



ST2500 M2 Array Module Installation Guide

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Revision History

Version and Date	Description of Changes
51339-00, Rev. A, May 2011	Initial release of the document.

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Step 1 – Preparing for a ST2500 M2 Array Module Installation

This topic provides basic information for installing the ST2500 M2 array module and the corresponding drive modules (the ST2501 M2 drive module) in a storage array. After you have completed these tasks, go to the *Initial Configuration and Software Installation* electronic document topics or the PDF on the SANtricity ES Storage Manager Installation DVD.

Storage arrays for 6-Gb/s SAS drives consist of a ST2500 M2 array module, or a ST2500 M2 array module and one or more ST2501 M2 drive modules in a cabinet. Use this document to install the ST2500 M2 array modules and all necessary drive modules for your configuration.

The following table shows the various configuration options.

Table 1 ST2500 M2 Array Module Options

ST2500 M2 Configurations	Options
Simplex (one controller) ST2500 M2 array module with no host interface card	<p>A maximum of 96 drives that you can upgrade to 192. The upgrade is a Premium feature.</p> <p>Any combination of ST2500 M2 array modules attached to ST2501 M2 drive modules, not to exceed a maximum of 96 (or 192) drive slots in the storage array.</p> <p>Two 6-Gb/s host connectors.</p> <p>8-GB battery backup.</p>
Simplex ST2500 M2 array module with a host interface card	<p>A maximum of 96 drives that you can upgrade to 192. The upgrade is a Premium feature.</p> <p>Any combination of ST2500 M2 array modules attached to ST2501 M2 drive modules, not to exceed a maximum of 96 (or 192) drive slots in the storage array.</p> <p>Two 6-Gb/s host connectors, in addition to one of the following host interface cards:</p> <ul style="list-style-type: none"> ■ Two 6-Gb/s SAS connectors ■ Four 1-Gb/s iSCSI connectors ■ Two 10-Gb/s iSCSI connectors ■ Four 8-Gb/s Fibre Channel (FC) connectors <p>8-GB battery backup.</p>
Duplex (two controllers) ST2500 M2 array module without a host interface card	<p>A maximum of 96 drives that you can upgrade to 192. The upgrade is a Premium feature.</p> <p>Any combination of ST2500 M2 array modules attached to ST2501 M2 drive modules, not to exceed a maximum of 96 (or 192) drive slots in the storage array.</p> <p>Two 6-Gb/s host connectors.</p> <p>8-GB battery backup.</p>
Duplex ST2500 M2 array module with a host interface card	<p>A maximum of 96 drives that you can upgrade to 192. The upgrade is a Premium feature.</p> <p>Any combination of ST2500 M2 array modules attached to ST2501 M2 drive modules, not to exceed a maximum of 96 (or 192) drive slots in the storage array.</p> <p>Two 6-Gb/s host connectors, in addition to one of the following host interface cards:</p> <ul style="list-style-type: none"> ■ Two 6-Gb/s SAS connectors ■ Four 1-Gb/s iSCSI connectors ■ Two 10-Gb/s iSCSI connectors ■ Four 8-Gb/s FC connectors <p>8-GB battery backup.</p>

ATTENTION Possible hardware damage – To prevent electrostatic discharge damage to the module, use proper antistatic protection when handling module components.

Key Terms

storage array

A collection of both physical components and logical components for storing data. Physical components include drives, controllers, fans, and power supplies. Logical components include pools and volumes. These components are managed by the storage management software.

array module

One module with drives, one or two controllers, fans, and power supplies. The array module provides the interface between a host and a storage array.

controller

A circuit board and firmware that is located within a controller module or an array module. A controller manages the input/output (I/O) between the host system and data volumes.

drive module

One module with drives, one or two environmental services monitors (ESMs), power supplies, and fans. A drive module does not contain controllers.

environmental services monitor (ESM)

A CRU in the drive module that monitors the status of the components. An ESM also serves as the connection point to transfer data between the drive module and the controller.

Small Form-factor Pluggable (SFP) transceiver

A component that enables Fibre Channel duplex communication between storage array devices. SFP transceivers can be inserted into host bus adapters (HBAs), controllers, and environmental services monitors (ESMs). SFP transceivers can support either copper cables (the SFP transceiver is integrated with the cable) or fiber-optic cables (the SFP transceiver is a separate component from the fiber-optic cable).

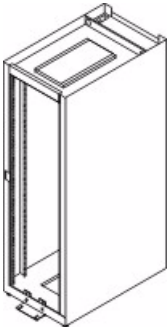
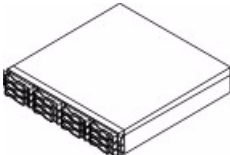

Gathering Items

Before you start installing the array module, you must have installed the cabinet in which the array module will be mounted.

Use the tables in this section to verify that you have all of the necessary items to install the array module.

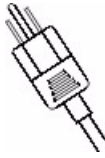
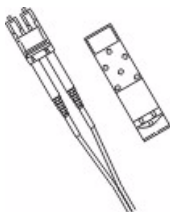
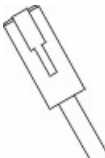
Basic Hardware


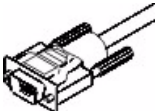

Table 2 Basic Hardware

	Item	Included with the Array Module
	<p>Cabinet</p> <ul style="list-style-type: none"> ■ Make sure that your cabinet meets the installation site specifications of the various ST2500 M2 storage array components. Refer to the <i>Storage System Site Preparation Guide</i> for more information. ■ Depending on the power supply limitations of your cabinet, you might need to install more than one cabinet to accommodate the different components of the ST2500 M2 storage array. Refer to the installation guide for your cabinet for instructions on installing the cabinet. 	
	ST2501 M2 drive module with end caps that are packaged separately.	✓
	<p>Mounting rails and screws</p> <p>The mounting rails that are available with the drive module are designed for an industry-standard cabinet.</p>	
	Fibre Channel switch (optional)	
	SAS switch (optional)	
	Gigabit Ethernet switch (optional)	
	<ul style="list-style-type: none"> ■ Host with Fibre Channel host bus adapters (HBAs) (optional) ■ Host with iSCSI HBAs (optional) or a network interface card (optional) ■ Host with SAS HBAs (optional) 	

ST2500 M2 Configuration Cables and Connectors

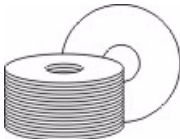
Table 3 Cables and Connectors

	Item	Included with the Array Module or Drive Modules
	<p>AC power cords.</p> <p>The array module and the drive modules ship with power cords for connecting to an external power source, such as a wall plug. Your cabinet might have special power cords that you use instead of the power cords that ship with the array module and the drive modules.</p>	✓
	<p>(Optional) Two DC power connector cables are provided with each drive module for connection to centralized DC power plant equipment.</p> <ul style="list-style-type: none"> Four DC power connector cables are provided if additional redundancy is required. A qualified service person is required to make the DC power connection per NEC and CEC guidelines. A two-pole 20-amp circuit breaker is required between the DC power source and the drive module for over-current and short-circuit protection. Before turning off any power switches on a DC-powered drive module, first you must disconnect the two-pole 20-amp circuit breaker. 	<p>✓</p> <p>For the DC power option only</p>
	<p>Copper SAS cables - Use for all drive-side connections within the storage array.</p> <p>Fiber-optic cables - Use for FC connections to the drive modules.</p> <p>For the differences between the fiber-optic cables and the copper Fibre Channel (FC) cables, see Things to Know – SFP Transceivers, Fiber-Optic Cables, Copper Cables, and SAS Cables.</p>	
	<p>Small Form-factor Pluggable (SFP) transceivers</p> <ul style="list-style-type: none"> The SFP transceivers connect fiber-optic cables to host ports and drive ports. Four or eight SFP transceivers are included with the array module; one for each of the host channel ports on the controllers. Depending on your connection requirements, you might need to purchase additional SFP transceivers (two SFP transceivers for each fiber-optic cable). Depending on the configuration of your storage array, you might need to use various combinations of four different types of SFP transceivers: 8-Gb/s Fibre Channel, 6-Gb/s SAS, 1-Gb/s iSCSI, or 10-Gb/s iSCSI. These SFP transceivers are not generally interchangeable. You must purchase <i>only</i> Restriction of Hazardous Substances (RoHS)-compliant SFP transceivers. 	✓
	<p>Copper Fibre Channel cables (optional)</p> <p>Use these cables for connections within the storage array.</p> <p>For the differences between the fiber-optic cables and the copper Fibre Channel cables, see Things to Know – SFP Transceivers, Fiber-Optic Cables, Copper Cables, and SAS Cables.</p>	✓
	<p>Ethernet cable</p> <p>This cable is used for out-of-band storage array management and for 1-Gb/s iSCSI connections.</p> <p>For information about out-of-band storage array management, see the description for "Deciding on the Management Method" in <i>Initial Configuration and Software Installation</i> electronic document topics or the PDF on the SANtricity ES Storage Manager Installation DVD.</p>	

	Item	Included with the Array Module or Drive Modules
	<p>SAS cables</p> <p>The SAS cables connect the host to the array module. If you install a drive module, you must use SAS cables to connect the array module to the drive module.</p>	
	<p>Serial cable</p> <p>This cable is used for support only. You do not need to connect it during initial installation.</p>	
	<p>DB9-to-PS2 adapter cable</p> <p>This cable adapts the DB9 connector on commercially available serial cables to the PS2 connector on the controller.</p>	

Product DVDs



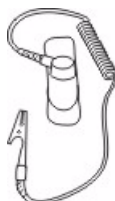
Table 4 Product DVDs

	Item	Included with the Array Module
	<p>Firmware DVD</p> <ul style="list-style-type: none"> ■ Firmware is already installed on the controllers. ■ The files on the DVD are backup copies. <p>SANtricity ES Storage Manager Installation DVD</p> <ul style="list-style-type: none"> ■ SANtricity ES Storage Manager software and documentation. ■ To access product documentation, use the documentation map file, <code>doc_launcher.html</code>, which is located in the <code>docs</code> directory. 	✓

Tools and Other Items

Table 5 Tools and Other Items

	Item	Included with the Module
	<p>Labels</p> <p>Help you to identify cable connections and lets you more easily trace cables from one module to another</p>	
	<p>A cart</p> <p>Holds the module and components</p>	
	A mechanical lift (optional)	

	Item	Included with the Module
	A Phillips screwdriver	
	A flat-blade screwdriver	
	Anti-static protection	
	A flashlight	
Use the Compatibility Matrix, at the following website, to obtain the latest hardware compatibility information. http://www.lsi.com/compatibilitymatrix/		

Things to Know – SFP Transceivers, Fiber-Optic Cables, Copper Cables, and SAS Cables

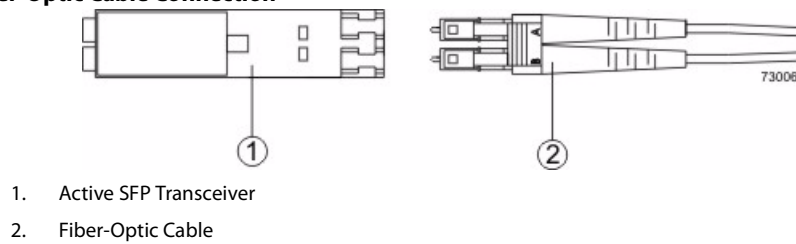
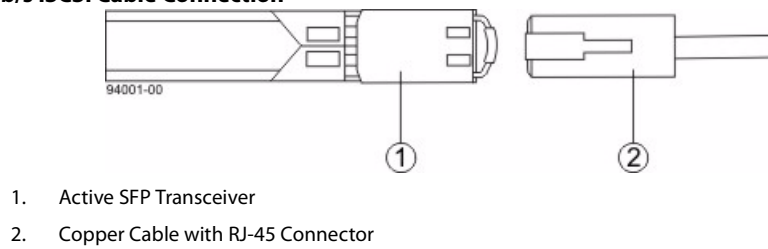
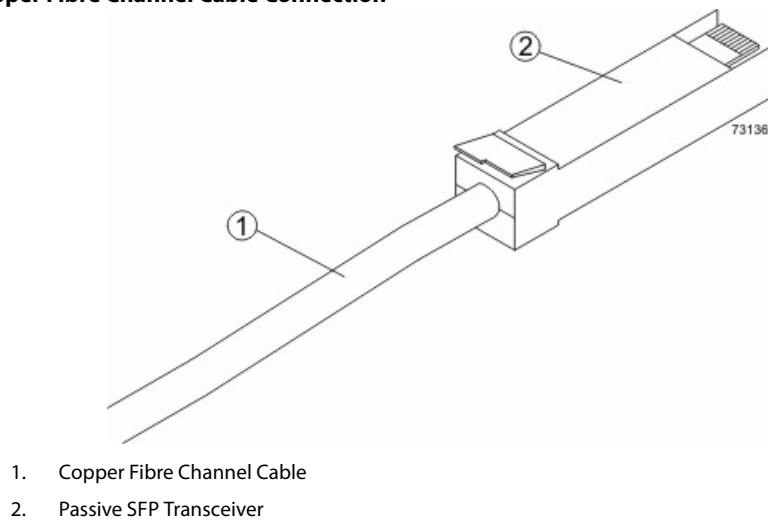
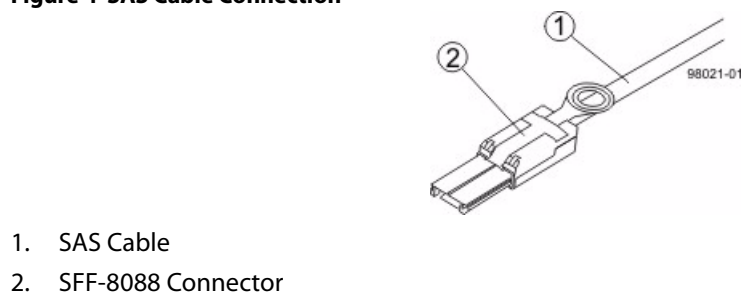
The figures in this topic display the fiber-optic cables, copper cables, SFP transceivers., and SAS cables with a SFF-8088 Connector.

NOTE Your SFP transceivers and cables might look slightly different from the ones shown. The differences do not affect the performance of the SFP transceivers.

The array module supports SAS, Fibre Channel (FC), and iSCSI host connections and SAS drive connections. FC host connections can operate at 8 Gb/s or at a lower data rate. Ports for 8-Gb/s Fibre Channel host connections require SFP transceivers designed for this data rate. These SFP transceivers look similar to other SFP transceivers but are not compatible with other types of connections. SFP transceivers for 1-Gb/s iSCSI and 10-Gb/s iSCSI connections have a different physical interface for the cable and are not compatible with other types of connections.

WARNING (W03) Risk of exposure to laser radiation – Do not disassemble or remove any part of a Small Form-factor Pluggable (SFP) transceiver because you might be exposed to laser radiation.



Figure 1 Fiber-Optic Cable Connection**Figure 2 1-Gb/s iSCSI Cable Connection****Figure 3 Copper Fibre Channel Cable Connection****Figure 4 SAS Cable Connection**

Things to Know – Taking a Quick Glance at the Hardware in a ST2500 M2 Array Module Configuration



WARNING (W14) Risk of bodily injury – A qualified service person is required to make the DC power connection according to NEC and CEC guidelines.

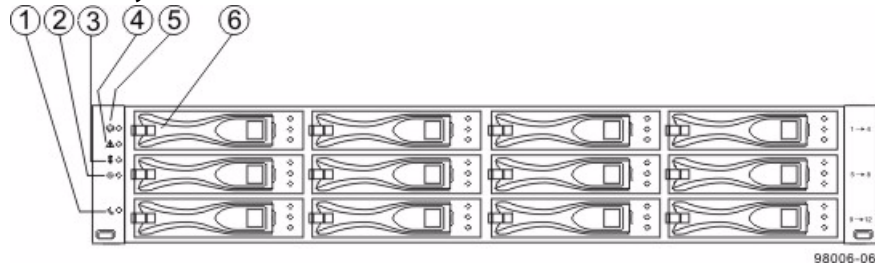


CAUTION (C05) Electrical grounding hazard – This equipment is designed to permit the connection of the DC supply circuit to the earthing conductor at the equipment.

NOTE Each module in the storage array must have a minimum of two drives for proper operation. If the module has fewer than two drives, a power supply error is reported.

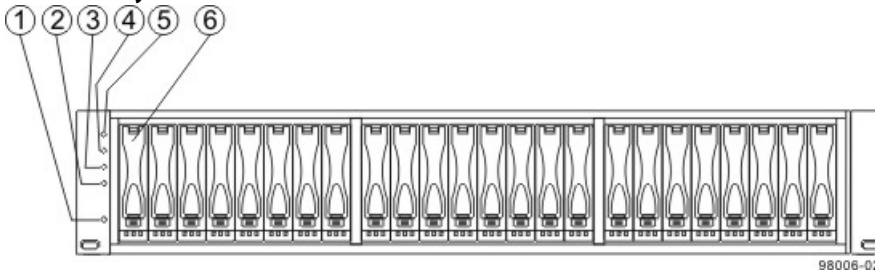
- The top of the array module is the side with labels.
- The configuration of the host ports might appear different on your system depending on which host interface card configuration is installed.

Figure 5 ST2500 M2 Array Module with 12 Drives – Front View

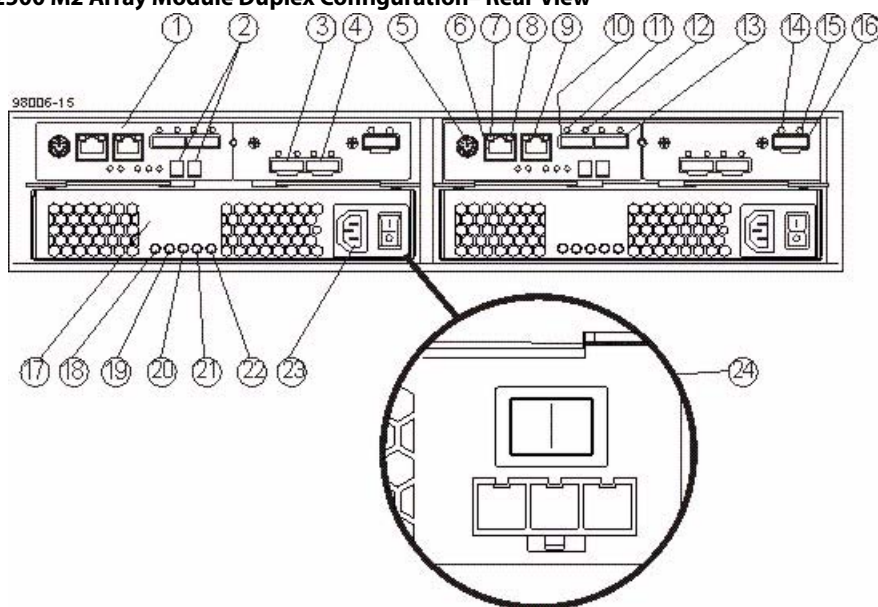


1. End Cap Standby Power LED
2. End Cap Power LED
3. End Cap Over-Temperature LED
4. End Cap Service Action Required LED
5. End Cap Locate LED
6. Drive Canister

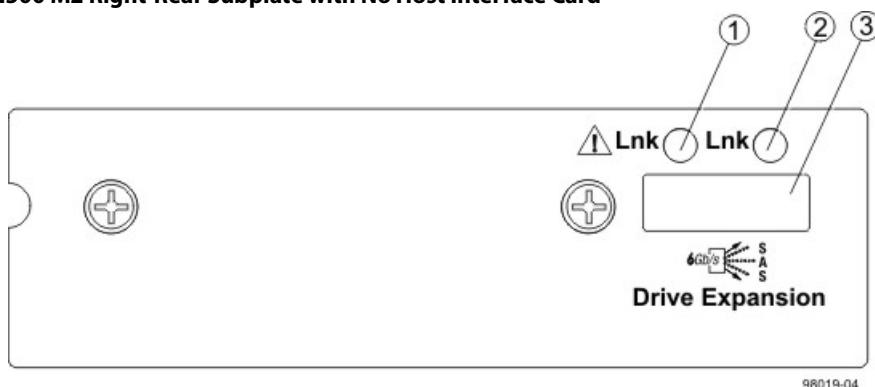
Figure 6 ST2500 M2 Array Module with 24 Drives – Front View



1. End Cap Standby Power LED
2. End Cap Power LED
3. End Cap Over-Temperature LED
4. End Cap Service Action Required LED
5. End Cap Locate LED
6. Drive Canister

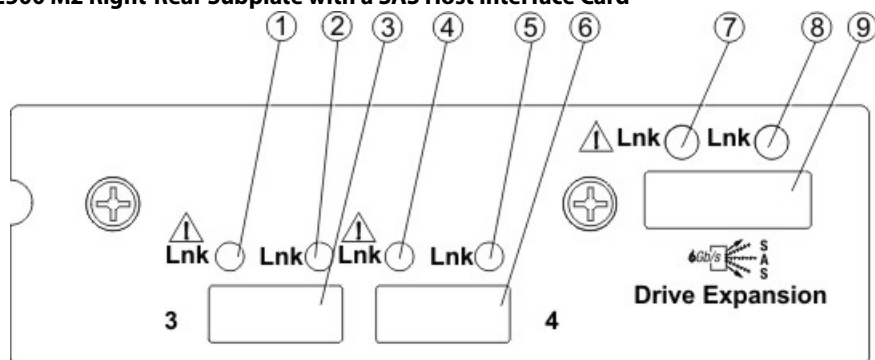
Figure 7 ST2500 M2 Array Module Duplex Configuration– Rear View

1. Controller A CRU
2. Seven-Segment Display
3. Host Interface Card Connector 1
4. Host Interface Card Connector 2
5. Serial Connector
6. Ethernet Connector 1
7. Ethernet Link Active LED
8. Ethernet Link Rate LED
9. Ethernet Connector 2
10. Host SFF-8088 Connector 2 (Native)
11. Host Link 2 Fault LED
12. Host Link 2 Active LED
13. Base Host SFF-8088 Connector 1
14. ESM Expansion Fault LED
15. ESM Expansion Active LED
16. Expansion SFF-8088 Port Connector
17. Power-Fan CRU
18. Standby Power LED
19. Power-Fan DC Power LED
20. Power-Fan Service Action Allowed LED
21. Power-Fan Service Action Required LED
22. Power-Fan AC Power Connector and Switch
23. Power-Fan DC Power Connector and Switch
24. (Magnified view of the bottom section of the right module)

Figure 8 ST2500 M2 Right-Rear Subplate with No Host Interface Card

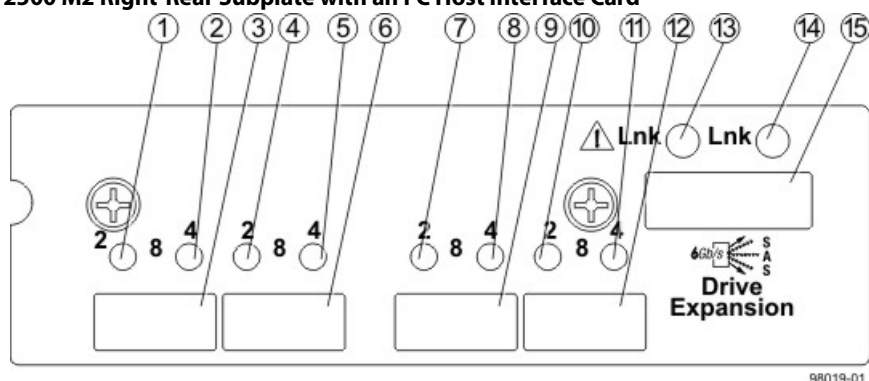
98019-04

1. ESM Expansion Fault LED
2. ESM Expansion Active LED
3. Expansion SFF-8088 Port Connector

Figure 9 ST2500 M2 Right-Rear Subplate with a SAS Host Interface Card

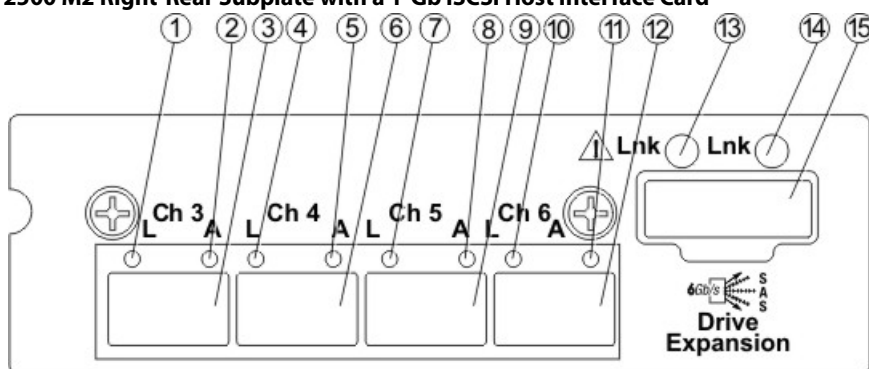
98019-03

1. Host Interface Card Link 3 Up LED
2. Host Interface Card Link 3 Active LED
3. SFF-8088 Host Interface Card Connector 3
4. Host Interface Card Link 4 Up LED
5. Host Interface Card Link 4 Active LED
6. SFF-8088 Host Interface Card Connector 4
7. ESM Expansion Fault LED
8. ESM Expansion Active LED
9. Expansion SFF-8088 Port Connector

Figure 10 ST2500 M2 Right-Rear Subplate with an FC Host Interface Card

98019-01

1. Host Interface Card Link 3 Up LED
2. Host Interface Card Link 3 Active LED
3. FC Host Interface Card Connector 3
4. Host Interface Card Link 4 Up LED
5. Host Interface Card Link 4 Active LED
6. FC Host Interface Card Connector 4
7. Host Interface Card Link 5 Up LED
8. Host Interface Card Link 5 Active LED
9. FC Host Interface Card Connector 5
10. Host Interface Card Link 6 Up LED
11. Host Interface Card Link 6 Active LED
12. FC Host Interface Card Connector 6
13. ESM Expansion Fault LED
14. ESM Expansion Active LED
15. Expansion SFF-8088 Port Connector

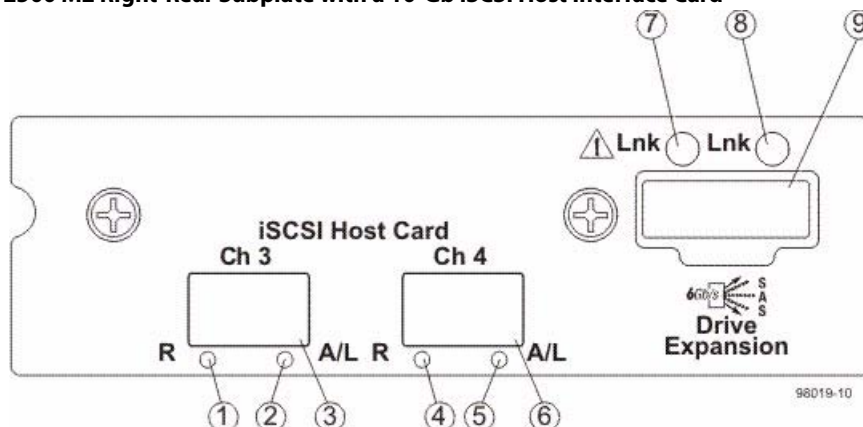
Figure 11 ST2500 M2 Right-Rear Subplate with a 1-Gb iSCSI Host Interface Card

98019-02

1. Host Interface Card Link 3 Up LED
2. Host Interface Card Link 3 Active LED
3. iSCSI Host Interface Card Connector 3
4. Host Interface Card Link 4 Up LED
5. Host Interface Card Link 4 Active LED
6. iSCSI Host Interface Card Connector 4
7. Host Interface Card Link 5 Up LED
8. Host Interface Card Link 5 Active LED
9. iSCSI Host Interface Card Connector 5

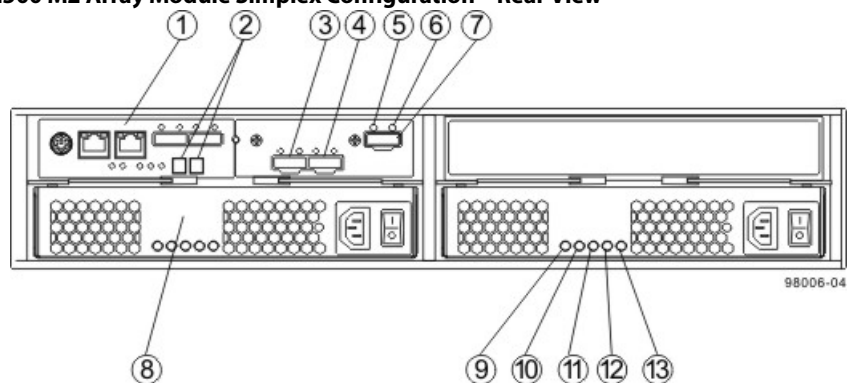
10. Host Interface Card Link 6 Up LED
11. Host Interface Card Link 6 Active LED
12. iSCSI Host Interface Card Connector 6
13. ESM Expansion Fault LED
14. ESM Expansion Active LED
15. Expansion SFF-8088 Port Connector

Figure 12 ST2500 M2 Right-Rear Subplate with a 10-Gb iSCSI Host Interface Card



1. Host Interface Card Link 3 Up LED
2. Host Interface Card Link 3 Active LED
3. iSCSI Host Interface Card Connector 3
4. Host Interface Card Link 4 Up LED
5. Host Interface Card Link 4 Active LED
6. iSCSI Host Interface Card Connector 4
7. ESM Expansion Fault LED
8. ESM Expansion Active LED
9. Expansion SFF-8088 Port Connector

Figure 13 ST2500 M2 Array Module Simplex Configuration – Rear View



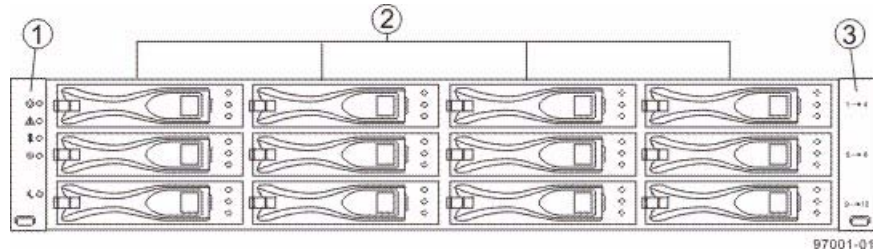
1. Controller A CRU
2. Seven-Segment Display
3. Host Interface Card Connector 1
4. Host Interface Card Connector 2
5. ESM Expansion Fault LED
6. ESM Expansion Active LED
7. Expansion Port SFF-8088 Connector

8. Power-Fan A CRU (optional)
9. Standby Power LED
10. Power-Fan DC Power LED
11. Power-Fan Service Action Allowed LED
12. Power-Fan Service Action Required LED
13. Power-Fan AC Power LED

ATTENTION Possible equipment damage – You must use the supported drives in the drive module to ensure proper performance. For information about supported drives, contact a Customer and Technical Support representative.

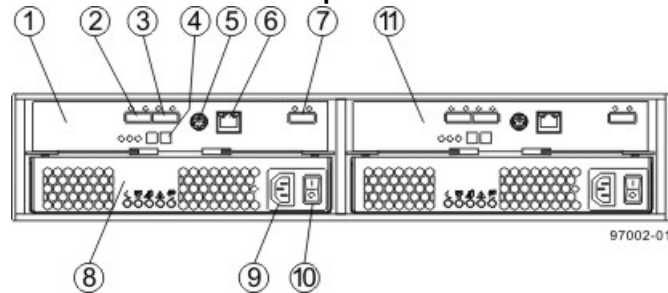
ATTENTION Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by the original manufacturer. Not all array modules are shipped with pre-populated drives. System integrators, resellers, system administrators, or users of the array module can install the drives.

Figure 14 ST2501 M2 Drive Module – Front View

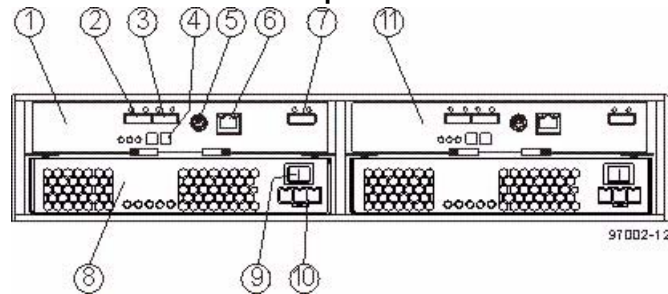


1. Left End Cap (Has the Drive Module LEDs)
2. Drives
3. Right End Cap

Figure 15 ST2501 M2 Drive Module with AC Power Option – Rear View



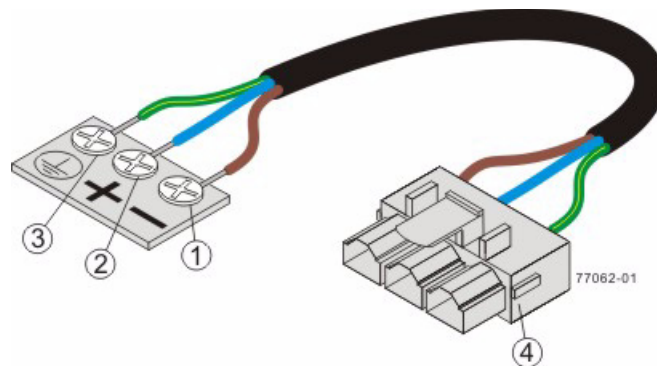
1. ESM A CRU
2. Host Connector 1
3. Host Connector 2
4. Seven-Segment Display Indicators
5. Serial Connector
6. Ethernet Connector
7. Expansion Port SFF-8088 Connector
8. Power-Fan CRU
9. Power Connector
10. Power Switch
11. ESM B CRU

Figure 16 ST2501 M2 Drive Module with DC Power Option – Rear View

1. ESM A CRU
2. Host Connector 1
3. Host Connector 2
4. Seven-Segment Display Indicators
5. Serial Connector
6. Ethernet Connector
7. Expansion Port SFF-8088 Connector
8. Power-Fan CRU
9. Power Connector
10. Power Switch
11. ESM B CRU

You can order an optional DC power supply connection and connector cables for the drive module. **A qualified service person is required to make the DC power connection per NEC and CEC guidelines.** A two-pole 30-amp circuit breaker is required between the DC power source and the drive module for over-current and short-circuit protection. Before turning off any power switches on a DC-powered drive module, you must disconnect the two-pole 30-amp circuit breaker.

WARNING (W12) Risk of electrical shock – This unit has more than one power source. To remove all power from the unit, all DC MAINS must be disconnected by removing all power connectors (item 4 below) from the power supplies.



1. Supply (Negative), Brown Wire, -48 VDC
2. Return (Positive), Blue Wire
3. Ground, Green/Yellow Wire
4. DC Power Connector

For Additional Information on the ST2500 M2 Array Module Configuration

Refer to the *Storage System Site Preparation Guide* on the SANtricity ES Storage Manager Installation DVD for information about the installation requirements of the various ST2500 M2 storage array components.

Step 2 – Installing and Configuring the Switches

Things to Know – Switches

NOTE Most of the switches, as shipped from the vendor, require an update to their firmware to work correctly with the storage array.

Depending on the configuration of your storage array, you might use Fibre Channel switches and iSCSI switches.

The switches in the following table are certified for use with a ST2500 M2 storage array, a 6180 storage array, and a 6580/6780 storage array, which all use SANtricity ES Storage Manager Version 10.77.

Table 6 Supported Switches

Vendor	Model	Fibre Channel	iSCSI	SAS
Brocade	200E	Yes	No	No
	3200	Yes	No	No
	3800	Yes	No	No
	3900	Yes	No	No
	3950	Yes	No	No
	12000	Yes	No	No
	3850	Yes	No	No
	3250	Yes	No	No
	24000	Yes	No	No
	4100	Yes	No	No
	48000	Yes	No	No
	5000	Yes	No	No
	300	Yes	No	No
	5100	Yes	No	No
	5300	Yes	No	No
	7500	Yes	No	No
	7800	Yes	No	No
	DCX	Yes	No	No
	FCOE	No	Yes	No

Vendor	Model	Fibre Channel	iSCSI	SAS
Cisco	9506	Yes	No	No
	9509	Yes	No	No
	9216	Yes	No	No
	9216i	Yes	No	No
	9120	Yes	No	No
	914x	Yes	No	No
	9513	Yes	No	No
	9020	Yes	No	No
	MDS9000	Yes	No	No
	9222i	Yes	No	No
	9134	Yes	No	No
	Catalyst 2960	No	Yes	No
	Catalyst 3560	No	Yes	No
	Catalyst 3750G-24TS	No	Yes	No
LSI	6160	No	No	Yes
McData	3232	Yes	No	No
	3216	Yes	No	No
	4300	Yes	No	No
	4500	Yes	No	No
	6064	Yes	No	No
	6140	Yes	No	No
	4400	Yes	No	No
	4700	Yes	No	No
QLogic	6140	No	Yes	No
	6142	No	Yes	No
	SANbox2-8	Yes	No	No
	SANbox2-16	Yes	No	No
	SANbox5200	Yes	No	No
	SANbox3600	Yes	No	No
	SANbox3800	Yes	No	No
	SANbox5208	Yes	No	No
	SANbox5600	Yes	No	No
	SANbox5800	Yes	No	No
	SANbox9000	Yes	No	No
PowerConnect	5324	No	Yes	No
	6024	No	Yes	No

If required, make the appropriate configuration changes for *each* switch that is connected to the storage array.

Refer to the switch's documentation for information about how to install the switch and how to use the configuration utilities that are supplied with the switch.

Procedure – Installing and Configuring Switches

1. Install your switch according to the vendor's documentation.
2. Use the Compatibility Matrix at the website <http://www.lsi.com/compatibilitymatrix/> to obtain this information:
 - The latest hardware compatibility information
 - The models of the switches that are supported
 - The firmware requirements and the software requirements for the switches
3. Update the switch's firmware by accessing it from the applicable switch vendor's website.
This update might require that you cycle power to the switch.
4. Find your switch in the following table to see whether you need to make further configuration changes. Use your switch's configuration utility to make the changes.

Table 7 Supported Switch Vendors and Required Configuration Changes

Switch Vendor	Configuration Changes Required?	Next Step
Brocade	Yes Change the In-Order Delivery (IOD) option to ON.	Make the change, and go to "Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module."
Cisco	Yes Change the In-Order Delivery (IOD) option to ON.	Make the change, and go to "Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module."
LSI	No	"Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module."
McData	No	"Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module."
QLogic	No	"Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module."
PowerConnect	No	"Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module."

Step 3 – Installing the Host Bus Adapters for the ST2500 M2 Array Module

Key Terms

HBA host port

The physical and electrical interface on the host bus adapter (HBA) that provides for the connection between the host and the controller. Most HBAs will have either one or two host ports. The HBA has a unique World Wide Identifier (WWID) and each HBA host port has a unique WWID.

HBA host port world wide name

A 16-character unique name that is provided for each port on the host bus adapter (HBA).

host bus adapter (HBA)

A physical board that resides in the host. The HBA provides for data transfer between the host and the controllers in the storage array over the I/O host interface. Each HBA contains one or more physical ports.

Things to Know – Host Bus Adapters and Ethernet Network Interface Cards

- The ST2500 M2 array module supports dual 6-Gb/s SAS host connections and optional host interface cards (HICs) for dual 6-Gb/s SAS, four 1-Gb/s iSCSI, two 10-Gb iSCSI, and four 8-Gb/s FC connections. The connections on a host must match the type (SAS HBAs for SAS, FC HBAs for FC, or iSCSI HBAs or Ethernet network interface cards [NICs] for iSCSI) of the HICs to which you connect them. For the best performance, HBAs for SAS and FC connections should support the highest data rate supported by the HICs to which they connect.
- For maximum hardware redundancy, you must install a minimum of two HBAs (for either SAS or FC host connections) or two NICs or iSCSI HBAs (for iSCSI host connections) in each host. Using both ports of a dual-port HBA or a dual-port NIC provides two paths to the storage array but does not ensure redundancy if an HBA or a NIC fails.

NOTE You can use the Compatibility Matrix to obtain information about the supported models of the HBAs and their requirements. Go to <http://www.lsi.com/compatibilitymatrix/>, and select the desired Developer Partner Program link. Check its Compatibility Matrix to make sure you have an acceptable configuration.

- Most of the HBAs, as shipped from the vendor, require updated firmware and software drivers to work correctly with the storage array. For information about the updates, refer to the website of the HBA vendor.

Procedure – Installing Host Bus Adapters

1. Go to <http://www.lsi.com/compatibilitymatrix/>, and select the desired Developer Partner Program link. Check its Compatibility Matrix to make sure you have an acceptable configuration.
The Compatibility Matrix provides this information:

- The latest hardware compatibility information
 - The models of the HBAs that are supported
 - The firmware requirements and the software requirements for the HBAs
2. Install your HBA according to the vendor documentation.

NOTE If your operating system is Windows Server 2008 Server Core, you might have additional installation requirements. Refer to the Microsoft Developers Network (MSDN) for more information about Windows Server 2008 Server Core. You can access these resources from www.microsoft.com.

3. Install the latest version of the firmware for the HBA. You can find the latest version of the firmware for the HBA at the HBA vendor website.

NOTE The remaining steps are general steps to obtain the HBA host port World Wide Name from the HBA BIOS utility. If you have installed the host context agent on all of your hosts, you do not need to perform these steps. If you are performing these steps, the actual prompts and screens vary depending on the vendor that provides the HBA. Also, some HBAs have software utilities that you can use to obtain the world wide name for the port instead of using the BIOS utility.

4. Reboot or start your host.
5. While your host is booting, look for the prompt to access the HBA BIOS utility.
6. Select each HBA to view its HBA host port world wide name.
7. Record the following information for each host and for each HBA connected to the storage array:
 - The name of each host
 - The HBAs in each host
 - The HBA host port world wide name of each port on the HBA

The following table shows examples of the host and HBA information that you must record.

Table 8 Examples of HBA Host Port World Wide Names

Host Name	Associated HBAs	HBA Host Port World Wide Name
ICTENGINEERING	Vendor x, Model y (dual port)	37:38:39:30:31:32:33:32
		37:38:39:30:31:32:33:33
	Vendor a, Model y (dual port)	42:38:39:30:31:32:33:42
		42:38:39:30:31:32:33:44
ICTFINANCE	Vendor a, Model b (single port)	57:38:39:30:31:32:33:52
	Vendor x, Model b (single port)	57:38:39:30:31:32:33:53

Step 4 – Installing the ST2500 M2 Array Module

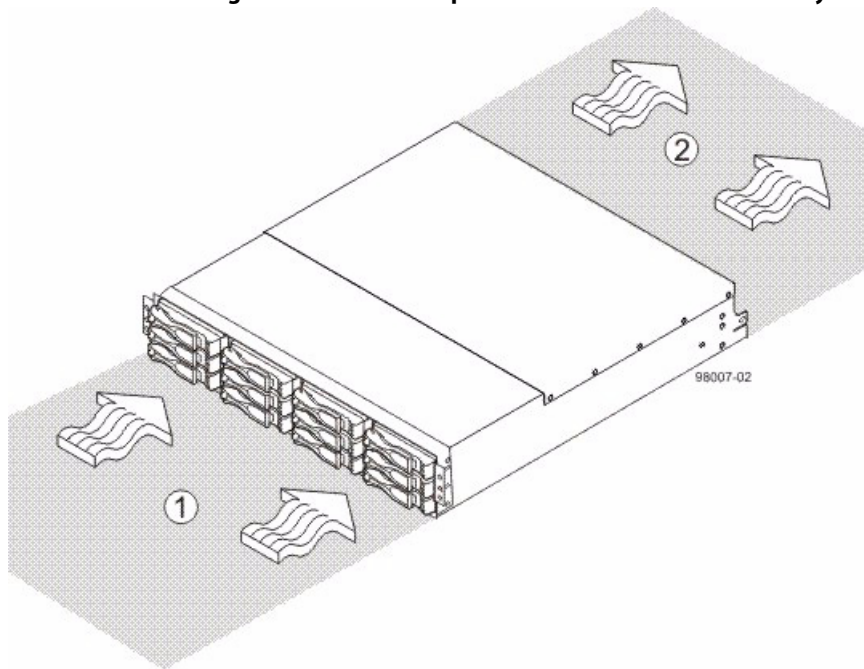
Things to Know – General Installation

The power supplies meet standard voltage requirements for both domestic and worldwide operation.

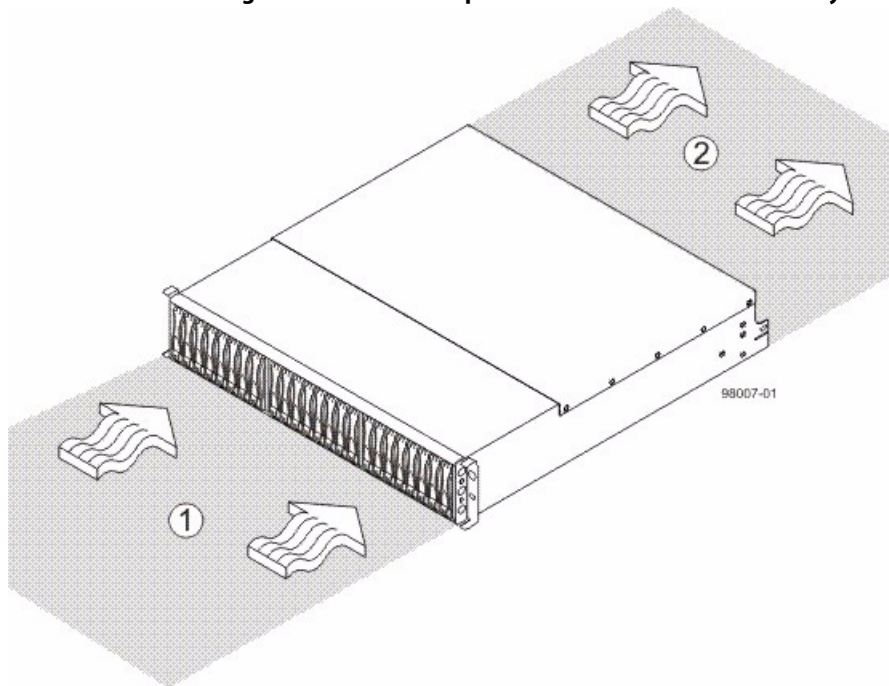
NOTE Make sure that the combined power requirements of your modules do not exceed the power capacity of your cabinet.

Procedure – Installing the ST2500 M2 Array Module

Figure 17 Airflow Direction Through and Clearance Requirements for the ST2500 M2 Array Module with 12 Drives



1. 76-cm (30-in.) clearance in front of the cabinet
2. 61-cm (24-in.) clearance behind the cabinet

Figure 18 Airflow Direction Through and Clearance Requirements for the ST2500 M2 Array Module with 24 Drives

1. 76-cm (30-in.) clearance in front of the cabinet
2. 61-cm (24-in.) clearance behind the cabinet

WARNING (W08) Risk of bodily injury –

>18 kg (39.7 lbs)

WARNING Two persons are required to safely lift the component.

1. Make sure that the cabinet is in the final location. Make sure that the cabinet installation site meets the clearance requirements (see the previous two figures for "Airflow Direction Through and Clearance Requirements for the ST2500 M2 Array Module with 12 Drives" and "Airflow Direction Through and Clearance Requirements for the ST2500 M2 Array Module with 24 Drives").
2. Lower the feet on the cabinet, if required, to keep it from moving.
3. Install the mounting rails in the cabinet. For more information, refer to the installation instructions that are included with your mounting rails.
 - If you are installing the mounting rails above an existing module, position the mounting rails directly above the existing module.
 - If you are installing the mounting rails below an existing module, allow 17.8-cm (7.00-in.) clearance below the existing module.

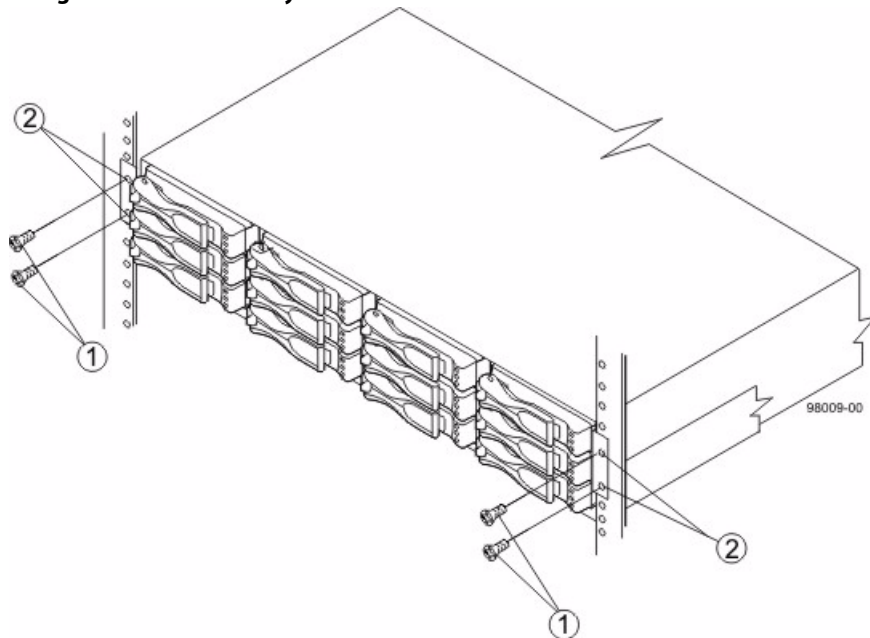
ATTENTION Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by the original manufacturer. Not all array modules are shipped with pre-populated drives. System integrators, resellers, system administrators, or users of the array module can install the drives.

NOTE Make sure that you place the array module in the middle portion of the cabinet while allowing room for drive modules to be placed above and below the array module. As you add drive modules, position them below and above the array module, alternating so that the cabinet does not become top heavy.

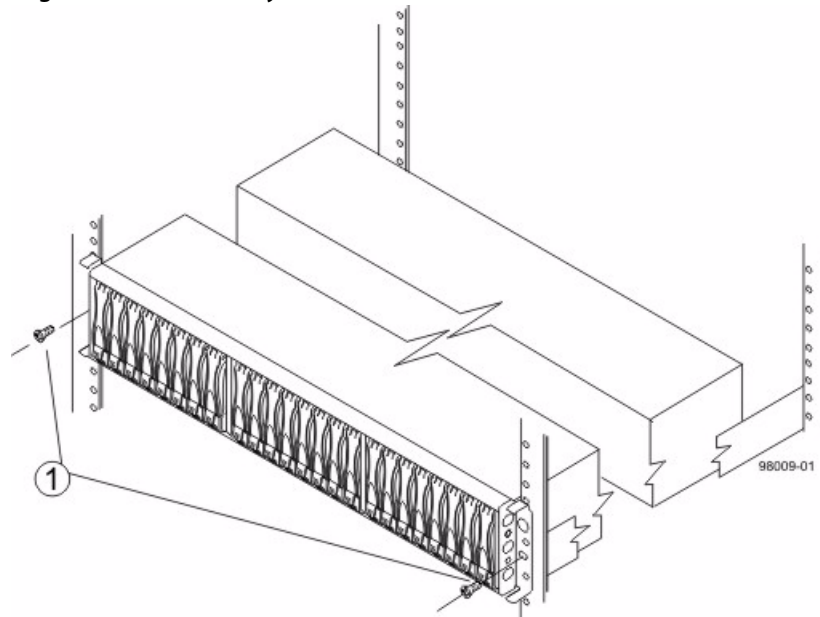
4. With the help of one other person, slide the rear of the array module onto the mounting rails. Make sure that the top mounting holes on the array module align with the mounting rail holes of the cabinet (see the following two figures for "Securing the ST2500 M2 Array Module with 12 Drives to the Cabinet" and "Securing the ST2500 M2 Array Module with 24 Drives to the Cabinet").

The rear of the array module slides into the slots on the mounting rails.

Figure 19 Securing the ST2500 M2 Array Module with 12 Drives to the Cabinet



1. Screws
2. Mounting Holes

Figure 20 Securing the ST2500 M2 Array Module with 24 Drives to the Cabinet

1. Screws

NOTE The rear of the array module contains two controllers. The top of the array module is the side with the labels.

5. Secure the screws in the top mounting holes and the bottom mounting holes on each side of the array module.
6. Secure the rear of the of the array module to the cabinet by using two screws to attach the flanges on each side at the rear of the array module to the mounting rails.
7. Install the bezel on the front of the array module.
8. Install the drive modules. Refer to [Step 7 – Connecting the ST2500 M2 Array Module to the Drive Modules](#).

Step 5 – Connecting the ST2500 M2 Array Module to the Hosts

Key Terms

direct topology

A topology that does not use a switch.

switch topology

A topology that uses a switch.

topology

The logical layout of the components of a computer system or network and their interconnections. Topology deals with questions of what components are directly connected to other components from the standpoint of being able to communicate. It does not deal with questions of physical location of components or interconnecting cables. (*The Dictionary of Storage Networking Terminology*)

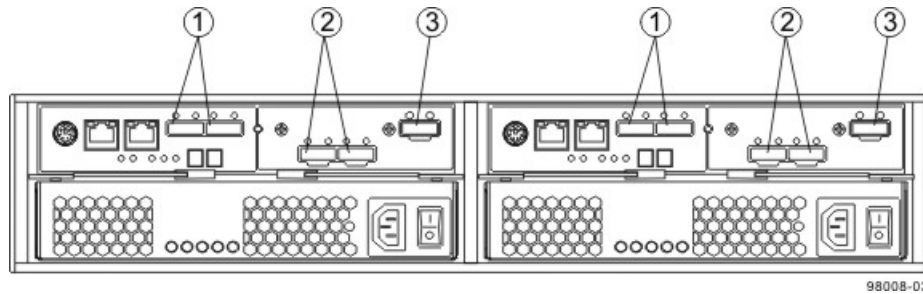
Things to Know – Host Channels

ATTENTION Possible hardware damage – To prevent electrostatic discharge damage to the module, use proper antistatic protection when you handle module components.

- Each controller has from two to six host ports.
- Two of the host ports are standard and support 6-Gb/s SAS data rates.
- Two to four of the host ports are optional, and, if present, are located on a host interface card (HIC). The following types of HICs are supported:

NOTE In configurations where a HIC does not exist, the space is covered with a blank faceplate.

- Two SAS connectors at 6-Gb/s
- Four iSCSI connectors at 1-Gb/s
- Two iSCSI connectors at 10-Gb/s
- Four FC connectors at 8-Gb/s

Figure 21 Host Channels on the Controllers – Rear View

1. Standard Host Connectors
2. Host Interface Card (HIC) Connectors (SAS in this Example)
3. SAS Expansion Connector

WARNING (W03) Risk of exposure to laser radiation – Do not disassemble or remove any part of a Small Form-factor Pluggable (SFP) transceiver because you might be exposed to laser radiation.

Procedure – Connecting Host Cables on a ST2500 M2 Array Module

NOTE Make sure that you have installed the HBAs. Refer to the documentation for the HBAs for information about how to install the HBA and how to use the supplied configuration utilities.

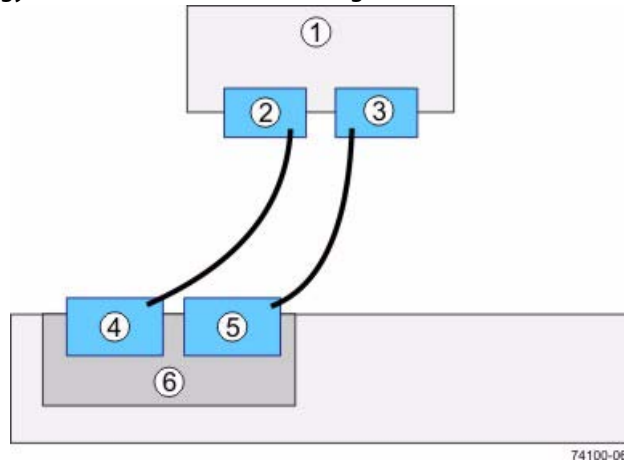
The type of HICs (SAS, FC, or iSCSI) must match the type of the host bus adapters (HBAs) or network interface cards (for iSCSI only) to which you connect them.

See the examples in the following section for example cabling patterns.

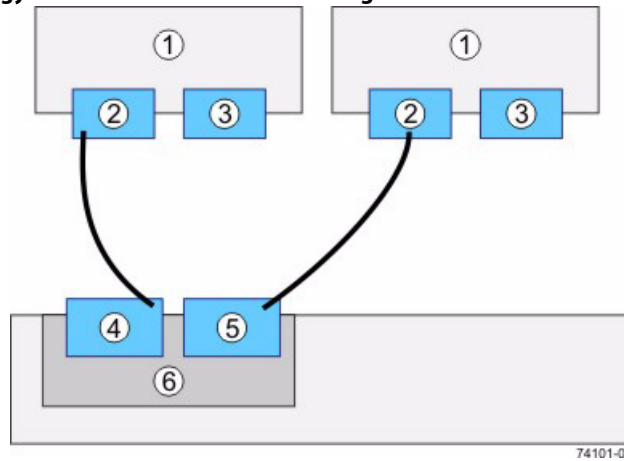
1. Perform one of these actions:
 - **You are using an FC HIC** – Go to [step 2](#).
 - **You are using either a SAS or an iSCSI HIC** – Go to [step 4](#). Connections for both SAS and iSCSI use copper cables with RJ-45 connectors and do not require SFP transceivers.
2. Make sure that the appropriate type of SFP transceiver is inserted into the host channel.
3. If a black, plastic plug is in the SFP transceiver, remove it.
4. Perform one of these actions:
 - **You are using either a SAS or an iSCSI HIC** – Starting with the first host channel of each controller, plug one end of the cable into the host channel.
 - **You are using an FC HIC** – Starting with the first host channel of each controller, plug one end of the cable into the SFP transceiver in the host channel.

The cable is either an Ethernet cable with RJ-45 connectors for 1-Gb/s iSCSI or 6-Gb/s SAS connections, or a fiber-optic cable for FC connections.

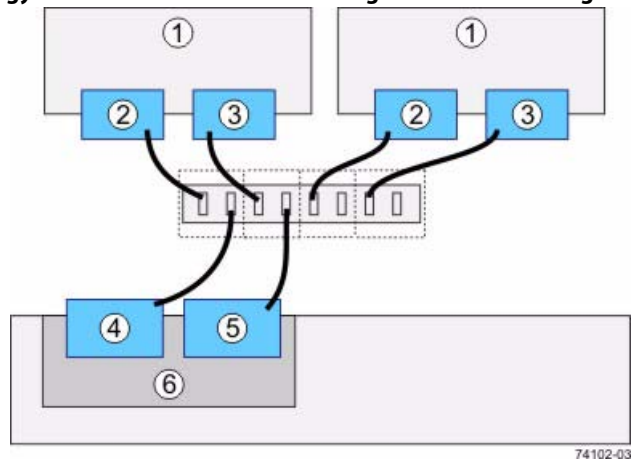
NOTE If Data Replicator Software connections are required, do not connect a host to the highest numbered host channel.

Figure 22 Direct Topology – One Host Connected to a Single Controller

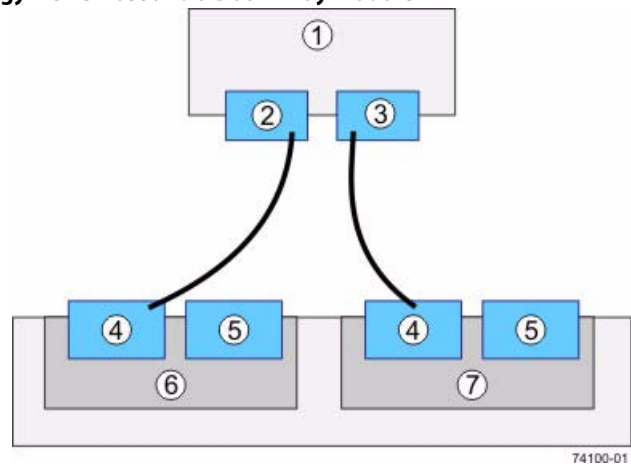
1. Host
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host Port 1
5. Host Port 2
6. Controller A

Figure 23 Direct Topology – Two Hosts Connected to a Single Controller

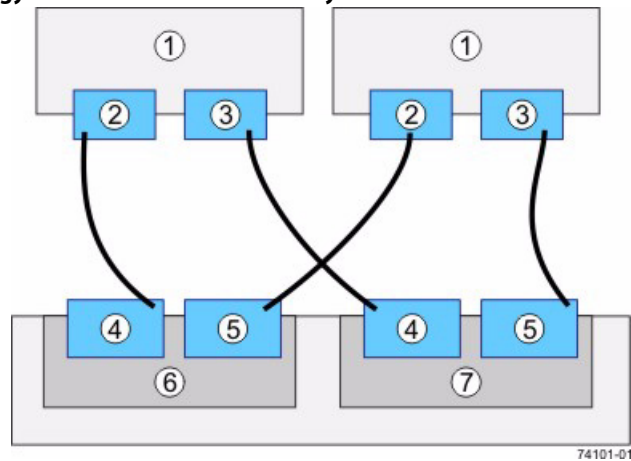
1. Host
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host Port 1
5. Host Port 2
6. Controller A

Figure 24 Switch Topology – Two Hosts Connected to a Single Controller Through a Switch

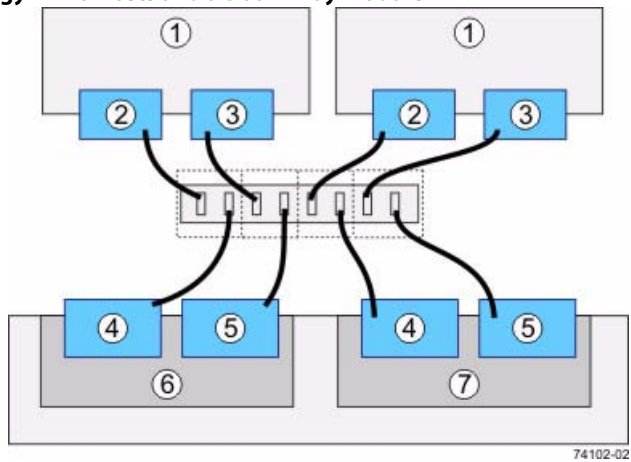
1. Host
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host Port 1
5. Host Port 2
6. Controller A

Figure 25 Direct Topology – One Host and a Dual Array Module

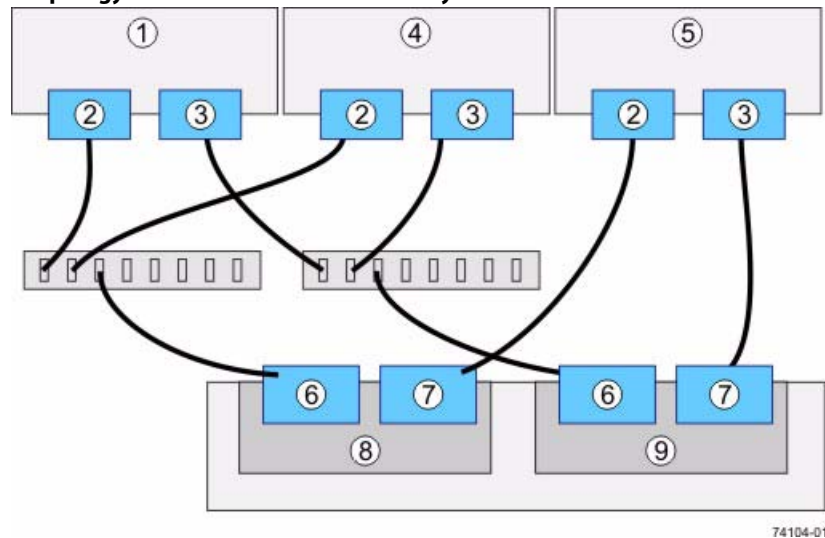
1. Host
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host Port 1
5. Host Port 2
6. Controller A
7. Controller B

Figure 26 Direct Topology – Two Hosts and a Dual Array Module for Maximum Redundancy

1. Hosts
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host Port 1
5. Host Port 2
6. Controller A
7. Controller B

Figure 27 Mixed Topology – Two Hosts and a Dual Array Module

1. Hosts
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host Port 1
5. Host Port 2
6. Controller A
7. Controller B

Figure 28 Mixed Topology – Three Hosts and a Dual Array Module

1. Host 1
2. HBA 1 or NIC 1
3. HBA 2 or NIC 2
4. Host 2
5. Host 3
6. Host Port 1
7. Host Port 2
8. Controller A
9. Controller B

5. Plug the other end of the cable either into an HBA in the host (direct topology) or into a switch (fabric topology).

NOTE The SAS host interface does not support a switch topology.

6. Affix a label to each end of the cable with this information. A label is very important if you need to disconnect cables to service a controller. Include this information on the labels:
 - The host name and the HBA port (for direct topology)
 - The switch name and the port (for fabric topology)
 - The controller ID (for example, controller A)
 - The host channel ID (for example, host channel 1)

Example label abbreviation – Assume that a cable is connected between port 1 in HBA 1 of a host named Engineering and host channel 1 of controller A. A label abbreviation could be as follows.

Heng-HBA1/P1, CtA-Hch1

7. Repeat step 3 through step 6 for each controller and host channel that you intend to use.

Step 6 – Installing the Drive Modules for the ST2500 M2 Array Module Configurations

Things to Know – General Installation of Drive Modules with the ST2500 M2 Array Module

NOTE If you are installing the drive module in a cabinet with other modules, make sure that the combined power requirements of the drive module and the other modules do not exceed the power capacity of your cabinet. For more information, refer to the SANtricity ES Storage Manager Installation DVD.

- Special site preparation is not required for any of these drive modules beyond what is normally found in a computer lab environment.
- The power supplies meet standard voltage requirements for both domestic and worldwide operation.
- Take these precautions:
 - Install the drive modules in locations within the cabinet that let you evenly distribute the drive modules around the array module.
 - Keep as much weight as possible in the bottom half of the cabinet.

WARNING (W15) Risk of bodily injury – An empty tray weighs approximately 56.7 kg (125 lb). Three persons are required to safely move an empty tray. If the tray is populated with components, a mechanized lift is required to safely move the tray.

For Additional Information on Drive Module Installation

Refer to the *Storage System Site Preparation Guide* on the SANtricity ES Storage Manager Installation DVD for important considerations about cabinet installation.

Procedure – Installing the ST2501 M2 Drive Module

WARNING (W08) Risk of bodily injury –



>18 kg (39.7 lbs)

WARNING Two persons are required to safely lift the component.

WARNING (W05) Risk of bodily injury – If the bottom half of the cabinet is empty, do not install components in the top half of the cabinet. If the top half of the cabinet is too heavy for the bottom half, the cabinet might fall and cause bodily injury. Always install a component in the lowest available position in the cabinet.

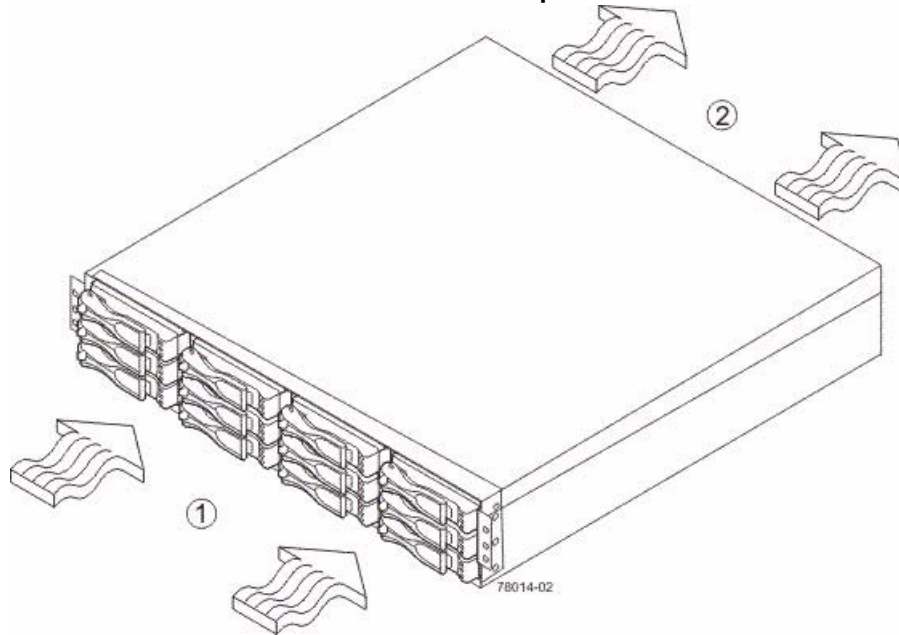
You can install the drive module into an industry standard cabinet.

This procedure describes how to install the mounting rails into an industry standard cabinet.

ATTENTION Possible hardware damage – To prevent electrostatic discharge damage to the tray, use proper antistatic protection when handling tray components.

1. Make sure that the cabinet is in the final location. Make sure that you meet the clearance requirements shown in the following two figures.

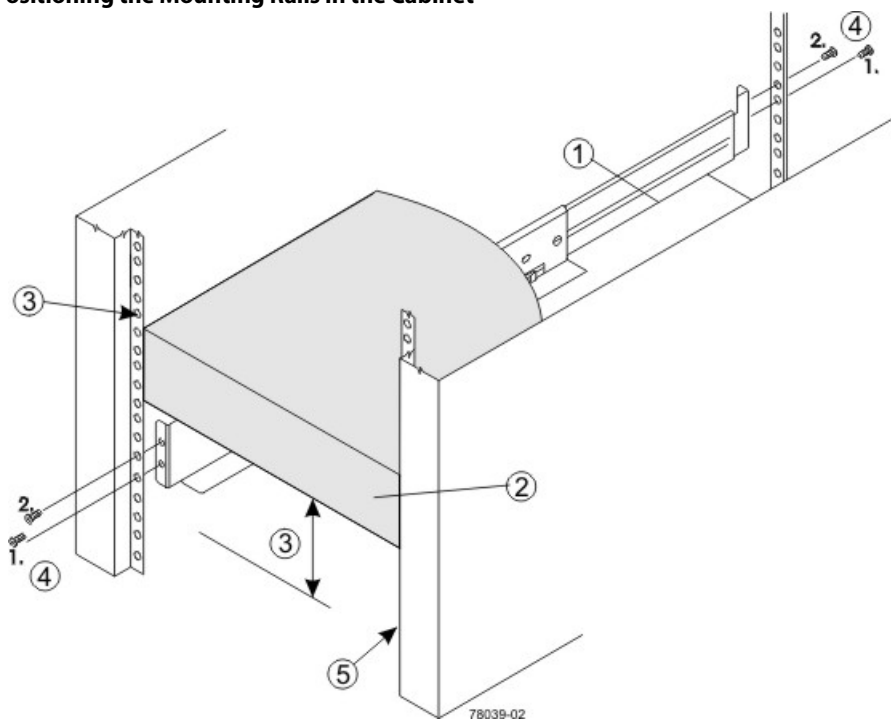
Figure 29 ST2501 M2 Drive Module Airflow and Clearance Requirements



1. 76 cm (30 in.) clearance in front of the cabinet
2. 61 cm (24 in.) clearance behind the cabinet

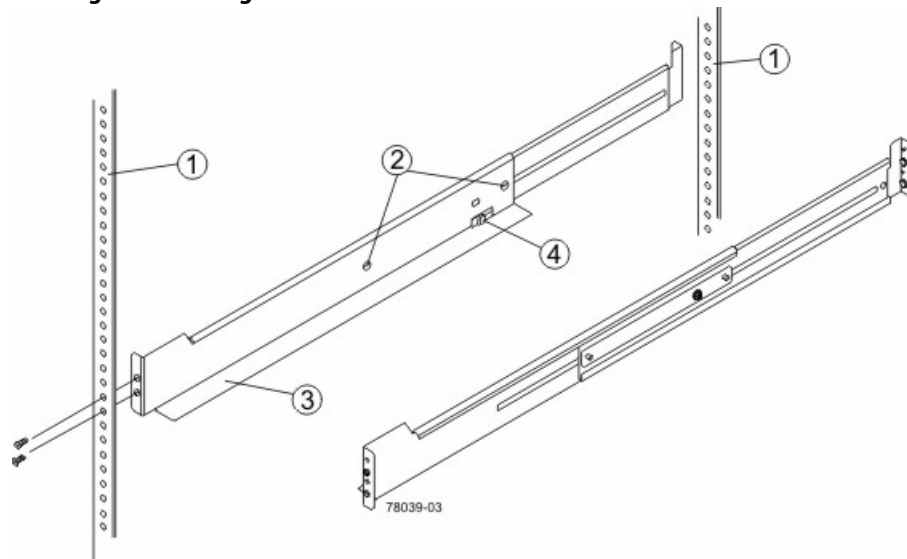
NOTE Fans pull air through the module from front to back across the drives.

2. Lower the feet on the cabinet to keep the cabinet from moving.
3. Remove the drive module and all contents from the shipping carton.
4. Position the mounting rails in the cabinet.

Figure 30 Positioning the Mounting Rails in the Cabinet

1. Mounting Rail
2. Existing Module
3. Clearance Above and Below the Existing Module
4. Screws for Securing the Mounting Rail to the Cabinet (Front and Rear)
5. Industry Standard Cabinet

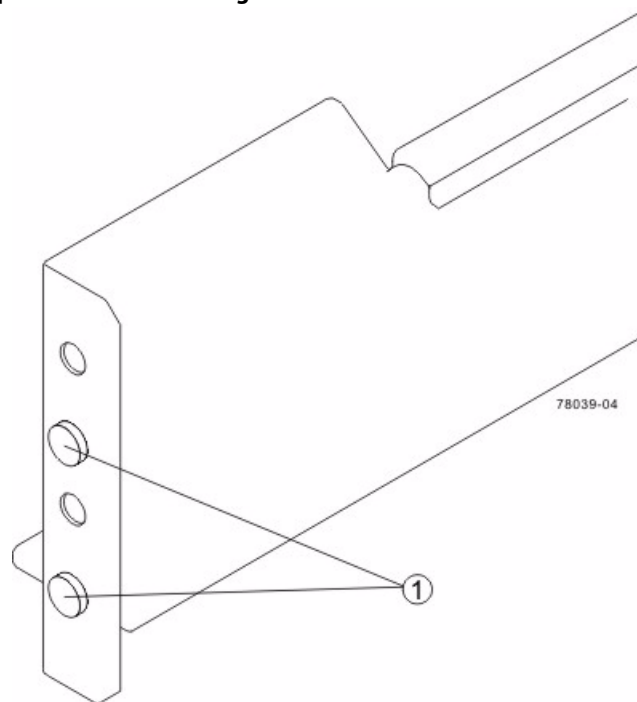
- If you are installing the mounting rails above an existing module, position the mounting rails directly above the module.
 - If you are installing the mounting rails below an existing module, allow 8.8-cm (3.5-in.) vertical clearance for a drive module or an array module.
5. Attach the mounting rails to the cabinet by performing these substeps:
 - a. Make sure that the adjustment screws on the mounting rail are loose so that the mounting rail can extend or contract as needed.

Figure 31 Attaching the Mounting Rails to the Cabinet

1. Cabinet Mounting Holes
2. Adjustment Screws for Locking the Mounting Rail Length
3. Mounting Rails
4. Clip for Securing the Rear of the Drive Module

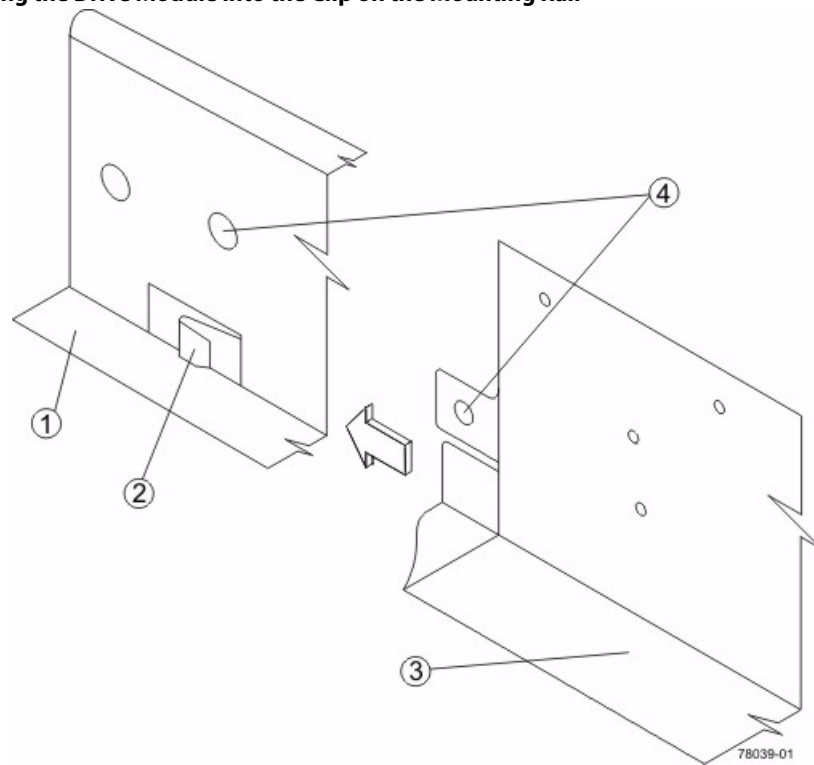
- b. Place the mounting rail inside the cabinet, and extend the mounting rail until the flanges on the mounting rail touch the inside of the cabinet.
- c. Make sure that the alignment spacers on the front flange of the mounting rail fit into the mounting holes in the cabinet.

The front flange of each mounting rail has two alignment spacers. The alignment spacers are designed to fit into the mounting holes in the cabinet. The alignment spacers help position and hold the mounting rail.

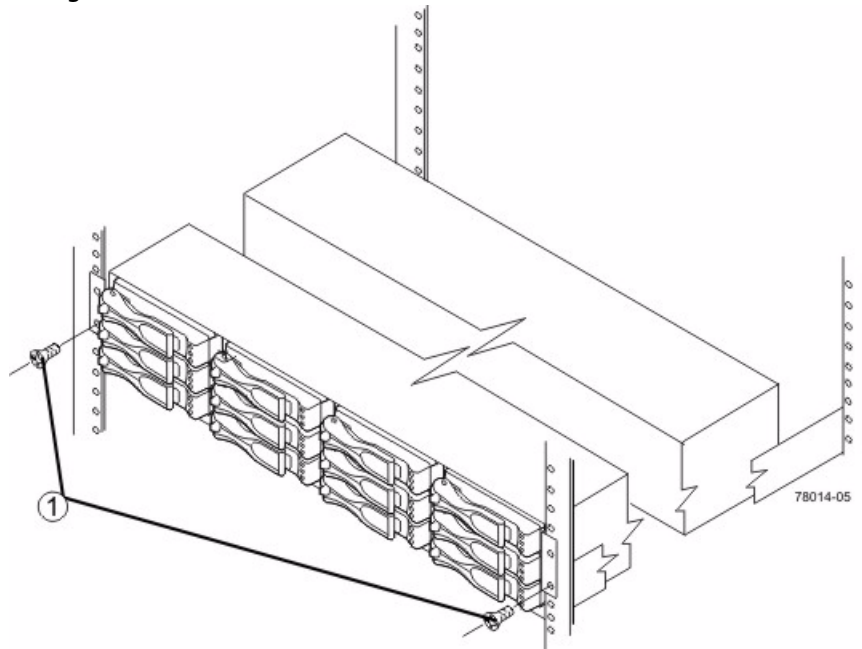
Figure 32 Alignment Spacers on the Mounting Rail

1. Alignment Spacers

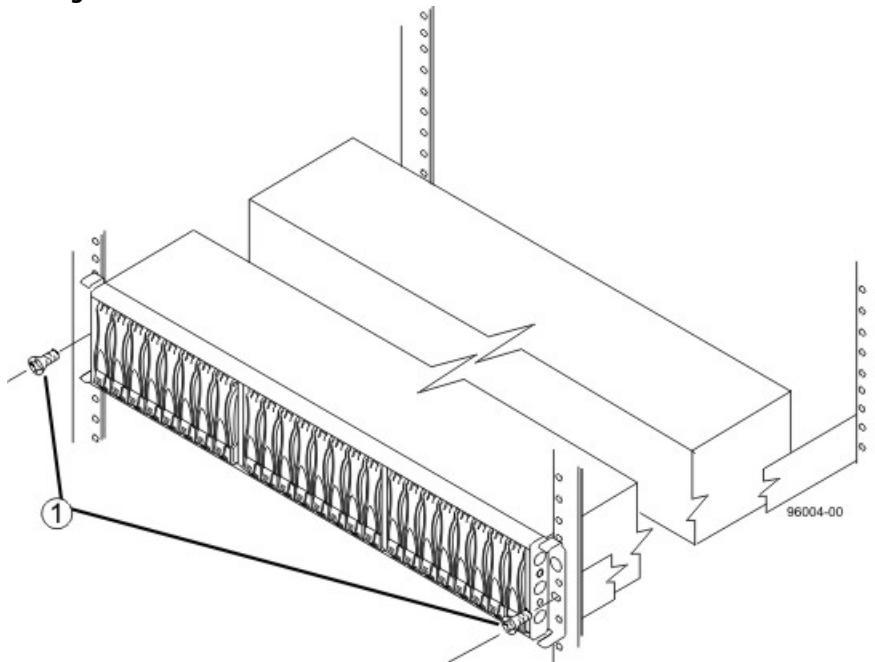
- d. Insert one M5 screw through the front of the cabinet and into the top captured nut in the mounting rail. Tighten the screw.
 - e. Insert two M5 screws through the rear of the cabinet and into the captured nuts in the rear flange in the mounting rail. Tighten the screws.
 - f. Tighten the adjustment screws on the mounting rail.
 - g. Repeat substep a through substep f to install the second mounting rail.
6. With the help of one other person, slide the rear of the drive module onto the mounting rails. The rear edge of the drive module must fit into the clip on the mounting rail. The drive module is correctly aligned when these conditions are met:
- The mounting holes on the front flanges of the drive module align with the mounting holes on the front of the mounting rails.
 - The rear edge of the drive module sheet metal fits into the clip on the mounting rail.
 - The holes in the drive module sheet metal for the rear hold-down screws align with the captured nuts in the side of the mounting rails.

Figure 33 Sliding the Drive Module into the Clip on the Mounting Rail

1. Mounting Rail
 2. Clip
 3. Partial View of the Drive Module Rear Sheet Metal
 4. Align the hole in the drive module sheet metal with the captured nut in the mounting rail.
7. Secure the front of the drive module to the cabinet. Use the two screws to attach the flange on each side of the front of the drive module to the mounting rails.
- a. Insert one M5 screw through the bottom hole of a flange on the drive module so that the screw goes through the cabinet rail and engages the bottom captured nut in the mounting rail. Tighten the screw.
 - b. Repeat substep a for the second flange.

Figure 34 Attaching the Front of the ST2501 M2 Drive Module

1. Screws for Securing the Front of the Drive Module

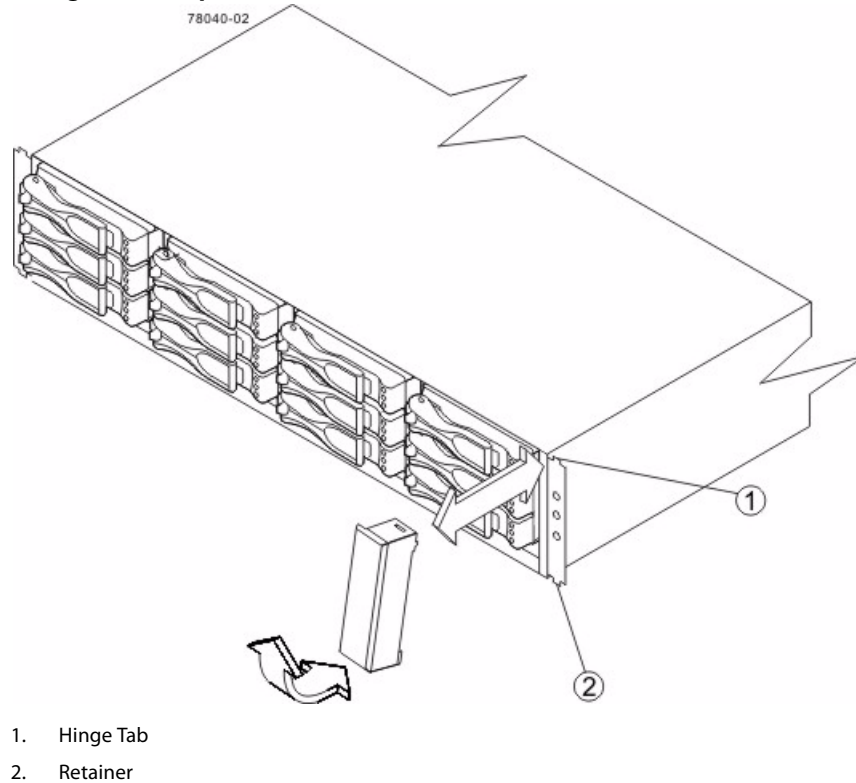
Figure 35 Attaching the Front of the Drive Module

1. Screws for Securing the Front of the Drive Module

8. Secure the side of the drive module to the mounting rails by performing these substeps:
 - a. Insert one M4 screw through the side sheet metal of the drive module into the captured nut on the side of the mounting rail. Tighten the screw.
 - b. Repeat substep a for the other side.
9. Attach the plastic end caps onto the front of the drive module.
 - a. Put the top of the end cap on the hinge tab that is part of the drive module mounting flange.

- b. Gently press on the bottom of the end cap until it snaps into place over the retainer on the bottom of the drive module mounting flange.

Figure 36 Attaching the End Caps to the ST2501 M2 Drive Module



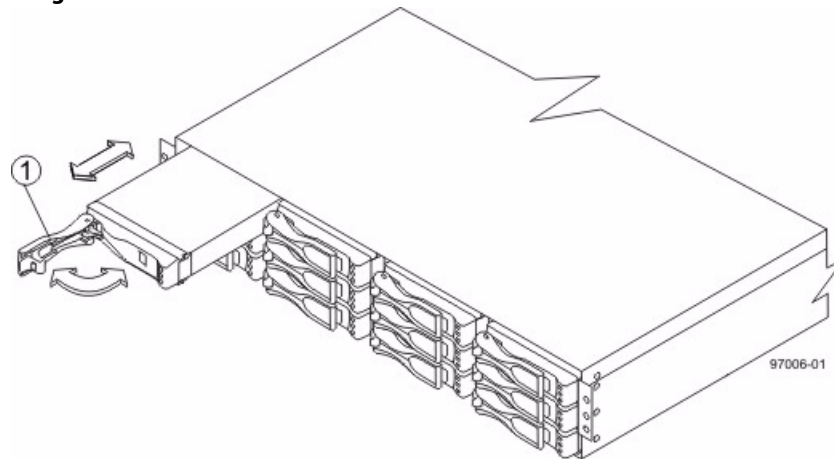
Procedure – Installing Drives for the ST2501 M2 Drive Modules

In some situations, the drive module might be delivered without the drives installed. Follow the steps in this procedure to install the drives. If your drive module already has drives installed, you can skip this step and go to either [Things to Know – AC Power Cords](#) or [Things to Know – DC Power Cords](#).

ATTENTION Risk of equipment malfunction – To avoid exceeding the functional and environmental limits, install only drives that have been provided or approved by the original manufacturer. Drives might be shipped but not installed. System integrators, resellers, system administrators, or users can install the drives.

NOTE The installation order is from top to bottom and left to right. The installation order is important because the drives might already contain configuration information that depends upon the correct sequence of the drives in the module.

1. Beginning with the first drive slot in the upper-left side of the drive module, place the drive on the slot guides, and slide the drive all the way into the slot.
2. Push the drive handle to the right (ST2501 M2 drive module) to lock the drive securely in place.

Figure 37 Installing a Drive in a ST2501 M2 Drive Module

1. Drive Handle

NOTE In some applications, the drive handle might have the hinge on the right.

3. Install the second drive beneath the first drive (ST2501 M2 drive module).
4. Install the other drives top to bottom and then left to right (ST2501 M2 drive module).

Step 7 – Connecting the ST2500 M2 Array Module to the Drive Modules

Key Terms

drive channel

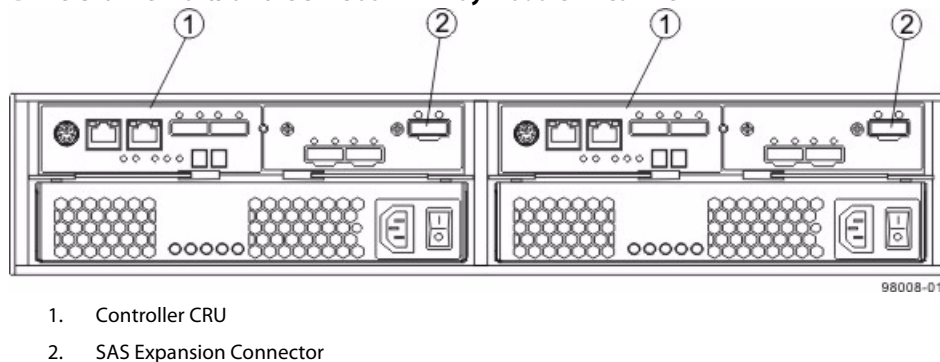
The path for the transfer of data between the controllers and the drives in the storage array.

Things to Know – ST2500 M2 Array Module

NOTE On the ST2500 M2 array module, each controller has a pair of levers with handles for removing the controller from the array module. One of these handles on each controller is located next to a host connector. The close spacing between the handle and the host connector might make it difficult to remove a cable that is attached to the host connector. If this problem occurs, use a flat-blade screwdriver to push in the release component on the cable connector.

- The ST2500 M2 array module supports the ST2501 M2 drive module for expansion.
- The maximum number of drive slots in the storage array is 96 (expandable to 192, including the 12 or 24 drive slots in the array module). Exceeding 96 (or 192) drive slots makes the storage array invalid. The controllers cannot perform operations that modify the configuration, such as creating new volumes.
- Each controller has one dual-ported SAS expansion connector to connect to the drive modules.

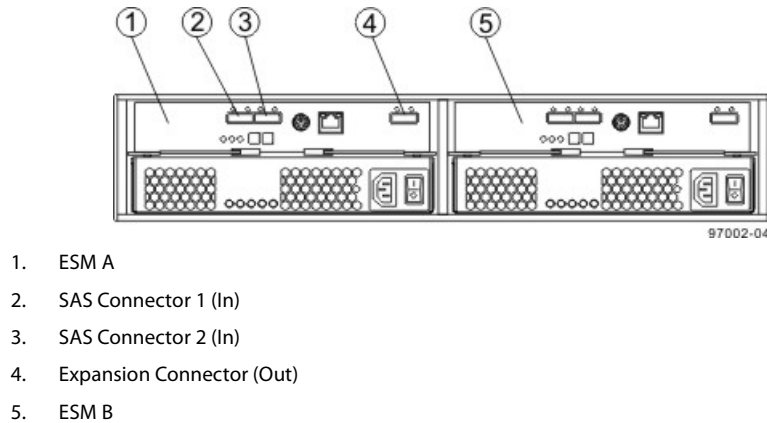
Figure 38 Drive Channel Ports on the ST2500 M2 Array Module – Rear View



NOTE To maintain data access in the event of the failure of a controller, an ESM, or a drive channel, you must connect a drive module or a string of drive modules to both drive channels on a redundant path pair.

Things to Know – Drive Modules with the ST2500 M2 Array Module

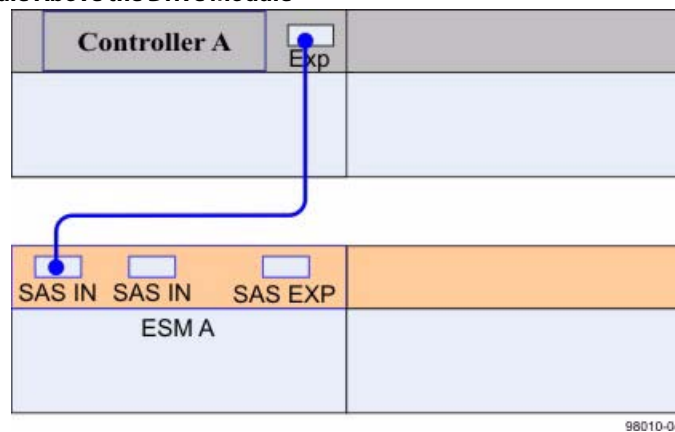
- Each ST2501 M2 drive module can contain a maximum of twelve 8.89-cm (3.5-in.) drives.
- The ESMs on the ST2501 M2 drive module contain two sets of In connectors and one set of Out connectors.

Figure 39 ST2501 M2 Drive Module – Rear View

Things to Know – Drive Module Cabling Configurations – Simplex System

The following figure shows an example of cable configurations from the simplex ST2500 M2 array module to an ST2501 M2 drive module. Use this example as a guide to connect cables in your storage array.

NOTE Configurations for connecting cables in a simplex system do not provide for module loss protection. Loss of a drive module that has a second drive module connected to it means that you cannot access the second drive module.

Figure 40 Array Module Above the Drive Module

Things to Know – Drive Module Cabling Configurations – Duplex System

The figures in this topic show examples of cable configurations from the array module to the drive modules. Use these examples as guides to connect cables in your storage array.

NOTE The configuration shown in the fourth image in this topic provides an example of module loss protection. With module loss protection, if one drive module cannot be accessed, you still have access to the remaining drive modules.

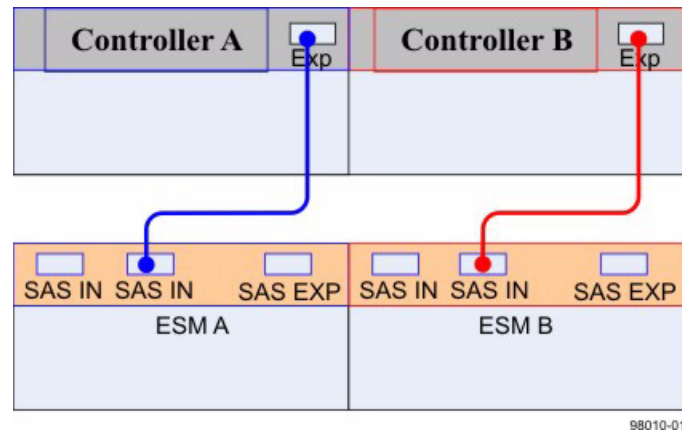
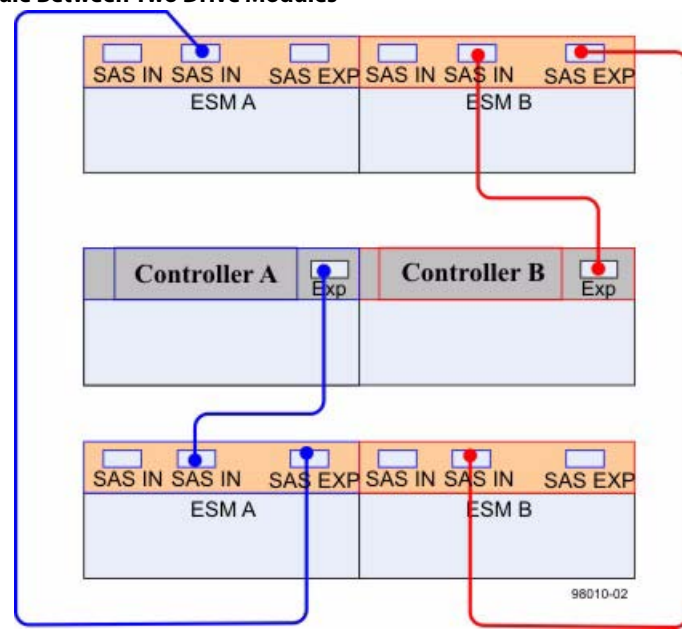
Figure 41 Array Module Above the Drive Module**Figure 42 Array Module Between Two Drive Modules**

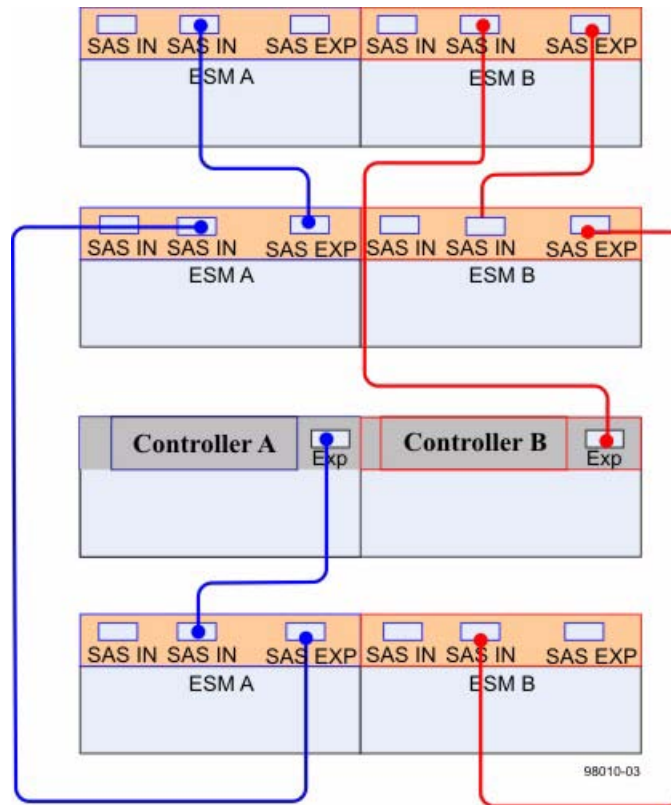
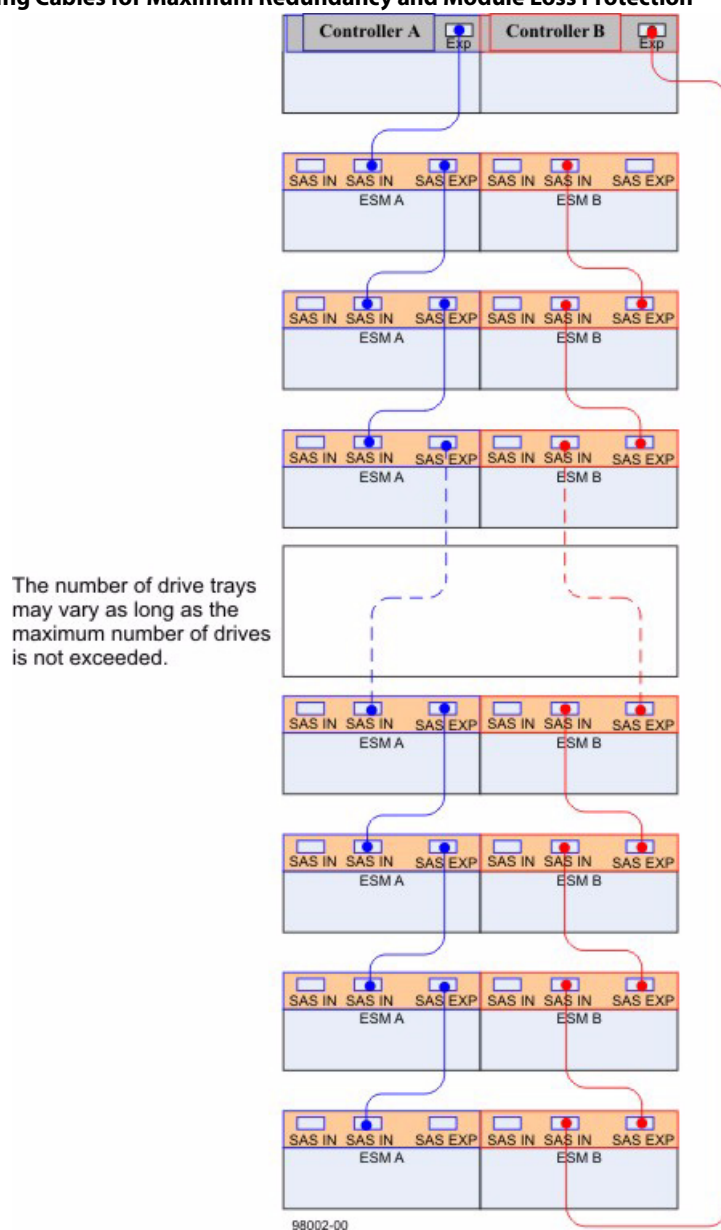
Figure 43 Array Module with Three Drive Modules

Figure 44 Connecting Cables for Maximum Redundancy and Module Loss Protection

Procedure – Connecting the ST2501 M2 Drive Modules

1. Use the following table to determine the number of SAS cables that you need.

Table 9 Drive Module Cables

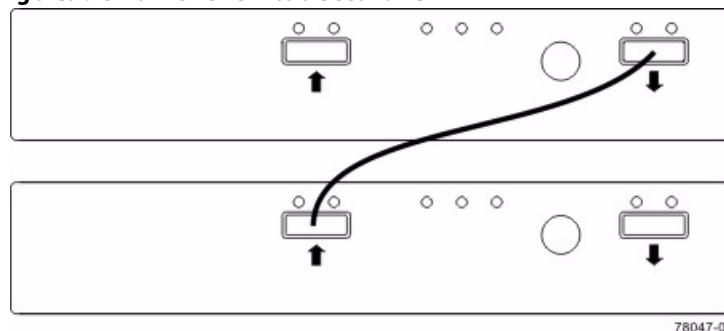
Number of Drive Modules that You Plan to Connect to the Array Module	Number of Cables Required
1	2
2	4
3	6

2. If there is a black, plastic plug in the SAS expansion connector of the controller, remove it.
3. Insert one end of the cable into the SAS expansion connector on the controller in slot A in the array module.
4. Insert the other end of the cable into the connector with an up arrow on the ESM in slot A in the drive module.
5. Are you adding more drive modules?

NOTE Each ESM in a drive module has three expansion connectors: two on the left-center of the ESM and one in the upper-right side. When connecting from an ESM in one drive module to an ESM in another drive module, make sure that you connect the connector on the upper-right to one of the connectors on the left-center. The following figure shows these arrows on an ESM. If the cable is connected either between the two left-center ESM connectors or between two upper-right ESM connectors, communication between the two drive modules is lost.

NOTE It does not matter which of the two left-center ESM connectors you use to connect to the expansion connector on the far-right side.

Figure 45 Connecting a Cable from One ESM to a Second ESM



- **Yes** – Go to step 6.
 - **No** – Go to step 9.
6. In the ESM in the first drive module, insert one end of the cable into the connector on the far-right side.
 7. In the ESM in the next drive module, insert the other end of the cable into one of the connectors in the left-center of the ESM.
 8. Repeat step 6 through step 7 for each drive module that you intend to add to the storage array.
 9. To each end of the cables, attach a label with this information:
 - The controller ID (for example, controller A)
 - The ESM ID (for example, ESM A)
 - The ESM connector (In or Out)
 - The drive module ID

For example, if you are connecting controller A to the In connector on ESM A in drive module 1, the label on the controller end of the cable will have this information:

CtA-Dch1, Dm1-ESM_A (left), In – Controller End

The label on the drive module end of the cable will have this information:

Dm1-ESM_A (left), In, CtrlA
 10. If you are installing the array module with two controllers, repeat step 2 through step 9 for the controller in slot B in the array module.

NOTE To connect cables for maximum redundancy, the cables attaching controller B must be connected to the drive modules in the opposite module order as for controller A. That is, the last drive module in the chain from controller A must be the first drive module in the chain from controller B.

Step 8 – Connecting the Ethernet Cables

Key Terms

in-band management

A method to manage a storage array in which a storage management station sends commands to the storage array through the host input/output (I/O) connection to the controller.

out-of-band management

A method to manage a storage array in which a storage management station sends commands to the storage array through the Ethernet connections on the controller.

Things to Know – Connecting Ethernet Cables

ATTENTION Risk of security breach – Connect the Ethernet ports on the controller module to a private network segment behind a firewall. If the Ethernet connection is not protected by a firewall, your storage array might be at risk of being accessed from outside of your network.

- These Ethernet connections are intended for out-of-band management and have nothing to do with the iSCSI host interface cards (HICs), whether 1Gb/s or 10Gb/s.
- Ethernet port 2 on each controller is reserved for access by your Sun Customer Care Center representative.
- In limited situations in which the storage management station is connected directly to the controller module, you must use an Ethernet crossover cable. An Ethernet crossover cable is a special cable that reverses the pin contacts between the two ends of the cable.

Procedure – Connecting Ethernet Cables

Perform these steps to connect Ethernet cables for out-of-band management. If you use only in-band management, skip these steps.

1. Connect one end of an Ethernet cable into the Ethernet port 1 on controller A.
2. Connect the other end to the applicable network connection.
3. Repeat step 1 through step 2 for controller B.

Step 9 – Connecting the Power Cords

The ST2500 M2 array module and the ST2501 M2 drive module can have either standard power connections to an AC power source or the optional connections to a DC power source (–48 VDC).

NOTE Make sure that you do not turn on the power to the array module or the connected drive modules until this documentation instructs you to do so. For the correct procedure for turning on the power, see [Step 10 – Turning on the Power and Checking for Problems in a ST2500 M2 Array Module Configuration](#).

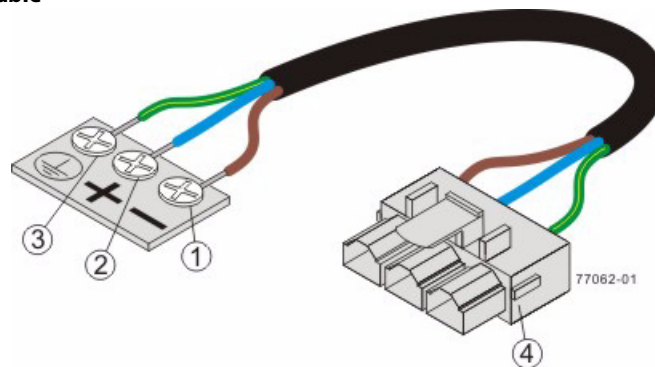
Things to Know – AC Power Cords

- For each AC power connector on the drive module, make sure that you use a separate power source in the cabinet. Connecting to independent power sources maintains power redundancy.
- To ensure proper cooling and assure availability, the drive modules always use two power supplies.
- You can use the power cords shipped with the drive module with typical outlets used in the destination country, such as a wall receptacle or an uninterruptible power supply (UPS). These power cords, however, are not intended for use in most EIA-compliant cabinets.

Things to Know – DC Power Cords

If your drive module has the DC power option installed, review the following information.

Figure 46 DC Power Cable



1. Supply (negative), brown wire, –48 VDC
 2. Return (positive), blue wire
 3. Ground, green/yellow wire
 4. DC power connector
- Each power-fan CRU has two DC power connectors. Be sure to use a separate power source for each power-fan CRU in the drive module to maintain power redundancy. You may, optionally, connect each DC power connector on the same power-fan CRU to a different source for additional redundancy.
 - A two-pole 30-amp circuit breaker is required between the DC power source and the drive module for over-current and short-circuit protection.



WARNING (W14) Risk of bodily injury – A qualified service person is required to make the DC power connection according to NEC and CEC guidelines.

Procedure – Connecting AC Power Cords

1. Make sure that the circuit breakers in the cabinet are turned off.
2. Make sure that both of the Power switches on the drive modules are turned off.
3. Connect the primary power cords from the cabinet to the external power source.
4. Connect a cabinet interconnect power cord (or power cords specific to your particular cabinet) to the AC power connector on each power CRU in the drive module.
5. If you are installing other drive modules in the cabinet, connect a power cord to each power CRU in the drive modules.

Procedure – Connecting DC Power Cords



WARNING (W14) Risk of bodily injury – A qualified service person is required to make the DC power connection according to NEC and CEC guidelines.

NOTE Make sure that you do not turn on power to the drive module until this guide instructs you to do so. For the proper procedure for turning on the power, see “Turning on the Power”.

NOTE Before turning off any power switches on a DC-powered drive module, you must disconnect the two-pole 20-amp circuit breaker.

1. Disconnect the two-pole 20-amp circuit breaker for the storage array.
2. Make sure that all of the DC power switches on the DC-powered drive module are turned off.
3. Connect the DC power connector cables to the DC power connectors on the rear of the controller module or array module, and drive modules.

NOTE The three source wires on the DC power connector cable (–48 VDC) connect the drive module to centralized DC power plant equipment, typically through a bus bar located above the cabinet.

NOTE It is not mandatory that the second DC power connection on each of the drive module’s DC power-fan CRUs be connected. The second DC power connection is for additional redundancy only and may be connected to a second DC power bus.

4. Have a qualified service person connect the other end of the DC power connector cables to the DC power plant equipment as follows:
 - a. Connect the brown –48 VDC supply wire to the negative terminal.
 - b. Connect the blue return wire to the positive terminal.
 - c. Connect the green/yellow ground wire to the ground terminal.

Step 10 – Turning on the Power and Checking for Problems in a ST2500 M2 Array Module Configuration

After you complete this task, you can install the software and perform basic configuration tasks on your storage array. Continue with the *Initial Configuration and Software Installation* in these electronic document topics or through the PDF that is available on the SANtricity ES Storage Manager Installation DVD.

Procedure – Turning On the Power to the Storage Array and Checking for Problems in a ST2500 M2 Array Module Configuration

NOTE You must turn on the power to all of the connected drive modules before you turn on the power for the array module. Performing this action makes sure that the controllers recognize each attached drive module.

NOTE While the power is being applied to the modules, the LEDs on the front and the rear of the modules come on and go off intermittently.

1. Turn on both Power switches on each drive module that is attached to the array module. Depending on your configuration, it can take several minutes for each drive module to complete the power-on process.
-

NOTE Before you go to step 2, check the LEDs on the drive modules to verify that the power was successfully applied to all of the drive modules. Wait 30 seconds after turning on the power to the drive modules before turning on the power to the array module.

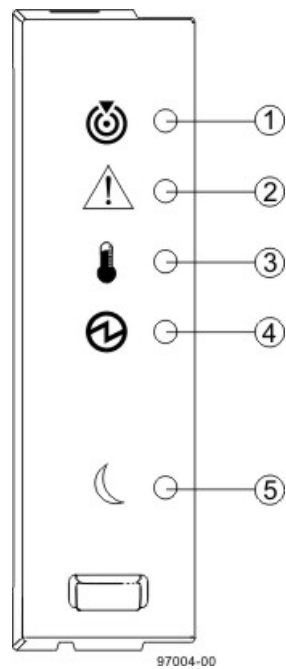
2. Turn on both Power switches on the rear of the array module. Depending on your configuration, it can take several minutes for the array module to complete the power-on process.
3. Check the LEDs on the front and the rear of the array module and the attached drive modules.
4. If you see any amber LEDs, make a note of their location.

Things to Know – LEDs on the ST2500 M2 Array Module

The following topics provide details on the LEDs found on the ST2500 M2 array module.

LEDs on the Left End Cap

Figure 47 LEDs on the Left End Cap

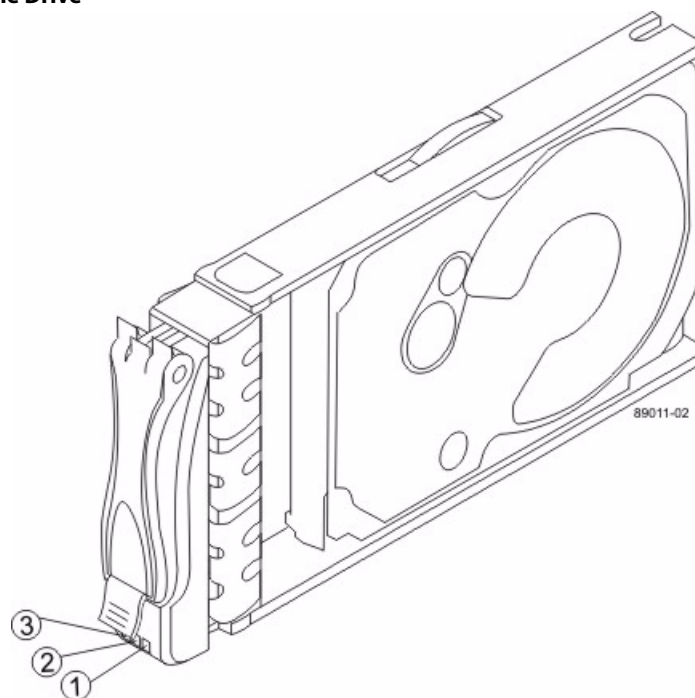


- 1. Array Module Locate LED
- 2. Service Action Required LED
- 3. Array Module Over-Temperature LED
- 4. Power LED
- 5. Standby Power LED

Table 10 LEDs on the Left End Cap

Location	LED	Color	On	Off
1	Array Module Locate	White	Identifies a array module that you are trying to find.	Normal status.
2	Service Action Required	Amber	A component within the array module needs attention.	Normal status.
3	Array Module Over-Temperature	Amber	The temperature of the array module has reached an unsafe level.	Normal status.
4	Power	Green	Power is present.	Power is not present.
5	Standby Power	Green	The array module is in Standby Power mode.	The array module is not in Standby Power mode.

LEDs on the Drive

Figure 48 LEDs on the Drive

1. Drive Power LED
2. Drive Service Action Required LED
3. Drive Service Action Allowed LED

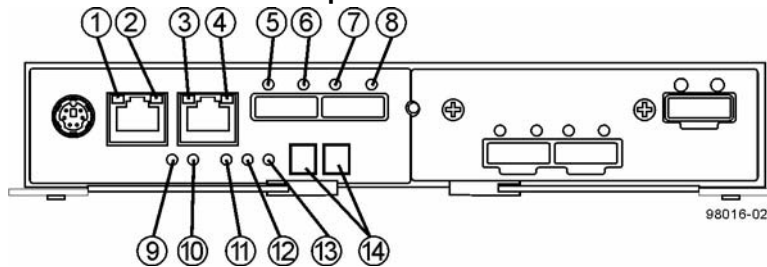
Table 11 LEDs on the Drive

Location	LED	Color	On	Blinking	Off
1	Drive Power	Green	The power is turned on, and the drive is operating normally.	Drive I/O activity is taking place.	The power is turned off.
2	Drive Service Action Required	Amber	An error has occurred.		Normal status.
3	Drive Service Action Allowed	Blue	The drive CRU can be removed safely from the array module.		The drive CRU cannot be removed safely from the array module.

Table 12 Drive State Represented by LEDs

Drive State	Drive Power LED (Green)	Drive Service Action Required LED (Amber)
Power is not applied.	Off	Off
Normal operation – The power is turned on, but drive I/O activity is not occurring.	On	Off
Normal operation – Drive I/O activity is occurring.	Blinking	Off
Service action required – A fault condition exists, and the drive is offline.	On	On

LEDs on the Controller CRU Main Faceplate

Figure 49 LEDs on the Controller CRU Main Faceplate

1. Ethernet Connector 1 Link Rate LED
2. Ethernet Connector 1 Link Active LED
3. Ethernet Connector 2 Link Rate LED
4. Ethernet Connector 2 Link Active LED
5. Host Link 1 Service Action Required LED
6. Host Link 1 Service Action Allowed LED
7. Host Link 2 Service Action Required LED
8. Host Link 2 Service Action Allowed LED
9. Battery Service Action Required LED
10. Battery Charging LED
11. Controller Service Action Allowed LED
12. Controller Service Action Required LED
13. Cache Active LED
14. Seven-Segment Tray ID

Table 13 LEDs on the Controller CRU Main Faceplate

Location	LED	Color	On	Off
1	Ethernet Connector 1 Link Rate LED	Green	There is a 100BASE-T rate.	There is a 10BASE-T rate.
2	Ethernet Connector 1 Link Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
3	Ethernet Connector 2 Link Rate LED	Green	There is a 100BASE-T rate.	There is a 10BASE-T rate.
4	Ethernet Connector 2 Link Active LED	Green	The link is up (the LED blinks when there is activity).	The link is not active.
5	Host Link 1 Service Action Required LED	Amber	At least one of the four PHYs is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.
6	Host Link 1 Service Action Allowed LED	Green	At least one of the four PHYs in the Host IN port is working and a link exists to the device connected to the IN port connector.	A link error has occurred.
7	Host Link 2 Service Action Required LED	Amber	At least one of the four PHYs is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.

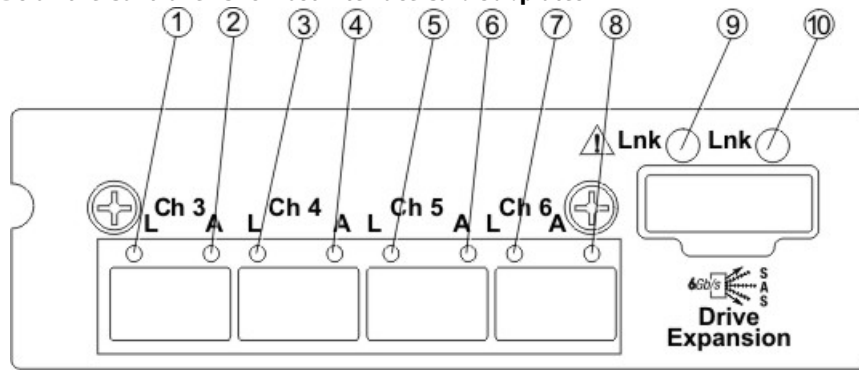
Location	LED	Color	On	Off
8	Host Link 2 Service Action Allowed LED	Green	At least one of the four PHYs in the Host IN port is working and a link exists to the device connected to the IN port connector.	A link error has occurred.
9	Battery Service Action Required LED	Amber	The battery in the controller CRU has failed.	Normal status.
10	Battery Charging LED	Green	The battery is fully charged. The LED blinks when the battery is charging.	The controller CRU is operating without a battery or the existing battery has failed.
11	Controller Service Action Allowed LED	Blue	The controller CRU can be removed safely from the array module.	The controller CRU cannot be removed safely from the array module.
12	Controller Service Action Required LED	Amber	A fault exists within the controller CRU.	Normal status.
13	Cache Active LED	Green	Cache is active.*	Cache is inactive or the controller CRU has been removed from the array module.

* After an AC power failure, this LED blinks while cache offload is in process.

LEDs on the Controller CRU Host Interface Card Subplates

NOTE The following figure shows an iSCSI host interface card (HIC), but the ST2500 M2 array module also supports a four-connector FC HIC and a two-connector SAS HIC with comparable LEDs.

Figure 50 LEDs on the Controller CRU Host Interface Card Subplates



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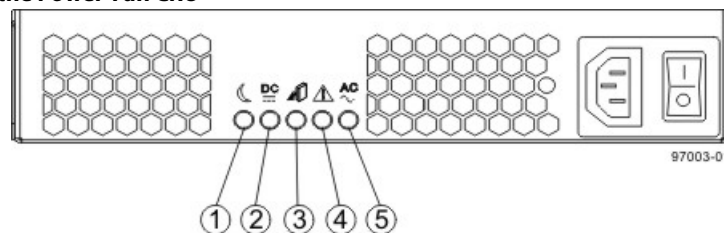
1. Host Interface Card Link 3 Up LED
2. Host Interface Card Link 3 Active LED
3. Host Interface Card Link 4 Up LED
4. Host Interface Card Link 4 Active LED
5. Host Interface Card Link 5 Up LED
6. Host Interface Card Link 5 Active LED
7. Host Interface Card Link 6 Up LED
8. Host Interface Card Link 6 Active LED
9. Expansion Fault LED
10. Expansion Active LED

Table 14 LEDs on the Controller CRU Host Interface Card Subplates*

Location	LED	Color	On	Off
1	Host Interface Card Link 3 Up LED	Green	The Ethernet link has auto-negotiated to 1 Gb/s.	The Ethernet link is down or does not auto-negotiate to 1 Gb/s.
2	Host Interface Card Link 3 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
3	Host Interface Card Link 4 Up LED	Green	The Ethernet link has auto-negotiated to 1 Gb/s.	The Ethernet link is down or does not auto-negotiate to 1 Gb/s.
4	Host Interface Card Link 4 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
5	Host Interface Card Link 5 Up LED	Green	The Ethernet link has auto-negotiated to 1 Gb/s.	The Ethernet link is down or does not auto-negotiate to 1 Gb/s.
6	Host Interface Card Link 5 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
7	Host Interface Card Link 6 Up LED	Green	The Ethernet link has auto-negotiated to 1 Gb/s.	The Ethernet link is down or does not auto-negotiate to 1 Gb/s.
8	Host Interface Card Link 6 Active LED	Green	The link is up (LED blinks when there is activity).	The link is not active.
9	Expansion Fault LED	Amber	At least one of the four PHY is working, but another PHY cannot establish the same link to the device connected to the Expansion OUT connector.	Normal status.
10	Expansion Active LED	Green	At least one of the four PHYs in the OUT connector is working and a link has been made to the device connected to the Expansion connector.	The link is not active.

* LEDs on the Controller CRU Host Interface Card Subplates shows the four-port iSCSI host interface card (HIC), which can also be a four-port FC HIC or a two-port SAS HIC.

LEDs on the Power-Fan CRU

Figure 51 LEDs on the Power-Fan CRU







1. Standby Power LED
2. Power-Fan DC Power LED
3. Power-Fan Service Action Allowed LED
4. Power-Fan Service Action Required LED
5. Power-Fan AC Power LED









Table 15 LEDs on the Power-Fan CRU

Location	LED	Color	On	Off
1	Standby Power	Green	The array module is in Standby mode, and DC power is not available.	The array module is not in Standby mode, and DC power is available.
2	Power-Fan DC Power	Green	DC power from the power-fan CRU is available.	DC power from the power-fan CRU is not available.
3	Power-Fan Service Action Allowed	Blue	The power-fan CRU can be removed safely from the array module.	The power-fan CRU cannot be removed safely from the array module.
4	Power-Fan Service Action Required	Amber	A fault exists within the power-fan CRU.	Normal status.
5	Power-Fan AC Power	Green	AC power to the power-fan CRU is present.	AC power to the power-fan CRU is not present.

Things to Know – General Behavior of the LEDs on the ST2500 M2 Array Module

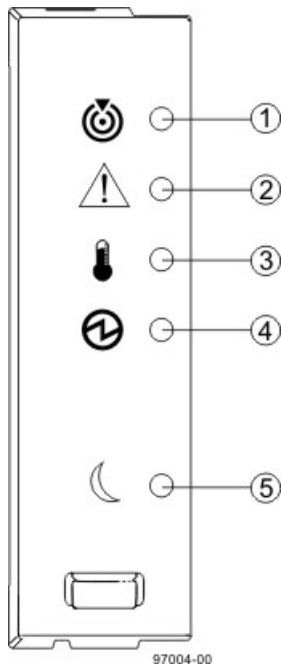
Table 16 LED Symbols and General Behavior

LED	Symbol	Location (CRUs)	Function
Power		Power-fan Interconnect-battery	<ul style="list-style-type: none"> ■ On – The controller has power. ■ Off – The controller does not have power. <p>NOTE – The controller CRUs do not have a Power LED. They receive their power from the power supplies inside the power-fan CRUs.</p>
Battery Fault		Battery	<ul style="list-style-type: none"> ■ On – The battery is missing or has failed. ■ Off – The battery is operating normally. ■ Blinking – The battery is charging.
Service Action Allowed		Drive (left LED, no symbol) Power-fan Controller Battery	On – You can remove the CRU safely. See “Things to Know – Service Action Allowed LEDs.”
Service Action Required (Fault)		Drive	<p>On – When the drive module LED is on, the cable is attached and at least one lane has a link up status, but at least one lane has a link down status.</p> <p>Off – One of the following conditions exists:</p> <ul style="list-style-type: none"> ■ No cable is attached. ■ A cable is attached, and all lanes have a link up status. ■ A cable is attached, and all lanes have a link down status.
Service Action Required (Fault)		Controller Power-fan CRU	<p>On – The controller or the power-fan CRU needs attention.</p> <p>Off – The controller and the power-fan CRU are operating normally.</p>
Locate		Front frame	On – Assists in locating the module.

LED	Symbol	Location (CRUs)	Function
Host Channel Connection (iSCSI)		Controller	The status of the host channel is indicated: <ul style="list-style-type: none"> ■ "L" LED on – A link is established. ■ "A" LED on – Activity (data transfer) is present.
Cache Active		Controller	The activity of the cache is indicated: <ul style="list-style-type: none"> ■ On – Data is in the cache. ■ Off – No data is in the cache.
Array Module Over-Temperature		Front bezel on the array module	On – The temperature of the drive module has reached an unsafe condition. Off – The temperature of the drive module is within operational range.
Standby Power		Front bezel on the array module	On – The controller module is in standby mode and the main DC power is off. Off – The array module is not in standby mode and the main DC power is on.
Seven-Segment ID Diagnostic Display		Controller	The module ID or a diagnostic code is indicated (see "Things to Know – Dynamic Display Sequence Definitions on the Seven-Segment Display"). For example, if some of the cache memory dual in-line memory modules (DIMMs) are missing in a controller, error code L8 appears in the diagnostic display (see "Things to Know – Supported Diagnostic Lock-Down Codes on the Seven-Segment Display").
AC power		Power-fan NOTE – The LED is directly above or below the AC power switch and the AC power connector.	Indicates that the power supply is receiving AC power input.
DC power		Power-fan NOTE – The LED is directly above or below the DC power switch and the DC power connector.	Indicates that the power supply is receiving DC power input.
Ethernet Speed and Ethernet Activity		Controller	The speed of the Ethernet ports and whether a link has been established are indicated: <ul style="list-style-type: none"> ■ Left LED On – 1-Gb/s speed. ■ Left LED Off – 100BASE-T or 10BASE-T speed. ■ Right LED On – A link is established. ■ Right LED Off – No link exists. ■ Right LED blinking – Activity is occurring.

Things to Know – LEDs on the ST2501 M2 Drive Module

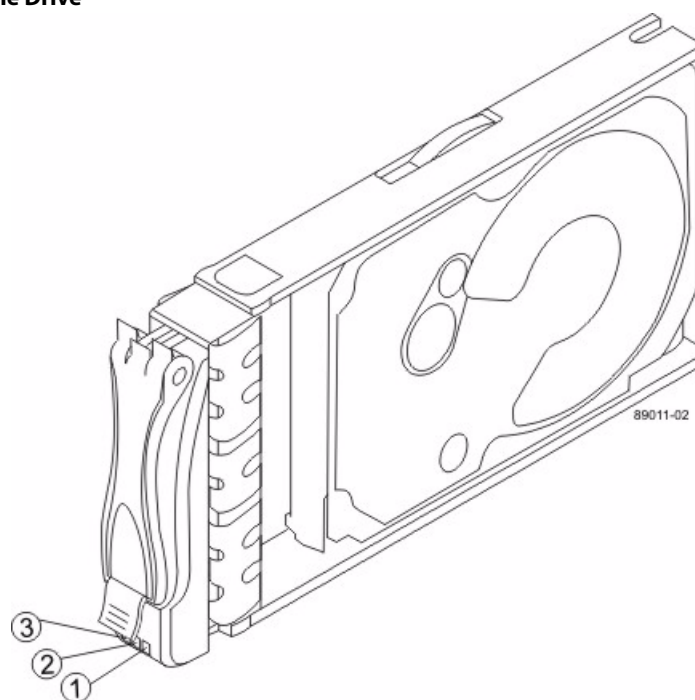
Figure 52 LEDs on the Left End Cap



- 1. Drive Module Locate LED
- 2. Service Action Required LED
- 3. Drive Module Over-Temperature LED
- 4. Power LED
- 5. Standby Power LED

Table 17 LEDs on the Left End Cap

Location	LED	Color	On	Off
1	Drive Module Locate	White	Identifies a drive module that you are trying to find.	Normal status.
2	Service Action Required	Amber	A component within the drive module needs attention.	Normal status.
3	Drive Module Over-Temperature	Amber	The temperature of the drive module has reached an unsafe level.	Normal status.
4	Power	Green	Power is present.	Power is not present.
5	Standby Power	Green	The drive module is in Standby Power mode.	The drive module is not in Standby Power mode.

Figure 53 LEDs on the Drive

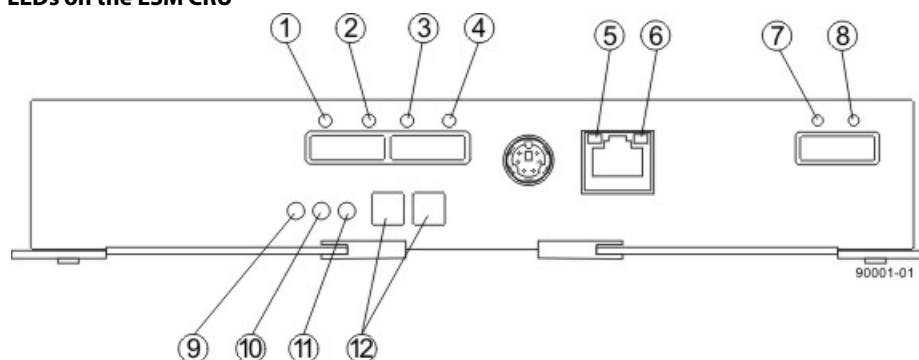
1. Drive Power LED
2. Drive Service Action Required LED
3. Drive Service Action Allowed LED

Table 18 LEDs on the Drive

Location	LED	Color	On	Blinking	Off
1	Drive Power	Green	The power is turned on, and the drive is operating normally.	Drive I/O activity is taking place.	The power is turned off.
2	Drive Service Action Required	Amber	An error has occurred.		Normal status.
3	Drive Service Action Allowed	Blue	The drive CRU can be removed safely from the drive module.		The drive CRU cannot be removed safely from the drive module.

Table 19 Drive State Represented by LEDs

Drive State	Drive Power LED (Green)	Drive Service Action Required LED (Amber)
Power is not applied.	Off	Off
Normal operation – The power is turned on, but drive I/O activity is not occurring.	On	Off
Normal operation – Drive I/O activity is occurring.	Blinking	Off
Service action required – A fault condition exists, and the drive is offline.	On	On

Figure 54 LEDs on the ESM CRU

1. Host Link 1 Fault LED
2. Host Link 1 Active LED
3. Host Link 2 Fault LED
4. Host Link 2 Active LED
5. Ethernet Link Active LED
6. Ethernet Link Rate LED
7. ESM Expansion Link Fault LED
8. ESM Expansion Link Active LED
9. ESM Service Action Allowed LED
10. ESM Service Action Required LED
11. ESM Power LED
12. Seven-Segment Tray ID

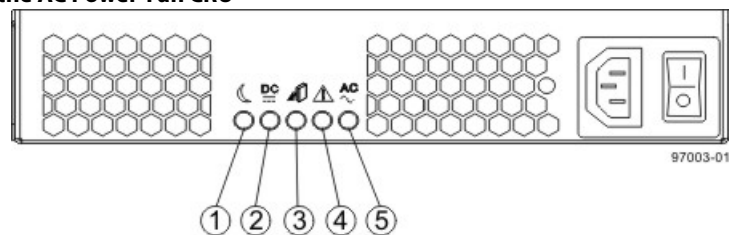
Table 20 LEDs on the ESM CRU

Location	LED	Color	On	Off
1	Host Link 1 Fault	Amber	At least one PHY of the four connectors is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector.	No link error has occurred.
2	Host Link 1 Active	Green	At least one of the four PHYs in the IN port is working, and a link exists to the device connected to the Host IN connector.	A link error has occurred.
3	Host Link 2 Fault	Amber	At least one PHY of the four connections is working, but another PHY cannot establish the same link to the device connected to the Host IN port connector	No link error has occurred.
4	Host Link 2 Active	Green	At least one of the four PHYs in the IN port is working, and a link exists to the device connected to the Host IN connector.	A link error has occurred.
5	Ethernet Link Active	Green	The link is up. (The LED blinks when there is activity.)	The link is not active.
6	Ethernet Link Rate	Green	There is a 100BASE-T rate.	There is a 10BASE-T rate.
7	ESM Expansion Link Fault	Amber	At least one of the four PHYs in the OUT port is working, but another PHY cannot establish the same link to the Expansion OUT connector.	Normal status.

Location	LED	Color	On	Off
8	ESM Expansion Link Active	Green	At least one of the four PHYs in the OUT port is working, and a link exists to the device connected to the Expansion OUT connector.	A link error has occurred.
9	ESM Service Action Allowed	Blue	The ESM can be removed safely from the drive module.	The ESM cannot be removed safely from the drive module.
10	ESM Service Action Required	Amber	A fault exists within the ESM. (This LED defaults on at power up. This LED turns off after the software has completed its power up self-test sequence.)	Normal status.
11	ESM Power	Green	12V power to the ESM is present.	Power is not present to the ESM.
12	Seven-Segment Tray ID	Green	See note.	Not applicable.

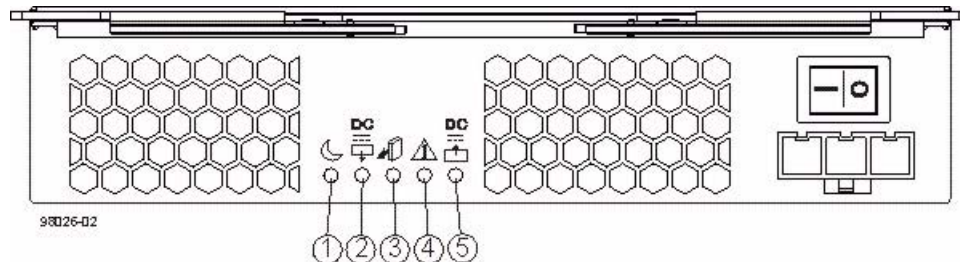
*For more information about the seven-segment tray IDs, see [Things to Know – Seven-Segment Display for the ST2501 M2 Drive Module](#).

Figure 55 LEDs on the AC Power-Fan CRU



1. Standby Power LED
2. Power-Fan Output DC Power LED
3. Power-Fan Service Action Allowed LED
4. Power-Fan Service Action Required LED
5. Power-Fan Input AC Power LED

Figure 56 LEDs on the DC Power-Fan CRU










1. Standby Power LED
2. Power-Fan Output DC Power LED
3. Power-Fan Service Action Allowed LED
4. Power-Fan Service Action Required LED
5. Power-Fan Input DC Power LED



Table 21 LEDs on the Power-Fan CRU

Location	LED	Color	On	Off
1	Standby Power	Green	The drive module is in Standby mode, and DC power is not available.	The drive module is not in Standby mode, and DC power is available.
2	Power-Fan DC Power	Green	DC power from the power-fan CRU is available.	DC power from the power-fan CRU is not available.
3	Power-Fan Service Action Allowed	Blue	The power-fan CRU can be removed safely from the drive module.	The power-fan CRU cannot be removed safely from the drive module.
4	Power-Fan Service Action Required	Amber	A fault exists within the power-fan CRU.	Normal status.
5	Power-Fan AC Power	Green	AC power to the power-fan CRU is present.	AC power to the power-fan CRU is not present.

General Behavior of the LEDs on the ST2501 M2 Drive Module

Table 22 LED Symbols and General Behavior

LED	Symbol	Location	General Behavior
Power		Drive module ESM CRU Power-fan CRU	On – Power is applied to the drive module or the CRU. Off – Power is not applied to the drive module or the CRU.
Drive Module Locate		Front bezel on the drive module	On or blinking – Indicates the drive module that you are trying to find.
Drive Module Over-Temperature		Front bezel on the drive module	On – The temperature of the drive module has reached an unsafe condition. Off – The temperature of the drive module is within operational range.
Standby Power		Front bezel on the drive module	On – The drive module is in Standby mode, and the main DC power is off. Off – The drive module is not in Standby mode, and the main DC power is on.
Service Action Allowed		ESM CRU Power-fan CRU Drive	On – It is safe to remove the ESM CRU, the power-fan CRU, or the drive. Off – Do not remove the ESM CRU, the power-fan CRU, or the drive. The drive has an LED but no symbol.
Service Action Required (Fault)		ESM CRU Power-fan CRU Drive	On – When the drive module LED is on, a component within the drive module needs attention. On – The ESM CRU, the power-fan CRU, or the drive needs attention. Off – The ESM CRU, the power-fan CRU, and the drive are operating normally. The drive has an LED but no symbol.
AC Power		ESM CRU Power-fan CRU	On – AC power is present. Off – AC power is not present.

LED	Symbol	Location	General Behavior
DC Power		Power-fan CRU	On – Regulated DC power from the power CRU and the fan CRU is present. Off – Regulated DC power from the power-fan CRU is not present.
Link Service Action Required (Fault)		ESM CRU	On – The cable is attached and at least one lane has a link-up status, but one lane has a link-down status. Off – The cable is not attached, the cable is attached and all lanes have a link-up status, or the cable is attached and all lanes have a link-down status.
Link Up	Two LEDs above each expansion connector	ESM CRU	On – The cable is attached and at least one lane has a link-up status. Off – The cable is not attached, or the cable is attached and all lanes have a link-down status.

Things to Know – Service Action Allowed LEDs

Each controller CRU, power-fan CRU, and battery CRU has a Service Action Allowed LED. The Service Action Allowed LED lets you know when you can remove a CRU safely.

ATTENTION Possible loss of data access – Never remove a controller CRU, a power-fan CRU, or a battery CRU unless the appropriate Service Action Allowed LED is on.

If a controller CRU or a power-fan CRU fails and must be replaced, the Service Action Required (Fault) LED on that CRU comes on to indicate that service action is required. The Service Action Allowed LED also comes on if it is safe to remove the CRU. If data availability dependencies exist or other conditions that dictate a CRU should not be removed, the Service Action Allowed LED stays off.

The Service Action Allowed LED automatically comes on or goes off as conditions change. In most cases, the Service Action Allowed LED comes on when the Service Action Required (Fault) LED comes on for a CRU.

NOTE If the Service Action Required (Fault) LED comes on but the Service Action Allowed LED is off for a particular CRU, you might need to service another CRU first. Check your storage management software to determine the action that you should take.

Things to Know – Sequence Code Definitions for the ST2500 M2 Array Module

During normal operation, the tray ID display on each controller CRU displays the array module ID. The Diagnostic LED (lower-digit decimal point) comes on when the display is used for diagnostic codes and goes off when the display is used to show the tray ID.

Table 23 Sequence Code Definitions for the ST2500 M2 Array Module

Category	Category Code (See Note 1)	Detail Codes (See Note 2)
Startup error	SE+ (See Note 3)	<ul style="list-style-type: none"> ■ 88+ Power-on default. ■ dF+ Power-on diagnostic fault.
Operational error	OE+	Lx+ Lock-down codes. (See the following table.)
Operational state	OS+	<ul style="list-style-type: none"> ■ OL+ = Offline. ■ bb+ = Battery backup (operating on batteries). ■ Cf+ = Component failure.
Component failure	CF+	<ul style="list-style-type: none"> ■ dx+ = Processor or cache DIMM. ■ Cx = Cache DIMM. ■ Px+ = Processor DIMM. ■ Hx+ = Host interface card. ■ Fx+ = Flash drive.
Diagnostic failure	dE+	Lx+ = Lock-down code.
Category delimiter	dash+	The separator between category-detail code pairs is used when more than one category detail code pair exists in the sequence.
End-of-sequence delimiter	Blank (See Note 4)	The end-of-sequence delimiter is automatically inserted by the hardware at the end of a code sequence.

Notes:

- 1 A two-digit code that starts a dynamic display sequence.
- 2 A two-digit code that follows the category code with more specific information.
- 3 The plus (+) sign indicates that a two-digit code displays with the Diagnostic LED on.
- 4 No codes display, and the Diagnostic LED is off.

Things to Know – Lock-Down Codes for the ST2500 M2 Array Module

Use the following table to determine the diagnostic lock-down code definitions on the Seven-Segment Display in the controller CRU for the ST2500 M2 array module.

Table 24 Supported Diagnostic Lock-Down Codes on the Seven-Segment Display

Diagnostic Code	Description
--	The firmware is booting.
.8, 8., or 88	This ESM is being held in reset by another ESM.
AA	The ESM A firmware is in the process of booting (the diagnostic indicator is not yet set).
bb	The ESM B firmware is in the process of booting (the diagnostic indicator is not yet set).
L0	The controller types are mismatched, which result in a suspended controller state.
L2	A persistent memory error has occurred, which results in a suspended controller state.
L3	A persistent hardware error has occurred, which results in a suspended controller state.
L4	A persistent data protection error has occurred, which results in a suspended controller state.
L5	An auto-code synchronization (ACS) failure has been detected, which results in a suspended controller state.
L6	An unsupported host interface card has been detected, which results in a suspended controller state.

Diagnostic Code	Description
L7	A sub-model identifier either has not been set or has been mismatched, which results in a suspended controller state.
L8	A memory configuration error has occurred, which results in a suspended controller state.
L9	A link speed mismatch condition has been detected in either the ESM or the power supply, which results in a suspended controller state.
Lb	A host interface card configuration error has been detected, which results in a suspended controller state.
LC	A persistent cache backup configuration error has been detected, which results in a suspended controller state.
Ld	A mixed cache memory DIMMs condition has been detected, which results in a suspended controller state.
LE	Uncertified cache memory DIMM sizes have been detected, which result in a suspended controller state.
LF	The controller has locked down in a suspended state with limited symbol support.
LH	A controller firmware mismatch been detected, which results in a suspended controller state.
LL	The controller cannot access either midplane SBB EEP-ROM, which results in a suspended controller state.
Ln	A CRU is not valid for a controller, which results in a suspended controller state.
LP	Drive port mapping tables are not detected, which results in a suspended controller state.
LU	The start-of-day (SOD) reboot limit has been exceeded, which results in a suspended controller state.

Things to Know – Diagnostic Code Sequences for the ST2500 M2 Array Module

Use the following table to determine the code sequences on the Seven-Segment Display in the controller canister for the ST2500 M2 array module. These repeating sequences can be used to diagnose potential problems with the controller module.

Table 25 Diagnostic Code Sequences for the ST2500 M2 Array Module

Displayed Diagnostic Code Sequences	Description
SE+ 88+ blank-	One of the following power-on conditions exists: <ul style="list-style-type: none"> ■ Controller power-on ■ Controller insertion ■ Controller inserted while held in reset
xy -	Normal operation.
OS+ Sd+ blank-	Start-of-day (SOD) processing.
OS+ OL+ blank-	The controller is placed in reset while displaying the tray ID.
OS+ bb+ blank-	The controller is operating on batteries (cache backup).
OS+ CF+ Hx + blank-	A failed host card has been detected.
OS+ CF+ Fx + blank-	A failed flash drive has been detected.
SE+ dF + blank-	A non-replaceable component failure has been detected.
SE+ dF + dash+ CF+ Px + blank-	A processor DIMM failure has been detected.
SE+ dF + dash+ CF+ Cx + blank-	A cache memory DIMM failure has been detected.
SE+ dF + dash+ CF+ dx + blank-	A processor or cache DIMM failure has been detected.
SE+ dF + dash+ CF+ Hx + blank-	A host card failure has been detected.
OE+ Lx + blank-	A lockdown condition has been detected.

Displayed Diagnostic Code Sequences	Description
OE+ L2+ dash+ CF+ Px + blank-	Persistent processor DIMM ECC errors have been detected, which result in a suspended controller state.
OE+ L2+ dash+ CF+ Cx + blank-	Persistent cache DIMM ECC errors have been detected, which result in a suspended controller state.
OE+ L2+ dash+ CF+ dx + blank-	Persistent processor or cache DIMM ECC errors have been detected, which result in a suspended controller state.
OE+ LC+ blank-	The write-protect switch is set during cache restore, which results in a suspended controller state.
OE+ LC+ dd + blank-	The memory size is changed from bad data in the flash drives, which results in a suspended controller state.
DE+ L2+ dash+ CF+ Cx + blank-	A cache memory diagnostic has been reported failed, which results in a suspended controller state.

Things to Know – Seven-Segment Display for the ST2501 M2 Drive Module

During normal operation, the tray ID display on each ESM displays the drive module ID. The Diagnostic LED (lower-digit decimal point) comes on when the display is used for diagnostic codes and goes off when the display is used to show the tray ID.

NOTE If a power-on or reset occurs, the Diagnostic LED, the Heartbeat LED (upper-digit decimal point), and all seven segments of both digits come on. The Diagnostic LED remains on until the drive module ID appears.

Table 26 Supported Diagnostic Codes

Diagnostic Code	ESM State	Description
.8, 8., or 88	Suspended	This ESM is being held in reset by another ESM.
L0	Suspended	The ESM types are mismatched.
L2	Suspended	A persistent memory error has occurred.
L3	Suspended	A persistent hardware error has occurred.
L9	Suspended	An over-temperature condition has been detected in either the ESM or the power supply.
LL	Suspended	The midplane SBB VPD EEPROM cannot be accessed.
Ln	Suspended	The ESM CRU is not valid for this drive module.
LP	Suspended	Drive port mapping tables are not found.
H0	Suspended	An ESM Fibre Channel interface failure has occurred.
H1	Suspended	An SFP transceiver speed mismatch (a 2-Gb/s SFP transceiver is installed when the drive module is operating at 4 Gb/s) indicates that an SFP transceiver must be replaced. Look for the SFP transceiver with a blinking amber LED.
H2	Suspended	The ESM configuration is invalid or incomplete, and it operates in a Degraded state.
H3	Suspended	The maximum number of ESM reboot attempts has been exceeded.
H4	Suspended	This ESM cannot communicate with the alternate ESM.
H5	Suspended	A midplane harness failure has been detected in the drive module.
H6	Suspended	An ESM firmware failure has been detected.

Diagnostic Code	ESM State	Description
H8		SFP transceivers are present in currently unsupported ESM slots, either 2A or 2B. Secondary trunking SFP transceiver slots 2A and 2B are not supported. Look for the SFP transceiver with the blinking amber LED, and remove it.
H9		A non-catastrophic hardware failure has occurred. The ESM is operating in a Degraded state.
J0	Suspended	The ESM CRU is incompatible with the drive module firmware.

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