately.

   b. You can terminate test execution by pressing the ESC key. The test loop stops at the end of the currently executing test and the extended self-test menu appears on the VDT screen.

   c. You can request a status report by pressing the F8 key. A loop count and error count appear at the end of the currently executing test as follows:

      mmmm ERRORS nnnn PASSES

      where:

      mmmm is the total number of errors from nnnn test string passes.

      The test loop continues executing after the status appears. You can receive a status display during each pass by including F8 in the test string.

d. Total loops executed and a total error count appear when the loop count completes. The display format is:

mmmm ERRORS nnnn PASSES

where:

mmmm is the total number of errors from nnnn test string passes.

You can now run other tests or return control to the option mode menu by pressing the ESC key.

3.3 LOADER ERRORS

Loader error indications and codes appear on either the programmer panel, the CDM, or the self-test LEDs. The device you use depends on which computer is in use, as follows:

Computer	Device
990/5, 990/10, 990/12	Programmer panel
990/10A, 990/12 LR, S600, S800	CDM
S300, S300A	Programmer panel or self-test LEDs

Since most of the error codes indicate a fatal hardware failure, corrective maintenance may be necessary before continuing operation. In the case of an error which may indicate destruction of data on the load media, ask yourself if the load device caused the destruction during the IPL. If so, do not attempt an IPL from the same load device with the only system backup media. In this case, attempt the IPL with backup media from an alternate load device to prevent corruption of the backup. If exactly the same error occurs during the second attempt, it is unlikely that data has actually been destroyed, but a hardware item common to both load devices (for example, disk controller or interface cables) may be defective.

The display codes for loader errors are the same for all computers, but they are not the same for all load devices. The following paragraphs explain the display codes for different load devices.

NOTE

If no programmer panel is connected to the S300 or S300A, loader error codes appear on the self-test LEDs. The error codes are the same as other computers, but they are presented in a sequenced manner since only eight LEDs are available. Refer to Appendix A for the method of display.

3.3.1 Loader Errors for a Disk or DSDD Diskette

When the load device is a disk or DSDD diskette, a loader error causes the RUN indicator to remain illuminated, the FAULT indicator to flash, and the display to contain a value other than >FFFF. The value is an error code listed in Table 3-8.

Table 3-8. Disk Loader Error Codes

Hexadecimal Error Code	Meaning
0XXX	Controller error, where XXX represents the status bits from the controller.
XX00	Unit error, where XX represents the unit status bits from the controller.
D001	Track 1 on the disk does not contain software that the loader can load. The byte count in track 0, sector 0, is zero.

The specific disk loader error codes (in hexadecimal), their explanations, and actions you should take are as follows:

Disk Controller Status Errors:

0002 DISK CONTROLLER SEARCH ERROR

Explanation:
The data on the disk may be destroyed, the disk controller or the disk drive may be faulty.

User Action:
Attempt to use backup media to determine if the disk was destroyed. If this does not work, have the disk drive serviced.

0004 DISK CONTROLLER COMMAND TIMEOUT

Explanation:
The disk interface or disk controller may be bad.

User Action:
Have the hardware serviced.

0010 DISK CONTROLLER ID ERROR

Explanation:
The disk drive was in error.

User Action:
Try the backup media or have the disk drive serviced.

0020 DISK CONTROLLER TILINE TIMEOUT

Explanation:
The disk controller or the system memory is bad.

User Action:
Have the controller or memory serviced.

0040 DISK CONTROLLER DISK DATA ERROR

Explanation:
The disk controller, disk drive, or load media is bad.

User Action:
Try the backup media or have the disk drive and controller serviced.

0050 DISK CONTROLLER DISK DATA ERROR

Explanation:
The disk controller, disk drive, or load media is bad.

User Action:
Try the backup media or have the disk drive and controller serviced.

0080 DISK CONTROLLER MEMORY PARITY

Explanation:
The system memory is bad.

User Action:
Have the memory serviced.

00FF DISK CONTROLLER SELF-TEST ERROR

Explanation:
The disk controller is bad.

User Action:
Have the disk controller serviced.

Disk Unit Status Errors:

0400 DISK UNIT SEEK INCOMPLETE

Explanation:
The disk drive failed.

User Action:
Retry the same disk drive. If the same error occurs, have the disk drive serviced.

0800 DISK UNIT END-OF-CYLINDER

Explanation:
The wrong disk controller or a bad disk interface component was installed.

User Action:
Verify that the correct disk controller was installed or have the disk controller serviced.

1000 DISK UNIT UNSAFE

Explanation:
The disk unit is not safe.

User Action:
Spin the disk down and back up, then retry the disk. If the same error occurs, have the disk drive serviced.

3F00 CONTROLLER INTERFACE CABLES

Explanation:
The disk controller interface cables were installed wrong.

User Action:
Install the cables correctly.

4000 DISK UNIT NOT READY

Explanation:
The disk unit was not ready.

User Action:
Retry the disk. If the same error occurs, have the disk drive serviced.

D001 MEDIA NOT LOADED

Explanation:
The selected load device does not have loadable media mounted.

User Action:
Retry after loading the appropriate media or use an alternate load device and media.

The controller status bits and unit status bits returned by the controller are also described in the installation and operation manual for the specific disk or diskette unit (see the Preface).

3.3.2 Loader Errors for a Magnetic Tape

When the load device is a magnetic tape, a loader error causes the RUN indicator to remain illuminated, the FAULT indicator to flash, and the display to contain a value other than >FFFF. The value is an error code listed in Table 3-9.

Table 3-9. Tape Loader Error Codes

Hexadecimal Error Code	Meaning
0XXX	Controller error, where XXX represents the status bits from the controller.
XX00	Unit error, where XX represents the unit status bits from the controller.
XXXX	Error in reading record XXXX.

The specific tape loader error codes (in hexadecimal), their explanations, and actions you should take are as follows:

Tape Controller Status Errors:

0002 FORMAT ERROR

Explanation:
The tape media density was wrong or the load device and tape controller were bad.

User Action:
Verify that the density is correct. If so, have the tape drive and controller serviced.

0004 TILINE TIMEOUT

Explanation:
The system memory or the tape controller is bad.

User Action:
Have the controller or the memory serviced.

0008 TILINE TRANSFER RATE ERROR

Explanation:
The tape controller was incorrectly installed or the system memory or tape controller is bad.

User Action:
Retry the IPL. If the same error occurs, have the memory or controller serviced.

0010 MEMORY PARITY ERROR

Explanation:
The memory controller or the tape controller is bad.

User Action:
Retry or have the memory controller and tape controller serviced. This status bit should only be set after a valid memory error during a write to tape. The IPL never writes to a tape; therefore, error code >0010 at this time does not indicate a valid memory error.

0020 DATA ERROR

Explanation:
A cyclic redundancy check (CRC) error (800 bpi) or an uncorrectable phase encoding (PE) error (1600 bpi) occurred.

User Action:
Clean the read/write heads or have the tape drive and controller serviced. This error bit may be combined with the following two data error bits on the front panel.

0040 DATA ERROR

Explanation:
A longitudinal redundancy check (LRC) error (800 bpi) or an error correction enabled (1600 bpi) occurred.

User Action:
Clean the read/write heads or have the tape drive and controller serviced.

0080 DATA ERROR

Explanation:
A vertical redundancy check (VRC) error (all) occurred.

User Action:
Clean the read/write heads or have the tape drive and controller serviced.

02xx PHASE ENCODED (PE) FORMAT INDICATOR

Explanation:
This status bit (bit 6) will be OFF when the selected tape drive is 800 bpi, ON for 1600 bpi. This is not an error status bit; it is an informative bit.

User Action:
This bit is always combined with all the preceding error bits to indicate the format of the tape controller.

Tape Unit Status Errors:

0100 COMMAND TIMEOUT

Explanation:
The tape controller did not receive data clocks within 25 feet of tape.

User Action:
Retry and verify tape movement. If the tape does not move, the problem is in the tape controller, cables, or the drive interface logic. If the tape does move 25 feet, the tape reel has no data on it or the tape drive control card, cables, or tape controller is bad. Ensure that the tape has data on it. If so, have the tape system serviced.

0800 ABNORMAL END OF TAPE (EOT)

Explanation:
The tape controller detected an unexpected EOT.

User Action:
Verify the presence of a tape marker at the point where the tape stopped. If there is no marker, the tape drive is defective.

1000 ABNORMAL END OF FILE (EOF)

Explanation:
The tape controller detected an unexpected EOF.

User Action:
Ensure that the tape has a complete 990 object file written on it. One or more records may be missing at the end. If the data is correct, retry or have the controller serviced.

2000 ABNORMAL END OF RECORD (EOR)

Explanation:
The tape controller detected an unexpected EOR.

User Action:
Ensure that the tape has a 990 object file written on it. The data on the tape may have records of the wrong size. If the data is correct, retry or have the controller serviced.

4000 ABNORMAL BEGINNING OF TAPE (BOT)

Explanation:
The tape controller detected an unexpected BOT marker.

User Action:
Check for a BOT marker. If there is no tape marker present, the tape drive is defective.

The controller status bits and unit status bits returned by the controller are also described in the installation and operation manual for the tape unit (see the Preface).

3.3.3 Loader Errors for a Cassette

When the load device is a cassette (733 ASR or MDU), a loader error causes the RUN indicator to remain illuminated, the FAULT indicator to flash, and the display to contain a value other than >FFFF. The value is the number of the record in which the failure occurred in the file being loaded.

Retry the IPL or have the load device serviced. If the IPL fails with the same record number, the load media is bad. If it fails with a different record number, clean the load device or have it serviced.

3.3.4 Loader Errors for an SSSD Diskette

When the load device is an SSSD diskette, a loader error causes the RUN indicator to remain illuminated, the FAULT indicator to flash, and the display to contain a value other than >FFFF. The value is the status word returned by the FD800 controller. The meaning of each bit in the status word is shown in Figure 3-8. The status word is also described in the installation and operation manual for the diskette unit (see the Preface).

In most cases, the status word indicates a fatal read error, such as a DATA or SEEK error, and corrective maintenance for the load device is necessary. Use another load device or a backup copy of the load media to determine if the problem is the load media or the load device.

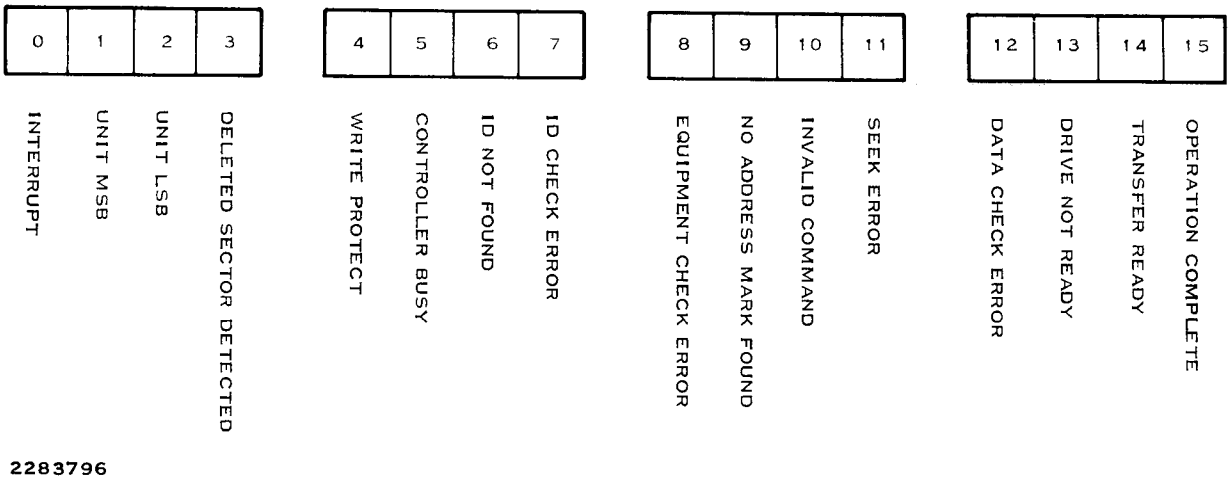


Figure 3-8. Status Word for SSSD Diskette Loader Errors

Appendix A

S300 and S300A Loader Error Code Display

The S300 and S300A computers use an alternate method to display loader error codes if no programmer panel is connected. The error codes display on the 8 self-test LEDs visible through the cooling vents in the top of the computer cover. Since only 8 LEDs are available compared to the 16 LEDs on a programmer panel, the error codes display in a sequential manner. The error codes, however, are the same as for all other computers.

The method used to display the ROM loader error codes on the self-test LEDs is as follows:

1. LED definition:

   a. LED 1 (green) lights whenever the most significant nibble (4 bits) of the error code displays.

   b. LED 2 lights whenever one of the four nibbles displays.

   c. LEDs 3 and 4 indicate whether the loader routine (LEDs 3 and 4 off) or an operating system routine (LEDs 3 and 4 on) is reporting the error.

   d. LEDs 5 through 8 display the value of the nibble. LED 5 is the most significant bit of the nibble.

2. The four nibbles of the error code rotate through the self-test LEDs in order from the most significant nibble to the least significant nibble.

3. Each nibble displays for approximately three seconds. The LEDs then turn off for approximately one second before the next nibble displays. After the four nibbles display, the sequence repeats until operator intervention halts the computer.

Index

This index lists key topics of this manual and specifies where each topic appears, as follows:

- Sections — Section references appear as *Section n*, where *n* represents the section number.
- Appendixes — Appendix references appear as *Appendix Y*, where *Y* represents the appendix letter.
- Paragraphs — Paragraph references appear as alphanumeric characters separated by decimal points. The first character refers to the section or appendix containing the paragraph, and any other numbers indicate the sequence of the paragraph within the section or appendix. For example:
  - *3.5.2* refers to Section 3, paragraph 5.2.
  - *A.2* refers to Appendix A, paragraph 2.
- Figures — Figure references appear as *Fn-x* or *FY-x*, where *n* represents the section and *Y* represents the appendix containing the figure; *x* represents the number of the figure within the section or appendix. For example:
  - *F2-7* refers to the seventh figure in Section 2.
  - *FG-1* refers to the first figure in Appendix G.
- Tables — Table references appear as *Tn-x* or *TY-x*, where *n* represents the section and *Y* represents the appendix containing the table; *x* represents the number of the table within the section or appendix. For example:
  - *T3-10* refers to the tenth table in Section 3.
  - *TB-4* refers to the fourth table in Appendix B.
- See and See also references — *See* and *See also* direct you to other entries in the index. For example:

  Logical Unit Number . . . . . *See* LUNO

  Device . . . . . *See also* individual device names or numbers

Page numbers that correspond to these index references appear in the Table of Contents.

USER'S RESPONSE SHEET

Manual Title: ROM Loader User's Guide (2270534-9701)

Manual Date: August 1984 **Date of This Letter:** _____

User's Name: _____ **Telephone:** _____

Company: _____ **Office/Department:** _____

Street Address: _____

City/State/Zip Code: _____

Please list any discrepancy found in this manual by page, paragraph, figure, or table number in the following space. If there are any other suggestions that you wish to make, feel free to include them. Thank you.

Location in Manual	Comment/Suggestion

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