Controller Enclosure Troubleshooting

Introduction

This chapter discusses how to identify interface problems, how to identify a controller failure, and how to service the controller modules and the memory modules within the controller enclosure as shown in Figure 92. For troubleshooting procedures, refer to the "Master Troubleshooting Table" on page 565

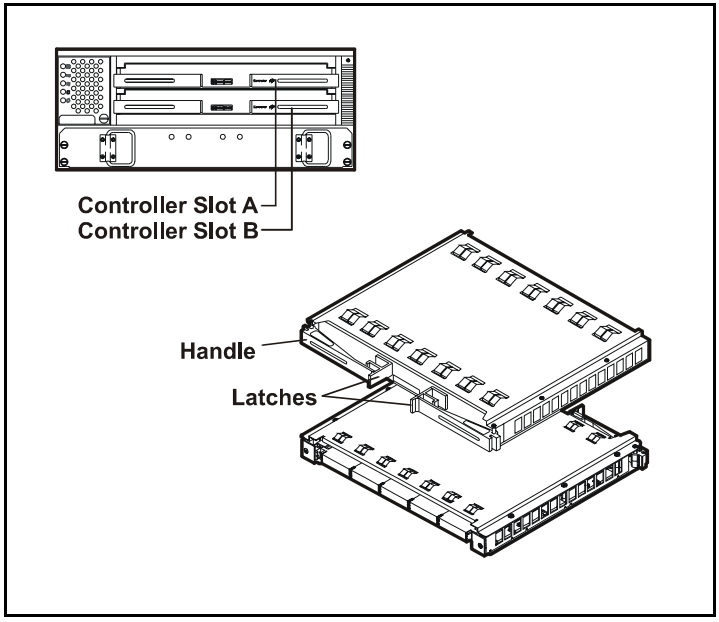

Figure 92 Controller Modules in Controller Enclosure

Controller Enclosure LEDs

Figure 93 shows the locations of the status LEDs for the controller enclosure. Table 61 summarizes the operating LED states for all components within the controller enclosure.

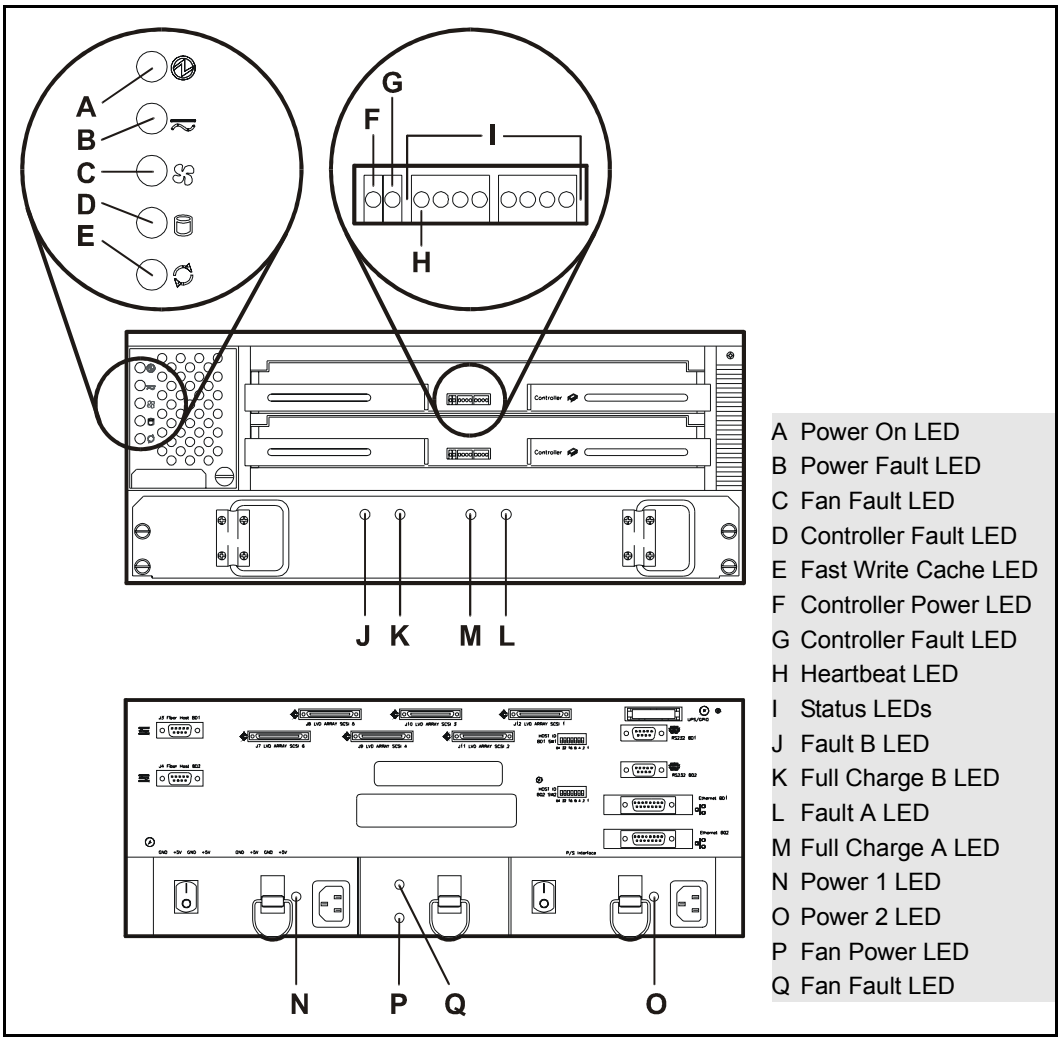

Figure 93 Controller Enclosure LEDs

Table 61 Normal LED Status for Controller Enclosure

Module	LED	Normal State
Controller Enclosure	Power On	On (green)
	Power Fault	Off
	Fan Fault	Off
	Controller Fault	Off
	Fast Write Cache	On (green) while data is in cache
Controller	Controller Power	On (green)
	Controller Fault	Off
	Heartbeat	Blink (green)
	Status	Green There are 8 status LEDs. The number and pattern of these LEDs depend on how your system is configured.
Controller Battery	Fault - B	Off
	Full Charge - B	On (green)[1]
	Fault - A	Off
	Full Charge - A	On (green)[1]
Controller Power Assembly	Power 1	On (green)
	Power 2	On (green)
Controller Fan Assembly	Fan Power	On (green)
	Fan Fault	Off

1. Both Full Charge A and Full Charge B LEDs are ON after batteries are fully charged. The LEDs flash while charging is in progress, and remain on when charging is complete.

Controller Status LEDs

A bank of eight status LEDs plus a Fault LED and a Power LED on the controller module display status information. Each controller module displays only its own status and fault information; it does not display information about the other controller module, if it is installed. Figure 94 shows the location of the controller status LEDs.

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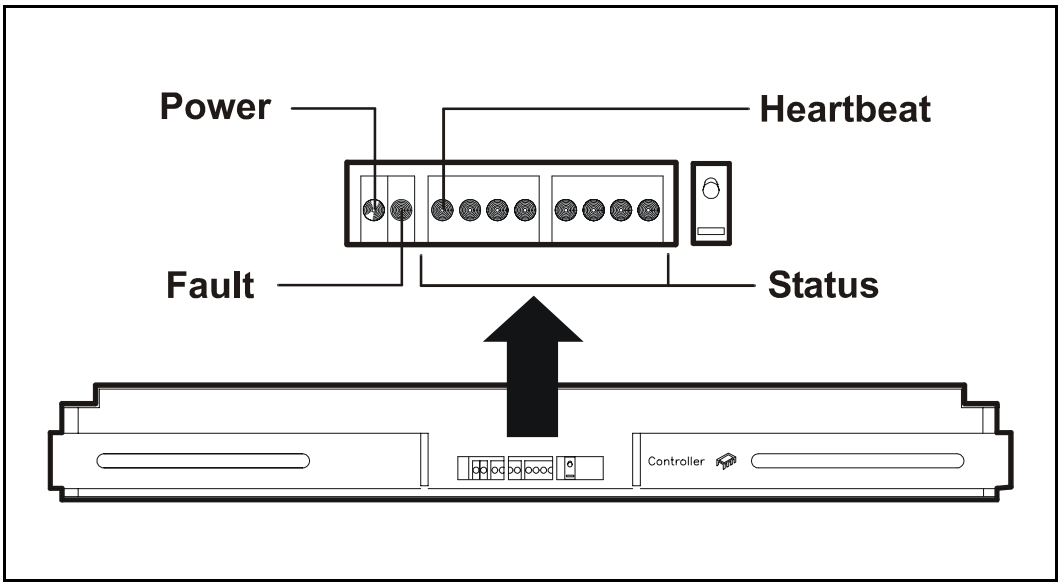


Figure 94 Controller Module Status LEDs

Normal Active -Active LED Patterns

The Heartbeat LED is in the most-significant position of the 8 status LEDs. The pattern displayed on the Status LED bank for an active controller alternates between 0x00 to 0x80 . A passive controller's status LEDs will alternate between 0x6E to 0xEE .

Errors During Normal Operations

It is possible for the controller to encounter errors from which it is unable to recover during normal operations. Specific status LED patterns are used to give a visual indication of any problem. The error pattern returns to the normal setting after the problem has been fixed. These error patterns are listed in Table 66 on page 519.

If the controller encounters an unexpected processor exception, the error pattern of 0xE1 ●●●○ ○○○● will briefly be displayed before the controller reboots itself.

Note *Note that a ● indicates the LED is ON or Flashing.*

If the controller encounters a PCI bus fault while running, the error pattern of 0xAA will be displayed solid ON the LED bank ●○●○ ●○●○ .

Controller Hardware Reset Pattern

Whenever the controller is held in a hardware reset state, all LEDs are on. Therefore, the pattern displayed by the LEDs is 0xFF ●●●● ●●●● .

Hardware Diagnostics Errors

Hardware diagnostics are run during power ON or when a controller module is reset. As diagnostics are run, the LEDs display information indicating which diagnostics are running. The patterns displayed by the LEDs correspond to the Component Code of the component being tested.

Note that the codes are 16-bit and the LEDs display the most significant byte first, followed by the least significant byte. The displays cycle approximately once every 2 seconds.

If a fatal diagnostic error occurs, the controller will not boot, and the LEDs will continue to display a code that gives an indication of the failed component. See Table 66 on page 519 for these codes.

Hardware Initialization

Hardware initialization codes are displayed on the LED bank as the hardware is initialized during a power up or reset sequence.

If the controller encounters errors during hardware initialization, error patterns are displayed on the LEDs. These error patterns are listed in Table 66 on page 519.

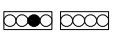
Note These status codes are displayed only momentarily and are typically not visible if the controller is operating normally. They are only visible if the firmware "hangs" while executing these functions.

Boot Menu Execution

Prior to the Boot Menu actually executing, the controller will display a number of status codes indicating various functions being executed (see Table 66 on page 519). Once the Boot Menu is invoked, the controller will cycle through all of the LEDs one by one, and the LED pattern displayed is shown in Table 62.

Note *Note that a ● indicates the LED is ON or Flashing.*

Table 62 LEDs Prior to Boot Menu

0x01	
0x02	
0x04	
0x08	
0x10	
0x20	
0x40	
0x80	
x01, etc.	

Note These status codes are displayed only momentarily and are typically not visible if the controller is operating normally. They are only visible if the firmware "hangs" while executing these functions.

Kernel Initialization

After the hardware is initialized, and the Boot Menu has been given a chance to be invoked, the controller will initialize the kernel as the final part of the Boot Firmware initialization. Table 66 lists the status codes that are displayed.

Note These status codes are displayed only momentarily and are typically not visible if the controller is operating normally. They are only visible if the firmware "hangs" while executing these functions.

Table 66 lists the LED patterns while diagnostics are run, or when diagnostic failures occur.

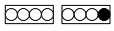
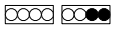
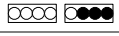
Firmware Download / Flash Programming Patterns

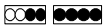
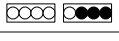
The controller displays specific LED patterns during firmware download.

If firmware is being downloaded to the controller, the LEDs are all turned ON one by one, until all LEDs are on. They are then all turned OFF one by one. The speed at which the LEDs are turned ON or OFF depends on the rate at which code is being downloaded. The LED pattern displayed is shown in Table 63.

Note *Note that a ● indicates the LED is On or Flashing.*

Table 63 Firmware Download LED Patterns

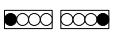
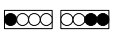
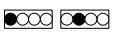
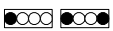
0x01	
0x03	
0x07	
0x0F	
0x1F	

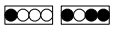
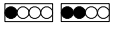
0x3F	
0x7F	
0xFF	
0x7F	
0x3F	
0x1F	
0x0F	
0x07	
0x03	
0x01	
0x03, etc...	

LED patterns are also displayed when the controller programs Flash EEPROM with downloaded code. See Table 64. Different patterns are displayed when the download occurs. These LED patterns are also displayed during automatic code synchronization.

Note *Note that a ● indicates the LED is On or Flashing.*

Table 64 EEPROM LEDs

Description	LED Pattern
In-between programming steps	0x80 
Erasing boot flash segments	0x81 
Writing boot flash segments	0x82 
Verifying erase of boot segments	0x83 
Verifying write of boot segments	0x84 
Erasing file flash segments	0x89 
Writing file flash segments	0x8A 

Verifying erase of file flash segments	0x8B 
Verifying write of file flash segments	0x8C 

Controller Start-Of-Day Process

During a reset the controller performs a complete internal selftest sequence known as "Start Of Day". The following is an overview of the processes that occur during a Start-Of-Day.

1. **Hardware diagnostics:** This process performs diagnostics on specific hardware components, and is only performed during a power-on reset. If there is a critical component failure when running diagnostics, the controller firmware will halt diagnostics execution and flash an error code on the LEDs, indicating the component that failed.
2. **Bootware loaded**: The controller's boot firmware is loaded from Flash memory into Processor memory.
3. **Application firmware loaded**: The controller application firmware is loaded from Flash memory into processor memory.
4. **Ethernet and Fibre Channel**: If the controller hardware supports the integrated Ethernet controller and/or the Fibre Channel host interface, the firmware components to support these interfaces are loaded. The Ethernet capability must specifically be enabled via an option in the User-configurable region of NVSRAM, offset 0x28 bit 3.
5. **Controller Heartbeat**: The controller heartbeat LED will begin to turn on and off. The LED pattern displayed will be 0x00, 0x80, 0x00, 0x80, 0x00, etc.… The absence of the heartbeat LED, is an indication that a fatal error has occurred.
6. **Controller firmware components to handle host operations**: The controller will initialize the host operations to allow the controller to receive and handle operations issued by a host system.
7. **Power-up/Reset Unit Attention for all logical units:** The controller will set the Power-up/Reset Unit Attention for all logical units, and the first non-inquiry host command to the logical unit will be returned with a Check Condition, along with the

sense data indicating that a power-on or reset has occurred. The Sense Key, ASC, and ASCQ will be 0x06, 0x29, and 0x00 respectively.

8. **Mode Select Commands disabled:** The controller will now disable Mode Select Commands until the Start-Of-Day process is complete. This is required so that subsystem configuration changes are prohibited until the controller has finished booting. Mode Select commands issued by a host during this time period, will be returned with an error by the controller, indicating that the addressed logical unit is currently not ready, and is in the process of becoming ready.

9. **Host Side selection enabled:** The controller will now enable selection on the host side, allowing host to select the controller. On a bus reset, this step is completed within 250ms of receiving the bus reset. On power-up, this step is completed within 10 seconds.

10. **Respond to host's Inquiry commands:** The controller is now able to respond to host Inquiry commands, based on the knowledge of previously-existing logical units, as well as their ownership information. An Inquiry issued by a host to a logical unit, will return information indicating whether the logical unit exists, and if it is owned by this controller. If the controller receives a non-Inquiry command, it delays the command a period of time determined by the value set in NVSRAM, before returning a "Not Ready – logical unit is in process of coming ready" error.

11. **Drive operations initialized:** The controller will now initialize firmware components to handle drive operations, allowing the controller to issue commands to the drives.

12. **LUN ownership read:** The controller will read LUN ownership from the NVSRAM.

13. **Loaded firmware modules displayed:** The controller will display a list of loaded firmware modules on the serial port.

14. **Spin up of drives:** The controller reads NVSRAM information for previously existing drives, and spins up the drives, following the Drive Spin-up algorithm as defined in NVSRAM. If the Drive-Spin-up algorithm defined in the NVSRAM, requires the controller to wait for a Start-Unit command from the host before spinning up the drives, the Start-Of-Day process will be suspended at this time, until the host issues a Start Unit command.

15. **Read drive and LUN configuration information from dacStore.** The controller will now read the drive and LUN configuration information from the dacStore on the drives,

and the appropriate structures are created in memory. If these logical units had dirty data in cache, the controller will flush the data to the drive media. If the controller believes that it's Battery Backup Unit has failed, it will attempt to recover any mirrored data from the alternate controller. Hosts are now allowed access to these previously-existing logical units. Non-Inquiry commands will no longer fail with a Not Ready error.

16. **The controller will attempt to spin up all remaining drives in the subsystem**. If new drives are discovered, their configuration information is read, and any LUNs on these drives are brought on line. If the controller finds LUN information on these "new" drives for a LUN that already exists in the array subsystem, then the LUN number will be changed to the next available LUN number. Please refer to the LUN Migration document for additional information regarding moving drives.

17. **Read array subsystem configuration:** The controller will read the array subsystem configuration from the dacStore on the drives to confirm the correct mode of redundant controller operation.

18. **Drive and controller hot-swap enable**: The controller now initializes the firmware components to handle drive and controller hot-swaps.

19. **Subsystem component polling**: The controller now initializes subsystem component polling.

20. **Restart interrupted drive re-constructions**: The controller will restart any drive re-construction processes that were interrupted due to power-fail or resets. With the current release of controller FW, the reconstruction process will be restarted from the beginning of the appropriate LUN. The controller has no knowledge of how much of the reconstruction process was completed, prior to the reset or power-fail.

21. **Copy-Back initiated:** If a Global Hot Spare (GHS) drive has been sparing for a Failed drive, and the originally Failed drive has been replaced, the controller will now initiate a copy-back from the GHS to the replaced drive.

22. **Discover new GHS drives:** If the controller discovers a new GHS has been inserted into the subsystem, it will start using the new GHS drive should a Failed drive be found.

23. **Discover missing drives:** The controller will display a list of drives that had LUN configuration on them but were cold-removed during the last power-down.

24. **Spin down Failed Drives:** Drives that are marked Failed, are now spun down, and their Fault LEDs are lighted.
25. **Restart LUN binding:** The controller will discover and restart LUNs that were in the process of being bound when the reset or power fail occurred.
26. **LUN 0 created:** If no LUNs are discovered, a default LUN is created.
27. **Enable Mode Select commands:** The controller will now enable Mode Select commands, allowing users to make configuration changes, such as adding or deleting LUNs, changing controller modes, or drive states.
28. **Controller** Start-Of-Day completed.

Errors During / After Firmware Download

Different patterns are displayed after downloading firmware. The patterns are shown in Table 65.

Note *Note that a ● indicates the LED is On or Flashing.*

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Table 65 Firmware Download LEDs

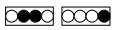
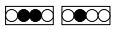
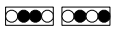
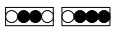
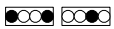
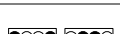
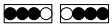
Error	LED Pattern
Download file is lacking header record.	0x61 
Download file header fails checksum test.	0x64 
Download file header contains unexpected download type.	0x65 
The user should attempt to download a known good file.	0x67 
Intermodule error call to flash function passed bad flash type. There is a mismatch between the Boot Firmware and the Application Firmware. The user must download matched versions of both controller Bootware and controller Application Firmware.	0x91 
Invalid address in flash device.	0x92 
Unable to fully erase boot flash segments (bad voltage or device). Replace the controller board.	0x95 
Unable to fully erase file flash segments (bad voltage or device). Replace the controller board.	0x96 
Unable to program boot flash after 3 cycles of erase and write. Replace the controller board.	0x97
Unable to program application file flash after 3 cycles of erase and write. Replace the controller board.	0x98 
Software load failure. There is a mismatch between the Boot Firmware and the Application Firmware. The user must download matched versions of both code types.	0xE6 

Table 65 Firmware Download LEDs (cont'd)

Kernel missing, or kernel CRC mismatch. The user must download a matching combination of controller Bootware and controller Application Firmware.	0xE7 
Application Firmware missing, or Application CRC mismatch. The user must download a version of controller Application Firmware that matches the currently loaded controller Bootware.	0xE8 

Controller Fault LED

The Controller Fault LED indicates a number of conditions.

Power On

When power is first applied to the board, the Controller Fault LED is turned ON by the controller hardware. This is a temporary state and the LED will turn OFF after the controller has powered up. If there is an error condition in the controller, the LED will remain On.

Firmware Download

When the downloadable firmware is initialized, it takes control of the Controller Fault LED and continues to drive the LED on. The LED will remain ON (not blinking) until the board completes diagnostics with no fatal errors. If a fatal error occurs, the Controller Fault LED will remain on. It will take approximately 6 seconds to complete level 0 diagnostics.

Controller Failure

A timeout timer (watchdog timer) also turns ON the Controller Fault LED if it does not get serviced periodically by the firmware, indicating that there has been a catastrophic controller failure. If this error happens, contact a trained service representative to upload new firmware.

Controller Status LED Codes Summary

Table 66 lists a summary of the various controller Status LED codes.

Note *Note that a ● indicates the LED is On or Flashing.*

Table 66 Controller Status LEDs codes

Code	Description	Comments	Cause / Solution
0x20	Kernel Start	Kernel Init. status	***Controller module / reseat or replace***
0x21	Kernel cache initialization		
0x22	Kernel IDT set-up		
0x23	Kernel hardware initialization		
0x24	Kernel initialization		
0x25	Kernel Task Manager start-up		
0x26	Kernel memory initialization		
0x27	Kernel clock start		
0x28	Kernel service initialization		
0x29	Kernel symbol table initialization		
0x2A	Kernel network initialization		
0x2B	Kernel flash EEPROM file system initialization		
0x2C	Kernel NMI enabled		
0x2D	Kernel page management initialization		
0x2E	Kernel shell initialization		
0x2F	Kernel application load		
0x30	Kernel application start		
0x33 0x00	Non-volatile Memory (8 Kbytes) diagnostics running	HW Diag. status	

Table 66 Controller Status LEDs codes (cont'd)

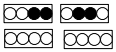
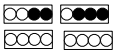
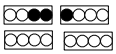
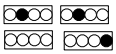
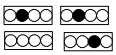
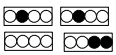
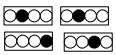
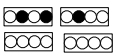
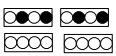
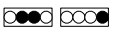
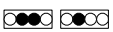
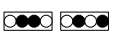
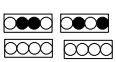
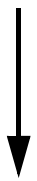
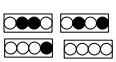
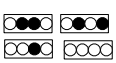
Code	Description	Comments	Cause / Solution
0x36 0x00 	Processor DRAM diagnostics running	HW Diag. status 	***Controller module / reseat or replace*** 
0x37 0x00 	RPA DRAM diagnostics running		
0x38 0x00 	Processor Level 2 Cache diagnostics running		
0x44 0x01 	CDC diagnostics running		
0x44 0x02 	SIO diagnostics running		
0x44 0x03 	RPA diagnostics running		
0x44 0x12 	SIO Interrupt diagnostics running		
0x54 0x00 	ICON diagnostics running		
0x55 0x00 	FReD diagnostics running		
0x61 	Download file is lacking header record		***Firmware file is bad / Download Firmware with a good file.*** 
0x64 	Download file header fails checksum test		
0x65 	Download file header contains unexpected download type		
0x65 0x00 	Host SCSI Channel (53C825) diagnostics running		***Controller module / reseat or replace*** 
0x65 0x10 	Host SCSI Channel (53C875) diagnostics running		
0x65 0x20 	Host Fibre Channel Interface diagnostics running		
0x67 	CRC failure on downloaded data		

Table 66 Controller Status LEDs codes (cont'd)

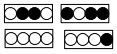
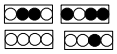
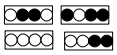
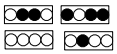
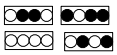
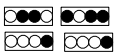
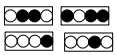
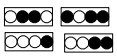
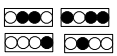
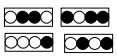
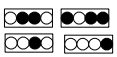
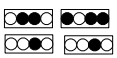
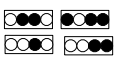
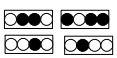
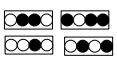
Code	Description	Comments	Cause / Solution
0x6B 0x01 	Drive SCSI Channel 1 (53C810) diagnostics running	HW Diag. status	***Controller module / reseat or replace***
0x6B 0x02 	Drive SC SI Channel 2 (53C810) diagnostics running		
0x6B 0x03 	Drive SCSI Channel 3 (53C810) diagnostics running		
0x6B 0x04 	Drive SCSI Channel 4 (53C810) diagnostics running		
0x6B 0x05 	Drive SCSI Channel 5 (53C810) diagnostics running		
0x6B 0x11 	Drive SCSI Channel 1 (53C825) diagnostics running		
0x6B 0x12 	Drive SCSI Channel 2 (53C825) diagnostics running		
0x6B 0x13 	Drive SCSI Channel 3 (53C825) diagnostics running		
0x6B 0x14 	Drive SCSI Channel 4 (53C825) diagnostics running		
0x6B 0x15 	Drive SCSI Channel 5 (53C825) diagnostics running		
0x6B 0x21 	Drive SCSI Channel 1 (53C875) diagnostics running		
0x6B 0x22 	Drive SCSI Channel 2 (53C875) diagnostics running		
0x6B 0x23 	Drive SCSI Channel 3 (53C875) diagnostics running		
0x6B 0x24 	Drive SCSI Channel 4 (53C875) diagnostics running		
0x6B 0x25 	Drive SCSI Channel 5 (53C875) diagnostics running		

Table 66 Controller Status LEDs codes (cont'd)

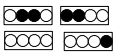
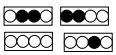
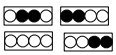
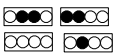
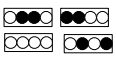
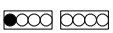
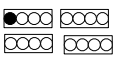
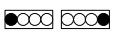
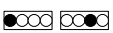
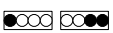
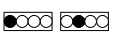
Code	Description	Comments	Cause / Solution
0x6C 0x01 	Drive SCSI Channel 1 Turnaround diagnostics running	HW Diag. status	***Controller module / reseat or replace***
0x6C 0x02 	Drive SCSI Channel 2 Turnaround diagnostics running		
0x6C 0x03 	Drive SCSI Channel 3 Turnaround diagnostics running		
0x6C 0x04 	Drive SCSI Channel 4 Turnaround diagnostics running		
0x6C 0x05 	Drive SCSI Channel 5 Turnaround diagnostics running		
0x6E 0xEE 	Passive controller - Normal during Firmware download. The controller may be in this state after power ON (in this case, use the AM60 software to set to "Active" state).		
0x80 	In-between programming steps		***Firmware file is bad / Download Firmware with a good file.***
0x80 0x00 	Active controller - Normal State		
0x81 	Erasing boot flash segments		***Firmware file is downloading or Firmware file is bad / Download Firmware with a good file.***
0x82 	Writing boot flash segments		
0x83 	Verifying erase of boot segments		
0x84 	Verifying write of boot segments		
0x89 	Erasing file flash segments		
0x8A 	Writing file flash segments		
0x8B 	Verifying erase of file flash segments		
0x8C 	Verifying write of file flash segments		

Table 66 Controller Status LEDs codes (cont'd)

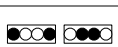
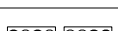
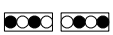
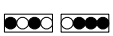
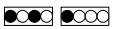
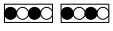
Code	Description	Comments	Cause / Solution
0x91 	Intermodule error call to flash function passed bad flash type	***Firmware file is bad / Download Firmware with a good file.*** Attempt to download Firmware again. If the problem persists, replace the controller module.	
0x92 	Invalid address in flash device	***Firmware file is bad / Download Firmware with a good file.*** Attempt to download Firmware again. If the problem persists, replace the controller module.	
0x93 	Length too long for flash device		
0x95 	Unable to fully erase boot flash segments		***Controller module / reseat or replace***
0x96 	Unable to fully erase file flash segments		
0x97	Unable to program boot flash after 3 cycles of erase and write		
0x98	Unable to program application file flash after 3 cycles of erase and write		
0xA1 	Start Boot Firmware	Boot Funct. Status	
0xA2	Initialize core hardware		
0xA3 	Determine hardware configuration		
0xA4 	Determine CDC memory size		
0xA5 	Determine RAID Parity Assist memory size		
0xA6 	Initialize BIOS timer		
0xA7 	Initialize serial interface		
0xA8 	General software initialization		
0xA9 	Display Boot banner		
0xAA 	Test Boot Menu invocation		
0xAA (steady) 	PCI fatal fault		
0xAB 	Test Boot Menu memory	Boot Funct. Status	***Memory problem / reseat or replace***

Table 66 Controller Status LEDs codes (cont'd)

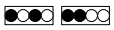
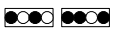
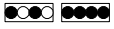
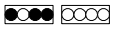
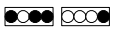
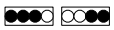
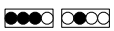
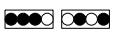
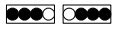
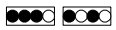
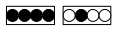
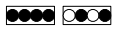
Code	Description	Comments	Cause / Solution
0xAC 	Load Boot Menu	Boot Funct. Status	***Controller module / reseat or replace***
0xAD 	Invoke Boot Menu		
0xAE 	Exit Boot Menu		
0xAF 	Test Diagnostics Manager memory		***Memory problem / reseat or replace***
0xB0 	Load Diagnostics Manager		***Controller module / reseat or replace***
0xB1 	Invoke Diagnostics Manager		***Controller module / reseat or replace***
0xB2 	Clear work memory		***Memory problem***
0xB3 	Clear extended memory		***Controller module / reseat or replace***
0xB4 	Kernel set-up		
0xB5 	Enable Level 2 cache		
0xB6 	Load kernel		
0xB7 	Load network manager		
0xB8 	Load Application code symbol table		
0xB9 	Invoke kernel		
0xBE 	Unexpected return from kernel		
0xBF 	Rebooting after Boot Firmware download		
0xE3 	No host channel devices on the PCI bus	HW Init. status	
0xE4 	Wrong number of drive channel devices on the PCI bus		
0xE5 	No RPA device on the PCI bus		

Table 66 Controller Status LEDs codes (cont'd)

Code	Description	Comments	Cause / Solution
0xE6 0x66 	Software load failure RPA parity error		***Firmware file is bad / Download Firmware with a good file.***
0xE7 	Kernel missing, or kernel CRC mismatch		
0xE8 	Application Firmware missing, or Application CRC mismatch		
0xEA 	Swapped controller		***Controller is in wrong slot.***
0xF1 	Processor set-up	HW Init. status	***Controller module / reseat or replace***
0xF2 	CDC chip set-up		
0xF3 	RAID Parity Assist chip set-up		
0xF4 	Memory Test		
0xF5 	Load Boot Firmware		
0xF7 	Clear Boot memory		
0xF8 	Enable Protected mode		
0xF9 	Memory test failure		
0xFA 	Exception error		
0xFB 	Start mode determination		
0xFC 	Invoke Boot Firmware		
0xFF 	Hardware reset		***Hardware reset is in progress or there is a bad controller module.***

Identifying Interface Problems

Types of Interface Problems

Interface problems include any malfunctions that delay, interrupt, or prevent successful input/output (I/O) activity between the hosts and other devices. This includes transmissions between the controller enclosure and disk enclosures attached to it. For the purpose of this discussion, the controller enclosure's interface components include the following:

- Internal components
  - Two Fibre Channel controller modules
  - Controller enclosure card cage (includes midplane w/SCSI connectors)
- External components:
  - Fibre Channel host adapters, cables, and hub or switching devices
  - SCSI cables, terminators, BCC modules in the disk enclosure

Interface problems can be caused by either software or hardware.

- Software problems, which indicate operating system or disk array application errors, typically involve one or more of the following:
  - Host operating system software error
  - Disk array or other application error
  - Incorrect configuration settings
- Hardware problems, which indicate defective equipment, include the following:
  - Loose, disconnected, or damaged interface cables or connectors
  - Improper SCSI termination on disk enclosure bus or defective terminators
  - Improper interface ID settings (hardware switches)
  - Failed controller modules, memory modules, or controller enclosure midplane
  - Failed disk modules, host adapter boards, or other devices on the Fibre Channel network
  - Failed disk modules

Hints for Troubleshooting Interface Problems

The first step in troubleshooting interface problems is determining whether the problem is caused by hardware or software. The following information should aid in making this determination:

- If the problem occurred during or immediately following a software activity, try to undo whatever the software did, then step through each software function (in smaller increments) until the problem occurs again. This will identify the function that is working incorrectly.
- If the problem occurred without an apparent software-related activity, check the operating system and storage management software for error messages and associated procedures. This may help determine if it is a software or hardware problem.
- Check the controller modules for faults.
- Check all the interface cables, particularly the host Fibre Channel cables, to make sure that they are securely connected and undamaged.
- If you moved the controller enclosure to another host or attached new devices to it, check the following:
  - **Loop ID settings for both controller modules**. Make sure these settings are unique and do not conflict with other devices. Change the settings if necessary.
  - **SCSI ID settings on all attached disk enclosure BCC modules**. Change the settings as necessary. Make sure all switch settings are set the same for both BCCs in each disk enclosure.
  - **Interface cable connections**. Make sure that all cables are routed correctly. Change the cable connections as necessary. For cable connection information for other devices, refer to applicable hardware manuals. Make sure that the Split/Full bus switch is set on the disk enclosure for the desired configuration.

Problems resulting from a defective host adapter board, controller module, memory module, or controller enclosure midplane may be difficult to detect. If checking all the items listed above does not identify the problem, try:

- Replacing the host adapter and appropriate interface cable to each host.

- Replacing the disk array controller module (including memory).
- Replacing the controller enclosure midplane (controller card cage).

Controller Servicing Notes

Here are a few suggestions to consider when servicing disk array controller modules:

- Always use proper precautions against electrostatic discharge when removing and handling disk array components.
- Always read pertinent documentation. This includes software instructions on replacing failed interface components and documentation shipped with the replacement FRUs, particularly the kit instructions. Kit instructions often contain the most current information regarding servicing.
- Always stop all I/O activity to the controller and associated disk modules before replacing the suspect or failed component unless alternate LVM links are properly configured.
- Memory modules, controller modules, and the controller enclosure card cage assembly, which includes the midplane are not user replaceable. These components must be serviced by a qualified, trained service technician only.
- A failed controller module can be hot swapped if the failed controller Is one of a redundant pair.
- If cache mirroring is enabled and one controller module fails, the remaining controller module will assume operation of the disk array, but write cache will be disabled.
- Remove the front cover to service the controller modules or to view the LEDs on each module.
- Make sure that the new controller module has the same amount of memory as the one you are replacing.

Note Do not swap a controller when the power is off!

- SCSI interface cables are not hot swappable.

- A controller fault may be due to a failed memory module.

Memory Module Servicing Notes

CAUTION **Memory modules must be serviced by a trained service technician ONLY.**

Before replacing a failed SIMM or DIMM, remember the following tips:

- Always use proper precautions against electrostatic discharge before removing and handling controller modules, SIMMs, and DIMMs.
- Always use the same type and size of memory module to replace a failed module.
- The Fault LED on the affected controller module will turn ON if one of its memory modules fail. This is the same LED used to indicate a controller failure. The controllers do not contain an LED or other mechanism for identifying individual memory module failures. The following information should help you determine if the problem is memory- or controller-related:
- Remove the failed controller module and replace a failed memory module while the other controller module is running.
- If cache mirroring is enabled and one controller module fails, the remaining controller module will assume operation of the disk array, but write cache will be disabled.

Controller Enclosure Troubleshooting

Introduction

This section describes procedures to troubleshoot the controller enclosure. See Figure 95. For troubleshooting procedures, refer to Table 68 or the "Master Troubleshooting Table" on page 565.

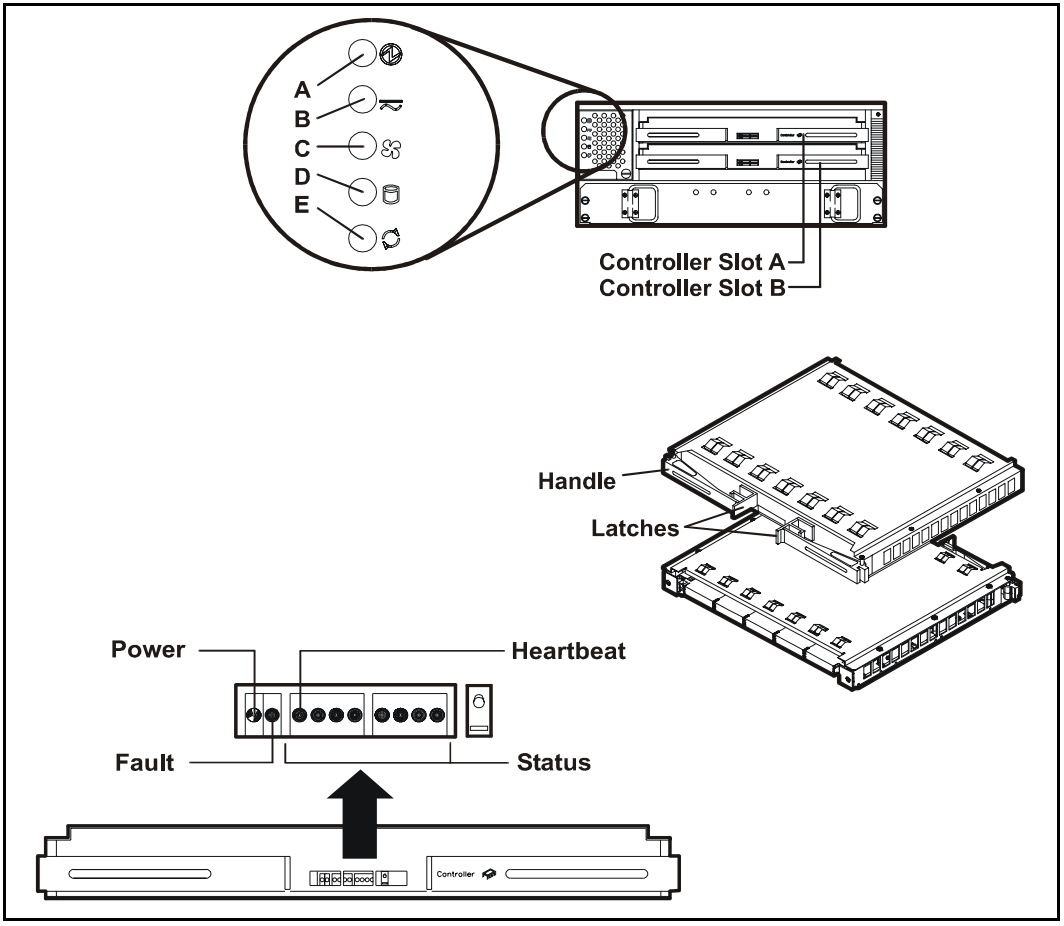


Figure 95 Controller FRU, Slots and LEDs

Table 67 Controller Enclosure Troubleshooting Flowchart (Sheet 1 of 5)

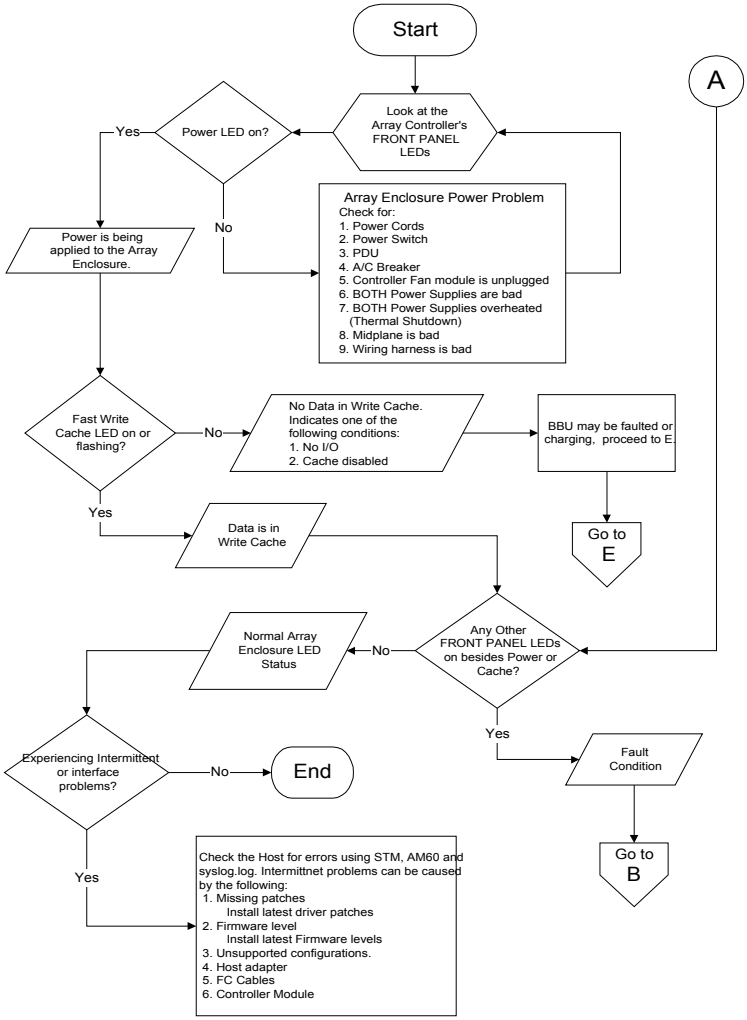


Table 67 Controller Enclosure Troubleshooting Flowchart (Sheet 2 of 5)

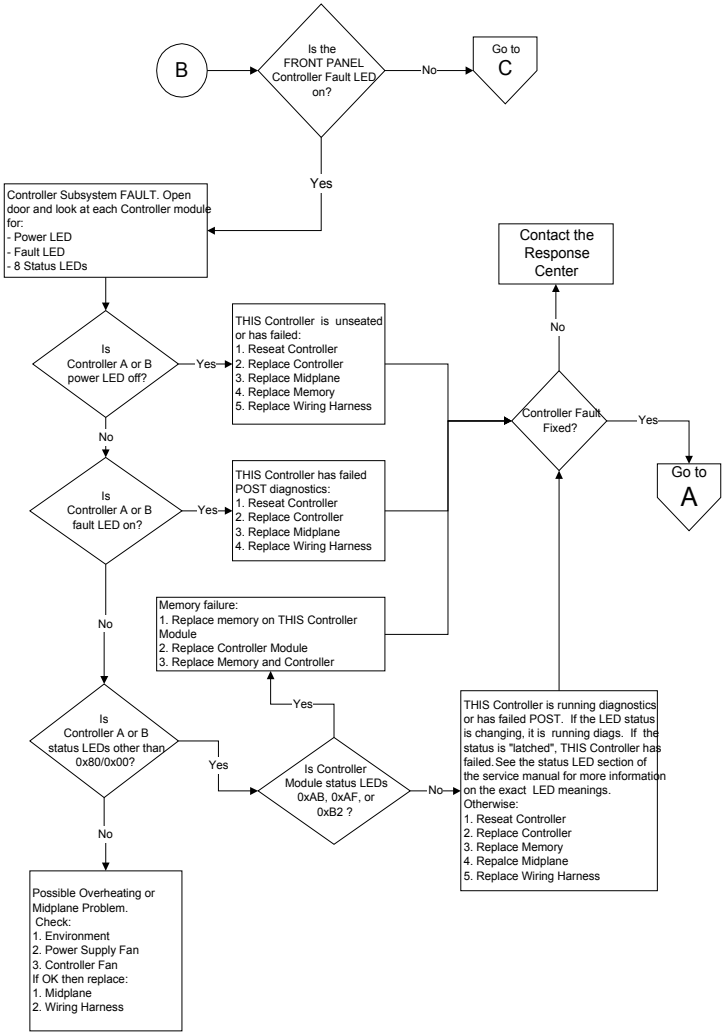


Table 67 Controller Enclosure Troubleshooting Flowchart (Sheet 3 of 5)

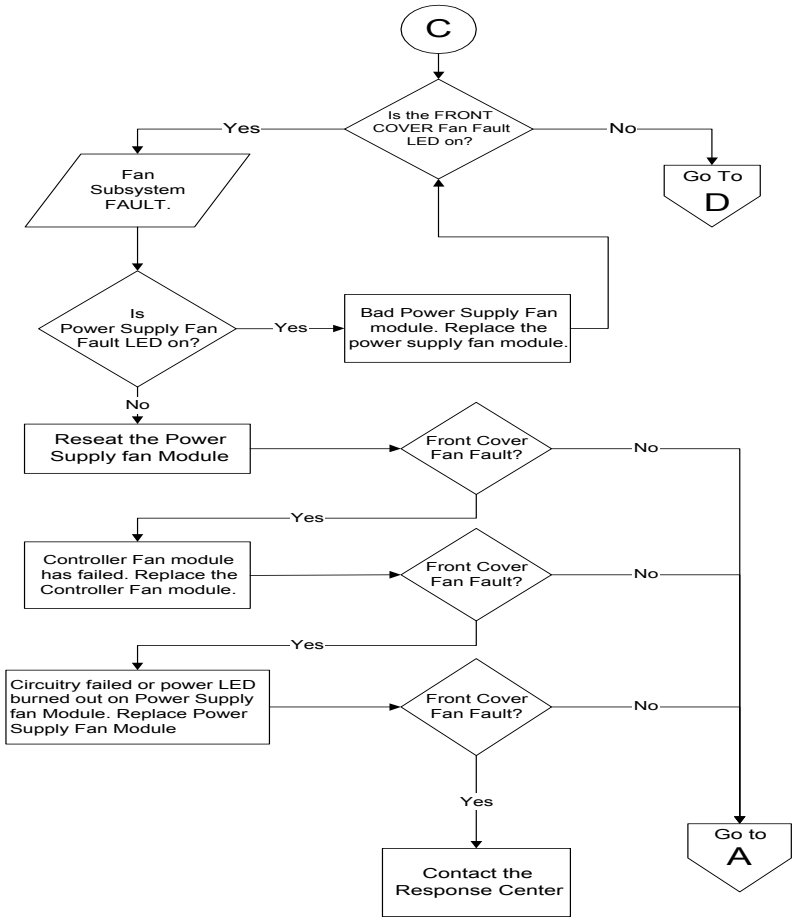


Table 67 Controller Enclosure Troubleshooting Flowchart (Sheet 4 of 5)

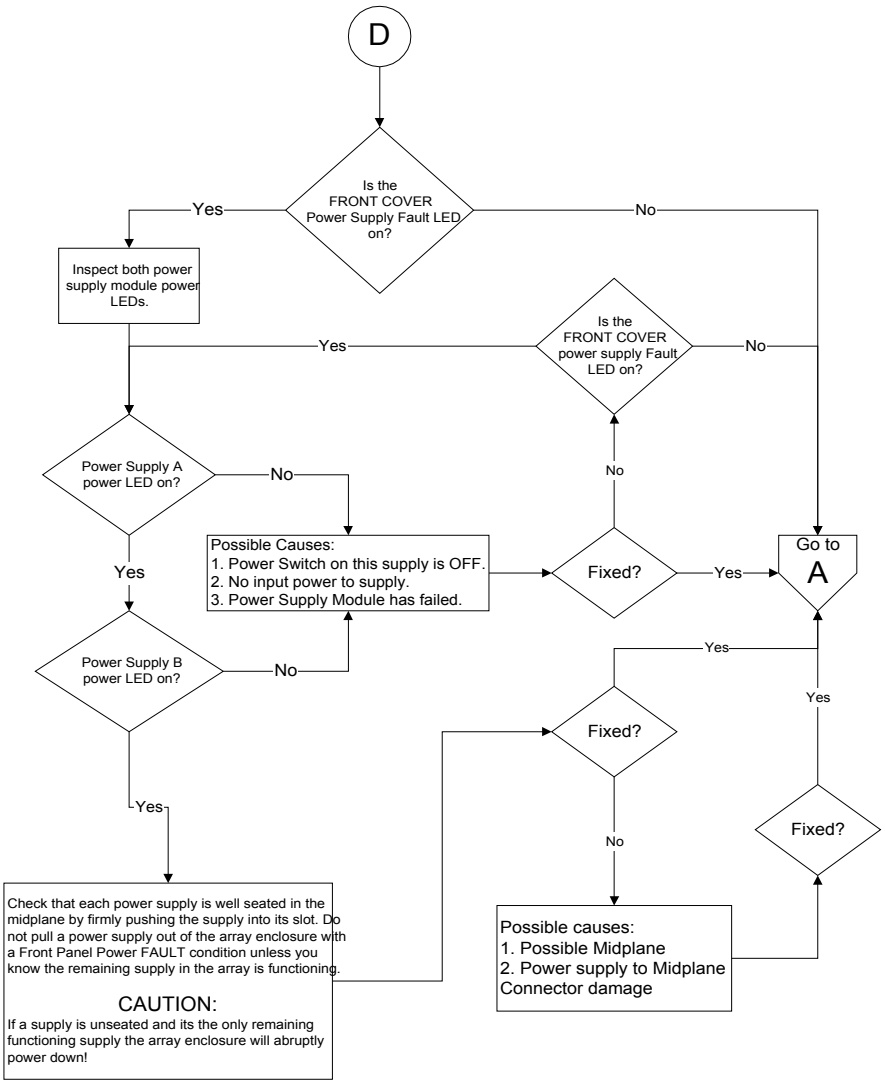


Table 67 Controller Enclosure Troubleshooting Flowchart (Sheet 5 of 5)

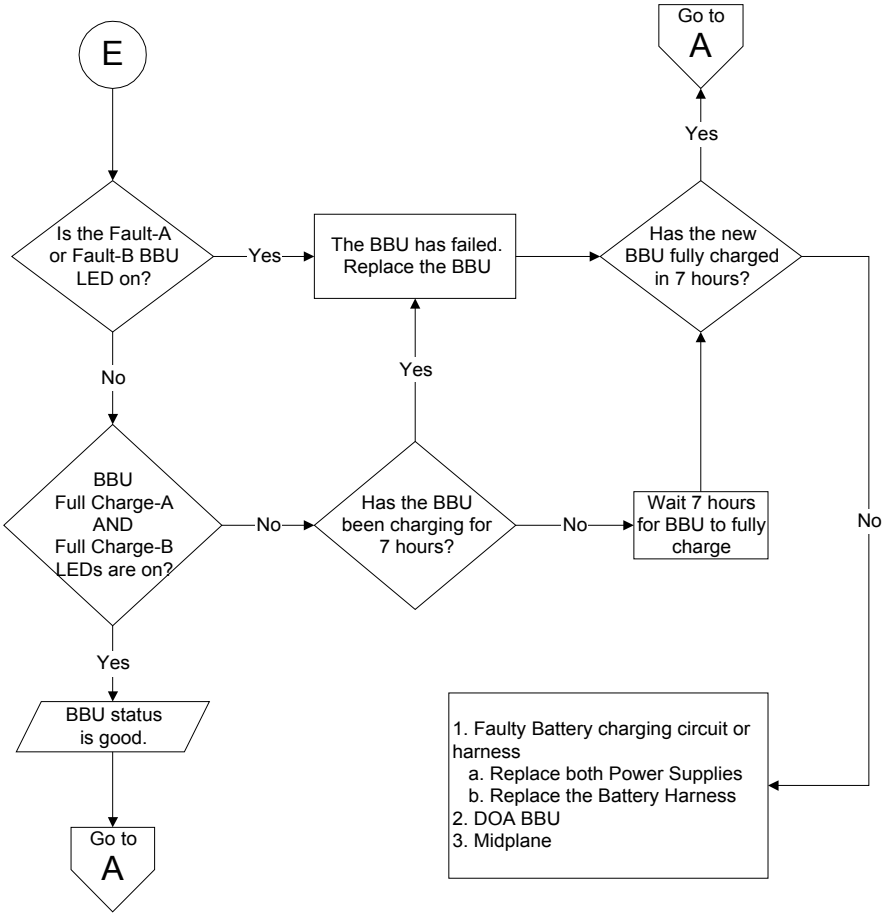


Table 68 Controller Troubleshooting

Symptom	Possible Cause	Procedure
Controller LED (front cover) is ON and the fan LED is off.	A Controller missing or unplugged	Check the Power LEDs on both controller modules. If one Power LED is off, make sure that the module is plugged in correctly and its handles are locked in place.
	B Controller failed	If the Fault LED remains ON after replacing the Controller, go to cause C.
	C One or more memory modules failed	Replace the memory modules. If the Fault LED remains ON after replacing the memory, go to cause D.
	D Controller enclosure midplane failed	Replace the Midplane. If the Fault LED remains ON after replacing the midplane, call the factory service center.
Software issued a Controller error message	A Controller failed	– Check the Fan LED on the front cover. If it is on, go to "Troubleshooting Controller Fan Module Problems" on page 547. If not, continue at the next step. – Replace the failed Controller.
Controller enclosure and Fan LED (front cover) are on	A Controller enclosure fan failure caused one or both Controller(s) to overheat	– Stop all activity to the Controller module and turn OFF the power. – Replace the failed Controller enclosure fan module. – Allow the Controller to cool down, then turn ON the power. – Check both Controllers for fault LEDs. If a Controller Fault LED turns on, replace the failed Controller.