Troubleshooting the Initial Hardware Configuration

Your chassis went through extensive testing and burn-in before leaving the factory; however, if your system appears to have problems starting up, use the information in this chapter to help isolate the problem. This chapter also includes the environmental reporting features of the CSC-ENVM card and discusses how to use them with your chassis.

This chapter includes the following:

- Troubleshooting overview
    - Problem solving
    - Troubleshooting systems
- Environmental reporting features
- Running bootstrap diagnostic tests

Troubleshooting Overview

Typically, any problems encountered at installation startup will be related either to the chassis or to the network. Use the information in this chapter to help isolate problems and to rule out the chassis as the source of the problem. For additional troubleshooting assistance, refer to the optional *Troubleshooting Internetworking Systems* publication.

Note Whether or not you can locate the problem, contact a customer service representative for information on how to proceed in resolving the problem you are having.

Before you call a customer service representative, have the following information ready:

- Chassis type and serial number
- Maintenance agreement or warranty information
- Type of software and version number
- Date you received the new chassis
- Brief description of the problem you are having
- Brief explanation of what steps you have taken to isolate the problem

Problem Solving

The key to problem solving in a system such as this is to try to isolate the problem to a specific subsystem. By comparing what the system is doing to what it should be doing, the task of isolating a problem is greatly simplified.

Consider the following subsystems:

- Power system—This subsystem includes the power supply, the Multibus and ciscoBus backplanes and wiring, and the AC switch (circuit breaker).

- Cooling system—The blower assembly should come on when power is applied and will stay on even if the power supply fails. The blower assembly is connected directly to the AC source.

- System cards—This subsystem is the most difficult to troubleshoot; however, the light-emitting diodes (LEDs) on the cards and appliques can be used to help identify a failure.

Note For complete information on reading interface card and applique LED indicators, refer to Appendix B, "Reading LED Indicators."

- System cables—This subsystem includes all of the internal and external cables that interconnect the cards and their appliques, and that connect the chassis to the network.

The following troubleshooting sections discuss these subsystems in more detail.

Troubleshooting the Power and Cooling Systems

Check the following items to help isolate the problem:

- With the AC switch on, does the blower operate?

    — If yes, the AC input checks out.

    — If no, suspect the AC input, AC source, chassis circuit breaker, or the power cable.

- With the AC switch on and system LEDs lit, the blower does not operate: suspect the blower.

- Does the system shut down after being on a short time on?

    — Suspect an ENVM-induced (thermal-related) shutdown.

    — Check the environmental requirements in Chapter 2, "Preparing for Installation," and make certain that the chassis intake and exhaust vents are clear.

    — Suspect a power supply failure.

- System partially boots and LEDs do not light: suspect a +12V and/or a +5V power supply failure.

Troubleshooting the System Cards and Cables

Check the following items to help isolate the problem:

- System will not boot properly or constantly/intermittently reboots.

    — Check the processor card connection to the backplane and the console cable.

    — Check the LED indicators. (See "Reading LED Indicators.")

    — Suspect the processor card or software.

    — System boots with a particular card disconnected from the backplane; suspect the card.

    — System boots with a particular applique or cable disconnected; suspect the applique or cable.

- System will not boot from Flash memory (assuming software is preconfigured to do so).

    — Check the connection between the Flash card and the MCI, CSC-1R, CSC-2R, or CSC-ENVM card.

    — Check the configuration register on the processor card for the correct jumper setting for booting from Flash. (Refer to the section "Configuration Register Settings" in Chapter 5.)

- System boots, but console screen is frozen.

    — Check the external and internal console connections.

    — Verify the console baud rate in the terminal's documentation.

- Card is not recognized by the system.

    — Check the card connection to the backplane.

    — Check the LEDs on the card and applique. (See "Reading LED Indicators.")

    — Check the card-numbering switch. (See the section "Card-Numbering Fundamentals" in Chapter 5.)

- Card is recognized, but interface port(s) will not initialize.

    — Check the internal interface cables for connection.

    — Check the external interface cables for connection.

    — Check DCE/DTE jumpers. (See the section "Configuring the CSC-MCI and CSC-SCI Cards" in Chapter 5.)

    — Check that the interface is not administratively shut down.

Timesaver In general, if a particular port will not initialize, and the LED indicator on the interface card is lit, the problem may be the applique or internal cabling; however, to save time during the troubleshooting process, check the more accessible interface card before checking the applique.

Environmental Reporting Features

The CSC-ENVM card (ENVM) not only provides nonvolatile and Multibus memory, but it also provides the environmental monitoring required for the chassis. This card checks input and exhaust air temperatures and backplane-voltage levels. If the ambient temperature exceeds a given range and threshold, or if intake airflow is restricted, or if any of the voltages drift away from the factory settings, an error is detected, and the ENVM shuts down all functions in the chassis. (The blower will continue to run.) Power is returned by turning off the main breaker switch, waiting 20 to 30 seconds, and then turning on the main breaker switch. (This is called *toggling* the breaker switch.)

System Environmental Reports

The system runs a routine that polls the ENVM for voltage and temperature readings. The system obtains these statistics from the ENVM at a rate of once a minute and stores them in a buffer. You can display the contents of this buffer with the **show environment** command. The resulting display contains the current intake and exhaust air temperatures, shutdown thresholds, and voltage measurements of DC lines. Following is sample output of the **show environment** command:

```
Router# show environment

Environmental controller firmware version 2.2
Serial number is 00225259, calibrated on 5-10-93, by technician mpo
  Internal temperature measured 27.0(C), shuts down at 43.0(C)
Air flow appears good.
+5 volt line measured at 5.061(V)
  +12 volt line measured at 12.070(V)
  -12 volt line measured at -12.034(V)
  -5 volt line measured at -4.915(V)
Router#
```

Automatic Warning Messages

If a measurement exceeds desired margins, but has not exceeded fatal margins, a warning message is printed to the system console. The system software queries the ENVM for measurements once a minute, but warnings for a given test point are printed to the screen at most once every four hours. If a measurement exceeds the desired margins at any time within a four-hour period, an automatic warning message appears on the console screen. As noted, the user may query the ENVM using the **show environment** command at any time to determine if a measurement is at the warning level. Following is an example of the message displayed on the console screen when a measurement has exceeded an acceptable margin:

```
Router#
ENVIRONMENTAL WARNING: Airflow appears marginal.
```

Following is an example of a message displayed on the console screen when an ambient temperature measurement has exceeded an acceptable margin, and the temperature reading is given:

```
Router#
ENVIRONMENTAL WARNING: Internal temperature measured 41.3(C)
```

Following is an example of a message displayed on the console screen when a voltage measurement has exceeded an acceptable margin, and the voltage reading is given:

```
Router#
ENVIRONMENTAL WARNING: +5 volt testpoint measured 5.310(V)
```

Shutdown Messages and Thresholds

The system displays the following type of message if voltage or temperature exceeds maximum or fatal thresholds:

```
Router#
SHUTDOWN: air flow problem
```

If a test point reaches the *fatal* threshold, the ENVM performs as follows:

1   The last measured values from each of the six test points are saved to internal NVRAM.

2   The system software is interrupted, and a shutdown message is displayed on the console screen.

3   The power supply is shut off after a few milliseconds of delay.

Caution The chassis is completely shut down if the internal temperature reaches the 43 C threshold. The internal temperature of the system exceeds the external ambient temperature by approximately 3 C. The system cannot be restarted until the internal air temperature returns to an ambient level, and the power switch is toggled (turned off and then on). If the shutdown was due to a voltage problem, toggling the switch may not be sufficient to bring the system back up, and a larger problem may be indicated.

Temperature and Airflow Troubleshooting Guidelines

Consider the following example-system conditions:

- Chassis is shut down.
- No LEDs are lit.
- No processing activity is occurring.
- Blower is still running.
- Last message displayed on the console screen indicates an air temperature problem, an airflow problem, or a voltage problem.

Step 1 Determine if the error message indicates an air temperature or airflow problem. If it is air temperature, go to Step 2. If it is airflow, go to Step 3.

Step 2 For suspected *air temperature problems*, answer the following questions:

Is the ambient room temperature less than 40 C at all times?

Is the temperature of the air going into the air intake vent less than 40 C?

Is there sufficient airflow through the chassis?

Is there sufficient airflow within the rack or wiring closet?

Is the front access panel of the chassis in place?

Is the air intake vent of the chassis isolated from the exhaust air of all other chassis?

The appropriate response for the questions in Step 3 should be yes. If not, correct the problem or contact a customer service representative for additional assistance.

Step 3 For suspected *airflow problems*, answer the following questions:

Is there insufficient air going through the chassis?

Is there any blockage in or around the air intake vent?

Is there any blockage in or around the air exhaust vent?

Are there multiple units installed in this rack configuration? If the answer is yes, will turning off some or all of the other chassis (if possible) allow the chassis to continue running?

Is there an air pressure differential between the air intake and exhaust vents?

Is the exhaust air of the chassis recirculating to its own air intake port?

The appropriate response for the questions in Step 3 should be no. If not, and if a problem cannot be resolved using these guidelines, contact a customer service representative for additional assistance.

To help determine why the ENVM told the system to shut down, use the **show environment last** command. (Refer to the section "Displaying the Reason for the Last Environmental Shutdown.")

Displaying the Reason for the Last Environmental Shutdown

If an ENVM-induced shutdown occurs, the ENVM logs the last measured value from each of the six test points to internal nonvolatile random access memory (NVRAM). Only the last set of these six measurements is stored at any one time. These measurements can be printed to the console using the **show environment last** command.

Following is sample output of the **show environment last** command:

```
Router# show environment last
Environmental controller firmware version 2.2
Serial number is 00225259, calibrated on 5-10-93, by technician mpo
  Internal temperature measured 27.0(C), shuts down at 43.0(C)
Air flow appears good.
+5 volt line measured at 5.061(V)
  +12 volt line measured at 12.070(V)
  -12 volt line measured at -12.034(V)
  -5 volt line measured at -4.915(V)

LAST Environmental Shutdown Measurements:
Internal temperature was 24.0(C)
Air flow sensor was good
+5 volt line was 4.990(V)
+12 volt line was 9.900(V)*
-12 volt line was -11719(V)
-5 volt line was -4.926(V)
Router#
```

System Bootstrap Diagnostics

This section describes how to test for problems with system memory using the bootstrap program. This program can help you isolate or rule out hardware problems encountered when installing your chassis. The diagnostic tests for the chassis help initialize the processor hardware and boot the main operating system software.

![Caution icon] **Caution**   Before proceeding, read through this procedure and the "Processor Card Configuration Register" section in Chapter 5. If you have any doubts about your ability to perform any part, contact a customer service representative for information on how to proceed.

If you remove the jumpers from the boot file number field (bits 3, 2, 1, and 0) of the configuration register, you can start the system in standalone bootstrap mode. The bootstrap mode prompt is an angle bracket (>). Once in bootstrap mode, enter **?** to display a list of available commands and options.

Following is a sample menu display from a system with a CSC/4 processor card (slightly different with the CSC/3):

```
> ?
$ state      Toggle cache state (? for help)
B [filename] Bootload filename and start it
C [address]  Continue [optional address]
D /S M L V   Deposit value V of size S into location L with modifier M
E /S M L     Examine location L with size S with modifier M
G [address]  Start up execution
H            Offer help with commands
I            Initialize
K            Stack trace
L filename   Bootload filename, but do not start it
O            Show configuration register option settings
P            Set break point
S            Single step next instruction
T function   Test device (? for help)
Deposit and Examine sizes may be B (byte), L (long) or S (short).
Modifiers may be R (register) or S (byte swap).
```

Following are some of the most useful bootstrap commands:

- The **H** command prints a summary of the bootstrap commands.

- The **I** command causes the bootstrap program to reinitialize the hardware and clear the contents of memory.

- The **K** command runs a stack trace on system hardware.

- The **B** command (with no argument) boots the default software from ROM, assuming there are no jumpers in the boot field portion of the configuration register. You can include an argument, *filename,* to specify a file to be booted over the network using Trivial File Transfer Protocol (TFTP). You can also include a second argument, *host,* which is the Internet address or name of a particular host on the network.

- The **T** command runs various diagnostic tests, but is not recommended.

  Enter **T ?** to display a list of the diagnostic tests:

```
M   Memory test
P   Probe IO/memory space
```

By default, the memory test examines onboard memory on the processor and memory cards. You can test NVRAM on the CSC-ENVM by supplying starting and ending addresses as described in Table 4-1. The test is destructive to data in NVRAM. The CSC-MC or Flash memory cannot be tested in this way.

Table 4-1   Nonvolatile Memory Addresses

Test	CSC/4 and CSC/3
CSC-ENVM 64K	Start: 2000000
System memory	End: 200FFFF
CSC-ENVM 64K	Start: 20B0000
Nonvolatile memory	End: 20BFFFF

Use the *Probe I/O memory space* test to look at the mapped I/O space in the main memory and test for interface card responses. The test starts at address 2000000. You can specify probe increments in order to look for specific regions. The test uses the probe increments to search for registers that can be read from and written to. See the examples following.

Running the Diagnostic Tests

Follow these steps to run the bootstrap diagnostics:

Step 1 Turn OFF power to the chassis and attach appropriate ESD protection.

Step 2 Remove the front access cover following the appropriate steps in the section "Opening the Chassis" in Chapter 5.

Caution Before proceeding, read the section "Processor Card Configuration Register" in Chapter 5 to familiarize yourself with the configuration register jumpers on the processor card.

Step 3 Remove the jumpers from the boot file number field (bits 3, 2, 1, and 0) of the processor configuration register. (Note jumper positions before removal.)

Note If you start the system with the Break disable (bit 8) jumper removed from the configuration register, you can press the Break key on the console terminal to force the system into bootstrap mode. Enter **c** to continue normal execution of the system software. If you disconnect the console cable when bit 8 is cleared to zero, a "break" is interpreted and the system is halted.

Step 4 Turn ON power to the chassis. Wait for the system to display the banner message and prompt you with an angle bracket (>).

Memory/Bus Diagnostics

To test memory, enter the following at the > prompt and then press the Return key:

```
t m
```

To use the default addresses and select the default tests, press the Return key after each prompt displayed, as in the following sample of the Memory/Bus Diagnostic on the CSC/4 processor card.

Caution If you want to preserve your NVRAM configuration files, do not use the following test between the nonvolatile memory addresses listed in Table 4-1 because the test will overwrite the configuration files in NVRAM.

```
Memory/Bus diagnostic
Starting Address [1000]?
Ending Address [400000]?
Hex argument for variable tests [FFFF]?
Select Tests [all]?
Number of passes to run [2]?
Message Level (0=silence, 1=summary, 2=normal)[2]?
Testing addresses between 0x1000 and 0x400000
Begin pass 0, test 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15   End pass
Begin pass 1, test 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15   End pass
No errors during 2 passes
```

Note In the preceding test, all address values are in hexadecimal; do not use the prefix *0x* when entering a number. Running a single pass of this test takes only a few minutes. If the program encounters memory problems, it displays appropriate error messages on the console screen.

I/O Space Memory Probe

To test I/O space, enter the following at the prompt (>) and press the Return key:

```
t p
```

The memory probe begins at address 2000000. You can specify probe increments. Table 4-2 lists the times required to run the memory tests.

Table 4-2   Memory Test and Memory Probe—Test Times

		Memory Probe Test Times	
Processor Card	Memory Test Times	Probe Increment = 1	Probe Increment[1] = 10
CSC/4	~11 minutes[2]	~20 seconds	~2 seconds
CSC/3	~8 minutes	~30 seconds	~1 seconds

1. In the probe test, increasing the value of the probe increment to 10 will decrease the time taken for the test, but will test in larger blocks of memory.
2. All time values are approximate (~).

The following example shows a test done with probe increments of 1:

```
IO/memory space probe
Starting address [2000000]?
Ending address [210FFFF]?
Probe increment (in shorts) [1]?
Probing from 0x2000000 to 0x210FFFF with interval 0x1
Region 0x210C000 to 0x210C07E exists (OK)
Done
>
```

The following example shows a test done with probe increments of 10:

```
IO/memory space probe
Starting address [2000000]?
Ending address [210FFFF]?
Probe increment (in shorts) [1]? 10
Probing from 0x2000000 to 0x210FFFF with interval 0x10
Region 0x210C000 to 0x210C060 exists (OK)
Done
>
```