



Dell EqualLogic PS-M4110 Blade Storage Arrays

Hardware Owner's Manual

Version 1.0

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Preface

Dell EqualLogic PS Series arrays optimize resources by automating capacity, performance, and network load balancing. Additionally, PS Series arrays offer all-inclusive array management software and firmware updates. Dell EqualLogic FS Series appliances, combined with PS Series arrays, offer a high performance, high availability, scalable NAS solution.

Audience

The information in this guide is intended for hardware administrators. Administrators are not required to have extensive network or storage system experience, however, it may be helpful to understand:

- Basic networking concepts
- Current network environment
- User disk storage requirements
- RAID configurations
- Disk storage management

Note: This manual provides examples of using PS Series arrays in some common network configurations. However, detailed information about setting up a network is beyond the scope of this manual. For related networking information, visit support.dell.com. You can also contact your support provider as described in this section in *Preface on page vi*.

Related Documentation

For detailed information about FS Series appliances, PS Series arrays, groups, volumes, array software, and host software, log in to the [Documentation page](#) at the customer support site.

Dell Online Services

You can learn about Dell products and services with this procedure:

1. Visit <http://www.dell.com> or the URL specified in any Dell product information.
2. Use the locale menu or click on the link that specifies your country or region.

Dell EqualLogic Storage Solutions

To learn more about Dell EqualLogic products and new releases, visit the Dell EqualLogic Tech Center site: <http://delltechcenter.com/page/EqualLogic>. Here you can also see articles, demos, online discussions, and more details about the benefits of our product family.

Technical Support and Customer Service

Dell support service is available to answer your questions about PS Series SAN arrays and FS Series appliances.

Contacting Dell

If you are a customer in the United States or Canada in need of technical support, call 1-800-945-3355. If you are outside of the United States or Canada, visit [Dell EqualLogic Product Support](#).

If you have an Express Service Code, have it ready. The code helps the Dell automated support telephone system direct your call more efficiently.

Warranty Information

The MODEL array warranty is included in the shipping box. For information about registering a warranty, visit <http://support.dell.com/support/topics/global.aspx/support/warranty>.

Notes, Cautions, and Warnings Symbols



A NOTE symbol indicates important information that helps you make better use of your hardware or software.



A CAUTION symbol indicates potential damage to hardware or loss of data if instructions are not followed.



A WARNING symbol indicates a potential for property damage, personal injury, or death.

1 Getting Started

This chapter includes information about the location and basic operation of the replaceable components in a storage array, the tools and equipment you will need, protecting hardware from electrostatic discharge, and power on/off operations.

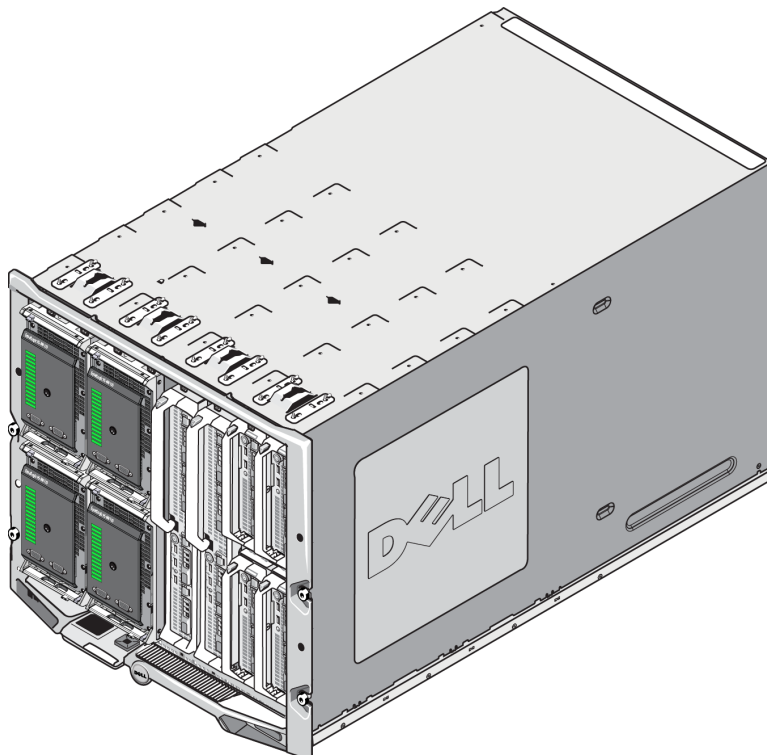
About the PS-M4110 Array

The PS-M4110 is a double-wide, half-height blade storage array with one or two hot-swappable Type13 control modules and up to 14 drives.

The PS-M4110 blade storage array fits inside and operates only when installed in a Dell EqualLogic PowerEdge M1000e Blade Enclosure. It receives power from, and makes all its network connections through the PowerEdge M1000e Blade Enclosure.

A fully-populated Dell PowerEdge M1000e Blade Enclosure is shown in [Figure 1](#).

Figure 1: M1000e Enclosure with PS-M4110 Blade Storage and Servers



This PowerEdge M1000e Blade Enclosure contains four PS-M4110 blade storage arrays, two single-wide full-height blade servers, and four single-wide half-height blade servers.

Front Panel Features and Indicators

The front of a PS-M4110 blade storage array is shown in [Figure 2](#).

- [Table 1](#) describes the features of the front panel.
- [Table 2](#) describes the drive LED indicators.
- [Table 3](#) describes the warnings and critical conditions that are indicated by the Array Status LED.

Figure 2: Front Panel Features and Indicators

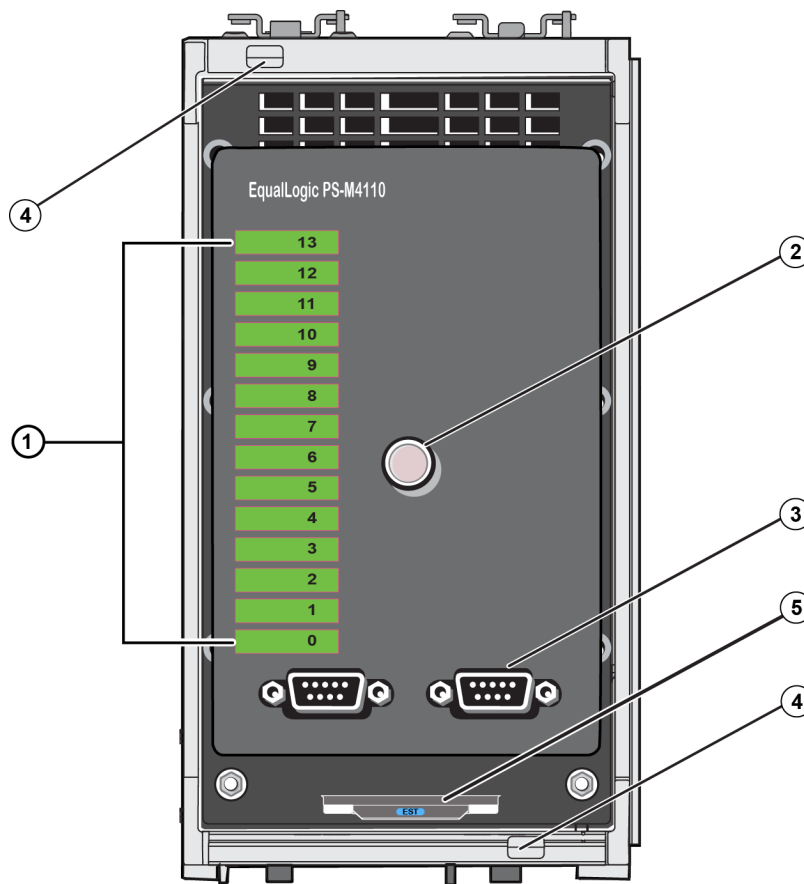


Table 1: Front Panel Feature Descriptions

Item	Indicator	Description
1	Drive Status LEDs	Each drive slot is represented by a green element and an amber element on the front panel. See Table 2 for details.
2	Array Status LED	The array status LED has these states:

Item	Indicator	Description
		<ul style="list-style-type: none"> • OFF—Array is in the OFF or Standby state. • Flashing amber — Array warning condition. See Table 3. • Steady amber — Array critical condition. See Table 3. • Steady blue — Normal operating state. • Flashing blue —System ID engaged.
3	Serial ports	<p>Enable you to connect a computer directly to the array.</p> <ul style="list-style-type: none"> • The serial port for control module 0 (CM0) is on the left. • The serial port for control module 1 (CM1) is on the right. <p>The serial ports are set to 9600 baud, 8 data bits, 1 stop bit, no parity, and no flow control.</p>
4	Array handle release buttons (top and bottom)	Unlocks the array enclosure's handle and use the handle to remove the array enclosure from the chassis.
5	Express Service Tag	Pull this tag to see the unit's Dell Express Service Tag number. This number is usually required if you need technical support.

Table 2: Drive LED Descriptions¹

Green Element	Amber Element	Description
OFF	OFF	Drive slot is empty
ON	OFF	One of these statuses: <ul style="list-style-type: none"> • drive is online • drive is ready • drive is a spare • foreign drive • drive is spun down for removal • new drive is present but not yet configured into the RAID set
Flashing	OFF	Drive slot identification at user's request.
OFF	ON	One of these statuses: <ul style="list-style-type: none"> • drive has failed • drive is unsupported

Table 3: Warning and Critical Conditions

Condition Level	Possible Reasons
Warning	<ul style="list-style-type: none"> • Non-critical hardware component failure • Control module removed • Cache syncing • High or low temperature

¹All timing values are +/- 25 msec.

Condition Level	Possible Reasons
	<ul style="list-style-type: none"> • RAID set fault • RAID set lost blocks • Internal communication failure • No progress with replication • Spare drive too small • Time of day clock battery low • Incorrect physical RAM size • More spare drives than expected • Spare drive is of wrong type • Solid-state drive added to RAID set
Critical	<ul style="list-style-type: none"> • Critical hardware component failure • High or low ambient temperature • RAID set double fault • RAID lost cache • RAID set lost-block table full • RAID orphan cache • Multiple RAID sets present • Incompatible control module • Enclosure management link failure • Enclosure open too long • Degraded parity • C2F power module failure • RAID set unresolved • Fabric mismatch • No communications with CMC

Shutting Down and Restarting the Array

You can shut down a PS Series array using the Group Manager GUI or the CLI over a telnet or serial connection, but this does not turn off power to the array or the enclosure.

A PS Series array includes hot-swappable drives and control modules (in a dual redundant module array). You can remove a faulty component without affecting operation if a functioning component is available. Otherwise, it is recommended that you cleanly shut down the array and turn power OFF by partially or fully removing the array before removing a component.

Note: Be aware that the power is still ON while the array is in the chassis.

Note: When an array is shut down, any volumes with data on the array are set offline until the array is restarted. This may affect initiators that are connected to the volumes.

Use Group Manager

In the Group Manager GUI, select the appropriate member name, click the Maintenance tab, and click Shut down.

Use telnet or a Serial Connection

1. Establish communications with the array. Either:

- Use telnet or SSH to connect to a functioning IP address assigned to a network interface on the array. Do not connect to the group IP address.

or

- Use the serial cable shipped with the array to connect either serial port on the front of the array to a console or a computer running a terminal emulator.

Make sure the serial line uses these parameters:

- 9600 baud
- Eight data bits
- One stop bit
- No parity
- No flow control

2. Log in to an account with read/write access, such as the `grpadmin` account.

3. Execute the `shutdown` command:

```
login: grpadmin
Password:
Welcome to Group Manager
Copyright 2001-2012 Dell Inc.
group1> shutdown
```

- If you are using a network connection, the session will be disconnected before the array is fully shut down.
- If you are using a serial connection to shut down an array, it is safe to partially or fully remove the array in order to disconnect power when the “press any key” message is displayed. (Pressing any key will restart both control modules.)

After performing array maintenance, you can restore power to the array.

When the array restart completes, the member and volumes will be set online.

Protecting Hardware

Protect the PS-M4110 blade storage array from electrostatic discharge at all times.

- When handling array hardware, make sure you use an electrostatic wrist strap or a similar form of protection. Connect the strap securely to yourself (not clothes) and securely to ground.
- Examples of an appropriate ground are a properly-grounded ESD mat or the metal frame of a grounded piece of equipment.
- If transporting the array, use the static-protective packaging that the array was shipped in, if possible.

Array Networking Considerations

This section provides requirements and recommendations for PS-M4110 array networking in the M1000e enclosure.

The PS-M4110 array uses a single 10Gb/s Ethernet port (Ethernet 0 (iSCSI)) for communication on one of two redundant fabrics, A or B (the default fabric).

- Fabric A is a redundant Ethernet fabric that supports IO module slots A1 and A2. The PS-M4110 requires 10Gb/s Ethernet IO modules in A1 and A2. The M1000e must have a Version 1.1 midplane to support 10Gb/s modules on Fabric A.

Note: If the M1000e has a Version 1.0 midplane, 10 Gb/s Ethernet IO modules are not supported by Fabric A and the PS-M4110 will not be able to connect.

- Fabric B is a redundant Ethernet fabric supporting IO module slots B1 and B2 at 10Gb/s with a 10GBASE-KR IO module.

Optionally, Ethernet port 1 on the PS-M4110 array can be set up as a management port and be accessed through the CMC. See *Setting up a Dedicated Management Port* in the *Dell EqualLogic PS-M4110 Installation Guide*.

Networking Information Resources

- Details about network requirements and recommendations are provided in [Network Requirements on page 7](#), [Network Recommendations on page 9](#) and [Optional Considerations on page 10](#).
- General network, and network configuration of the M1000e is beyond the scope of this manual. Refer to the *Dell PowerEdge M1000e Enclosure Owner's Manual* and *Dell PowerEdge Configuration Guide* for this information. Also, refer to the associated Dell IO module documentation.
- Additional documentation can be accessed on the Dell support site (support.dell.com). See the [Preface on page vi](#) for information about accessing the Dell support site.

- You can also contact your technical support provider for help and information, as described in the [Preface on page vi](#).

Network Requirements

Switched 10Gb Ethernet Network

When the PS-M4110 is installed in a M1000e chassis that has the proper M-Series IO Modules (KR-based blade network switches) or pass-throughs installed, all network connections are 10GbE. The IO modules on the fabric to which the PS-M4110 is connected must be KR-based 10GbE.

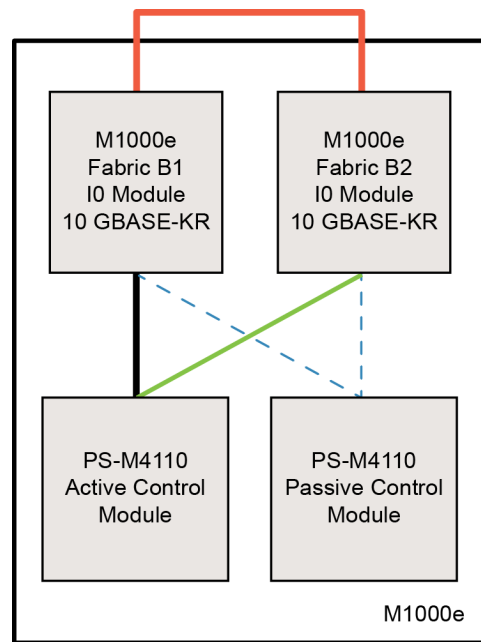
Interconnect All SAN Switches

For increased availability, the Ethernet ports on both PS-M4110 control modules are automatically connected to each redundant M1000e IO module (IOM) of the configured fabric. (Assuming that both IO modules are installed.) One port is active and one port is passive.

For example, if a PS-M4110 is configured for Fabric B, and both the B1 IOM and B2 IOM are installed, the Ethernet ports from each control module are connected to both B1 and B2 IOMs. This provides a total of four potential Ethernet paths. However, only one Ethernet path is active at any given time.

In the above example, if the B1 IO module fails, both active and passive PS-M4110 ports will automatically failover to the B2 IO module.

See [Figure 3](#) for an illustration of the above example, showing how the PS-M4110 control modules and M1000e fabric IOMs are connected.

Figure 3: Example of Default Fabric B Network Paths

- Active 10G path
- Network path failover
- - - Passive control module standby network paths
- External stack or LAG connection

Stack Switches Together

When using a PS-M4110 inside an M1000e enclosure, the IO modules must be interconnected (stacked or LAGged together).

For example, if fabric B is configured, the B1 and B2 IOMs must be stacked or LAGged together. The redundant fabric IO modules must be connected using inter-switch links (stack interfaces or link aggregation groups (LAG)). The links must have sufficient bandwidth to handle the iSCSI traffic.

For ease of management, Dell recommends using stacking configurations wherever possible. Use the Equal-Logic Group Manager GUI or CLI to assign an IP address and netmask to each interface.

Figure 3 shows an example of stacking B1 and B2 IO modules.

Configure Access to Group IP Address

If a PS-M4110 connects with storage arrays that are outside of the M1000e chassis (external arrays), the network must be configured so that the PS-M4110 has access to the group IP address used by the external arrays. All of the arrays in the group must be in the same (layer 3) subnet.

Network Recommendations

Provide Redundant Network Paths Between Hosts and Arrays

Use a multipathing solution to make sure that no single point of failure exists between hosts and arrays.

Dell recommends using the Dell EqualLogic Host Integration Tools (HIT) solution, available for Microsoft, VMware and Linux platforms.

Provide Adequately-Sized Reliable Network Link (for replication)

When replicating with groups outside of the M1000e chassis, for effective and predictable replication, make sure that the network link between the primary and secondary groups is reliable and provides sufficient bandwidth for copying the required amount of data within the required time.

Disable STP Functionality on Switch Ports that Connect End Nodes

If possible, do not use Spanning-Tree Protocol (STP) on switch ports that connect directly to iSCSI end nodes (iSCSI initiators or array network interfaces).

However, if you must use STP or RSTP (preferable to STP), you should enable the port settings (available on some switches) that let the port transition faster into STP forwarding state upon link-up (i.e. portfast). This functionality can reduce network interruptions that occur when devices restart, and it should only be enabled on switch ports that connect end nodes.

Some iSCSI BOOT Initiators may not startup reliably when STP is enabled, due to the convergence time. For further information, refer to the associated specifications for your NIC and Switch.

You can use Spanning-Tree for a single-cable connection between switches, and you can use Link Aggregation Groups (LAG) (or port-channels) for multi-cable connections between switches.

Enable Flow Control on Switches and NICs

Enable Flow Control on each switch port and NIC that handles iSCSI traffic. PS Series arrays will respond correctly to Flow Control.

Disable Unicast Storm Control on Switches

Disable unicast storm control on each switch that handles iSCSI traffic if the switch provides this feature. However, the use of broadcast and multicast storm control is encouraged on switches.

Enable Jumbo Frames

Enable Jumbo Frames on each switch and each NIC that handles iSCSI traffic.

PS series arrays support Jumbo Frames, which is enabled by default (MTU 9000). Enable Jumbo Frames on each switch and iSCSI initiator (NIC) to take advantage of this feature. For further information, refer to the associated documentation for your switch and NIC.

Optional Considerations

Management Network

Optionally, Ethernet 1 on the PS-M4110 array can be set up for a management port and be accessed through the CMC to keep management traffic separate from iSCSI traffic.


You can do this by using the Dell Chassis Management Console command line interface (CLI), or the EqualLogic Group Manager GUI or CLI. See *Setting up a Dedicated Management Port* in the *Dell EqualLogic PS-M4110 Installation Guide*.

2 Handling the Array

This section provides information about handling the PS-M4110 array. It describes how to open, remove, and insert the array inner drawer that holds the array drives and control modules. It also describes how to remove and insert the entire array from the M1000e enclosure.

About Handling the Array

Be careful when handling the PS-M4110 blade storage array. The PS-M4110 array has an outer shell that houses an inner drawer (containing the array drives and control modules). The inner drawer can accidentally slide out of the outer shell if it is not closed.

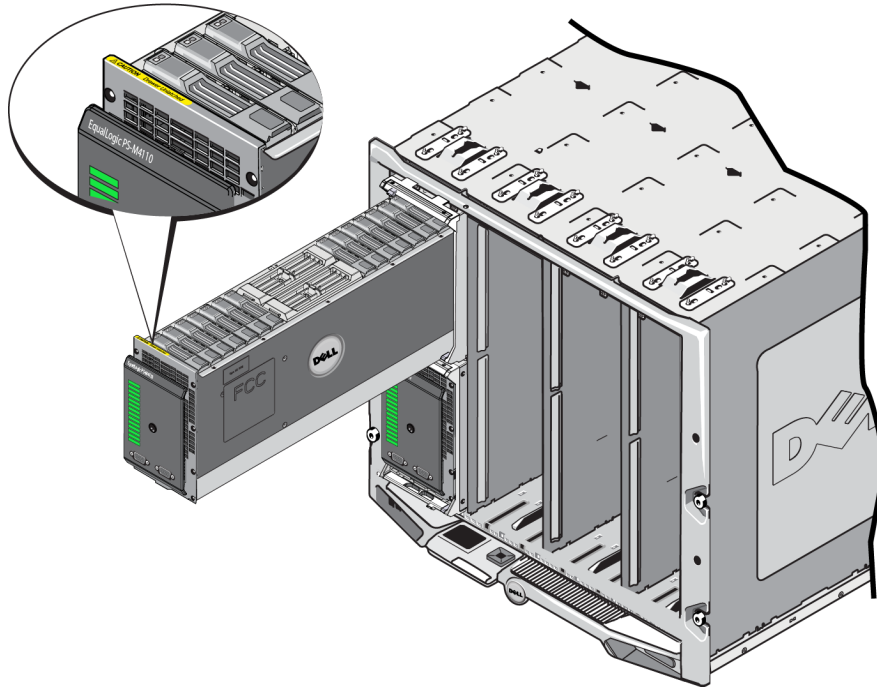
 **Warning:** If the inner drawer slides open unexpectedly, the sudden weight shift of the heavy inner drawer could cause the array to fall off the surface it is resting on, or to be dropped by a person holding it. Damage to the array, or injury to yourself or nearby people, could result.

Before handling a PS-M4110 blade storage array, always check that the array inner drawer is securely closed.

A warning symbol and message that indicates that the drawer is open is printed on the front top edge of the inner drawer. This message is visible only if the inner drawer is open. Check to make sure that this message is not visible before handling the array. See [Figure 4](#).

Figure 4: Drawer Open Indication

CAUTION Drawer Unlatched



Opening the Array Drawer

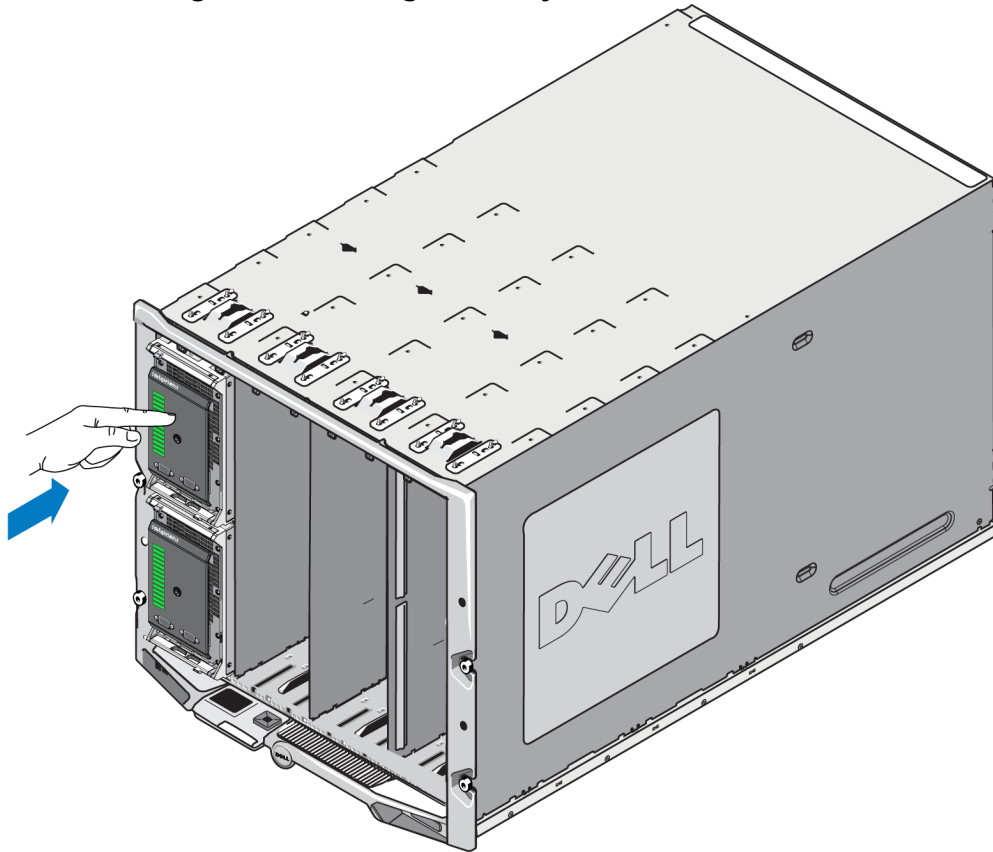
You must open the array inner drawer to access the drives and control modules. It is designed to open fully to provide complete access to all the drives and control modules.

Note: If you need to remove the array inner drawer completely from its shell when it is out of the M1000 enclosure, see [Releasing the Array Inner Drawer Safety Latch on page 25](#).

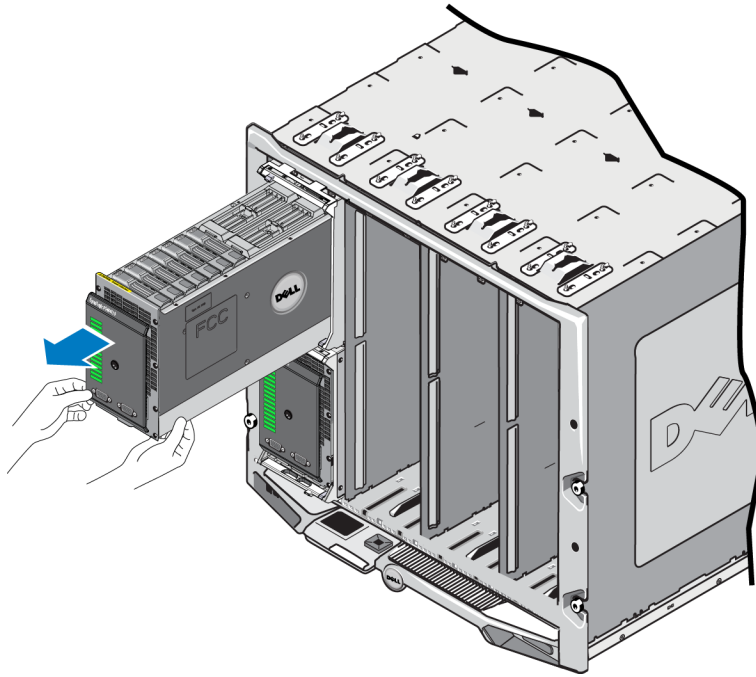
Caution: The front panel is not designed as a handle. It can break if treated roughly. When opening the array inner drawer, do not pull on the front panel. Grip and pull the drawer by its top, bottom, or sides.

To open the array inner drawer:

1. Push firmly on the array's front panel, releasing it quickly. See [Figure 5](#). This press-and-release motion releases the array inner drawer from its enclosure. It should spring open enough to provide access to grip the sides or bottom with your hands.

Figure 5: Pressing the Array Drawer to Unlatch It

2. Grip the side or bottom edges of the array drawer (not the plastic front panel) and slowly pull the drawer out, as shown in [Figure 6](#).

Figure 6: Opening the Array Drawer

3. Continue to pull the drawer open, carefully controlling the speed at which it opens, until you can reach the drive or control module you need to access.

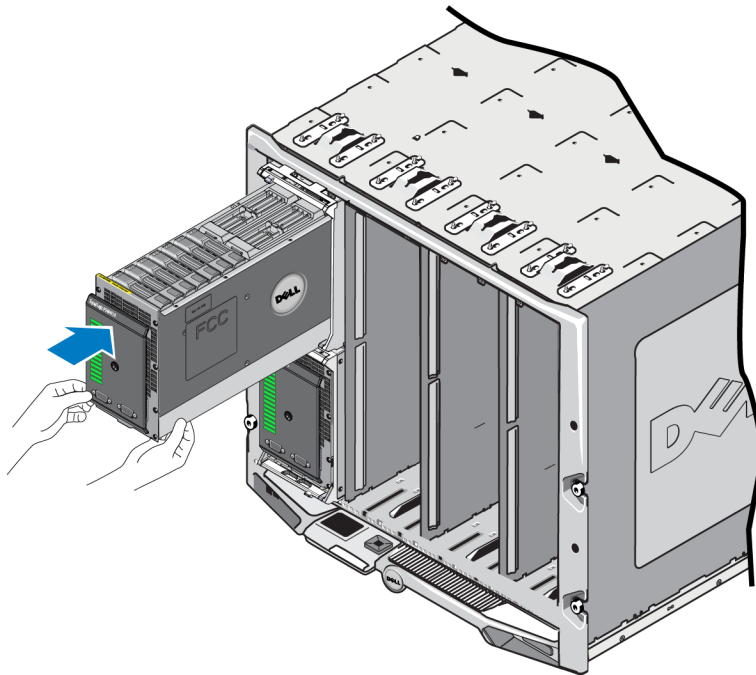
Caution: Be careful when opening the array drawer -- it is heavy. Open the drawer slowly, so that it does not have a lot of momentum as it slides open. If the drawer slides out too quickly, it could damage its housing. It could also break free of its housing and fall on the floor, causing damage to array and injury to nearby people.

Closing the Array Drawer

For proper operation, the array inner drawer must be completely closed and secured within its housing. You can open the drawer briefly to replace a failed component, but do not leave it open for long periods of time — leaving it open disrupts the flow of air that cools the drives and could lead to overheating.

When you have finished working on the array components within the array drawer, close it immediately. To close the array drawer:

1. Press gently on the front panel of the array, pushing the drawer all the way into its enclosure. See [Figure 7](#).

Figure 7: Pressing Array Inner Drawer Closed

2. Continue pressing the front panel until you hear and feel the drawer click into place.
3. When you think the array drawer is fully closed, *gently* pull on the sides of the front panel to make sure that the drawer is secure within the enclosure.

Caution: The front panel is not a handle; do not use it to lift the array.

Removing the Array from the M1000e Chassis

You can completely remove the entire PS-M4110 storage blade array (array drawer and its housing) from the M1000e enclosure when necessary. For example, to move equipment in your lab, to move the array to a different M1000e enclosure, or to replace the entire array if it fails.

Each PS-M4110 blade array has two release latches. Only one release latch is engaged, depending on whether the array enclosure is installed in an upper or lower slot in the enclosure:

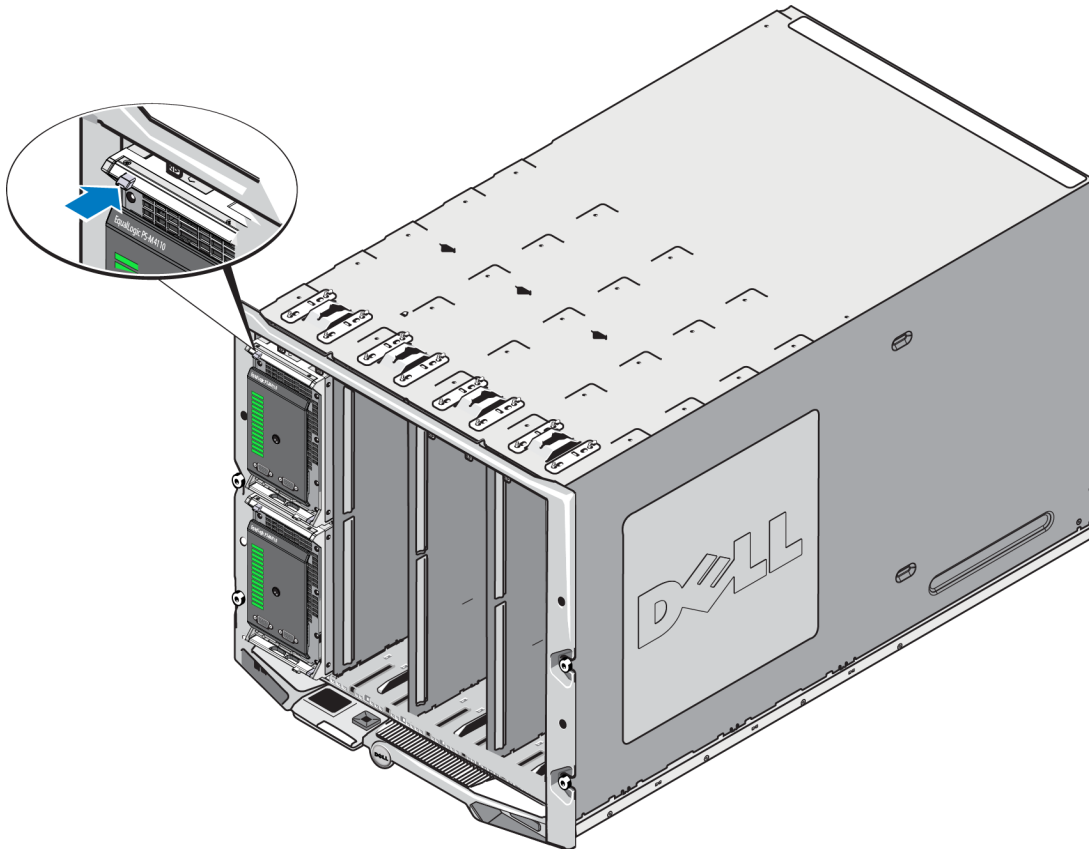
- The **release button above the front panel** is used to remove the array from the **upper slots** in the M1000e enclosure. Shown in [Figure 8](#).
- The **release button below the front panel** is used to remove the array from the **lower slots** in the M1000e enclosure. Shown in [Figure 10](#).

Caution: Make sure the array drawer is fully closed within its housing so that it does not slide open while removing the blade array from the M1000e enclosure. The drawer is very heavy and can slide out quickly, unbalancing the array and increasing the risk of dropping the array, of damaging the array, and injury to nearby people.

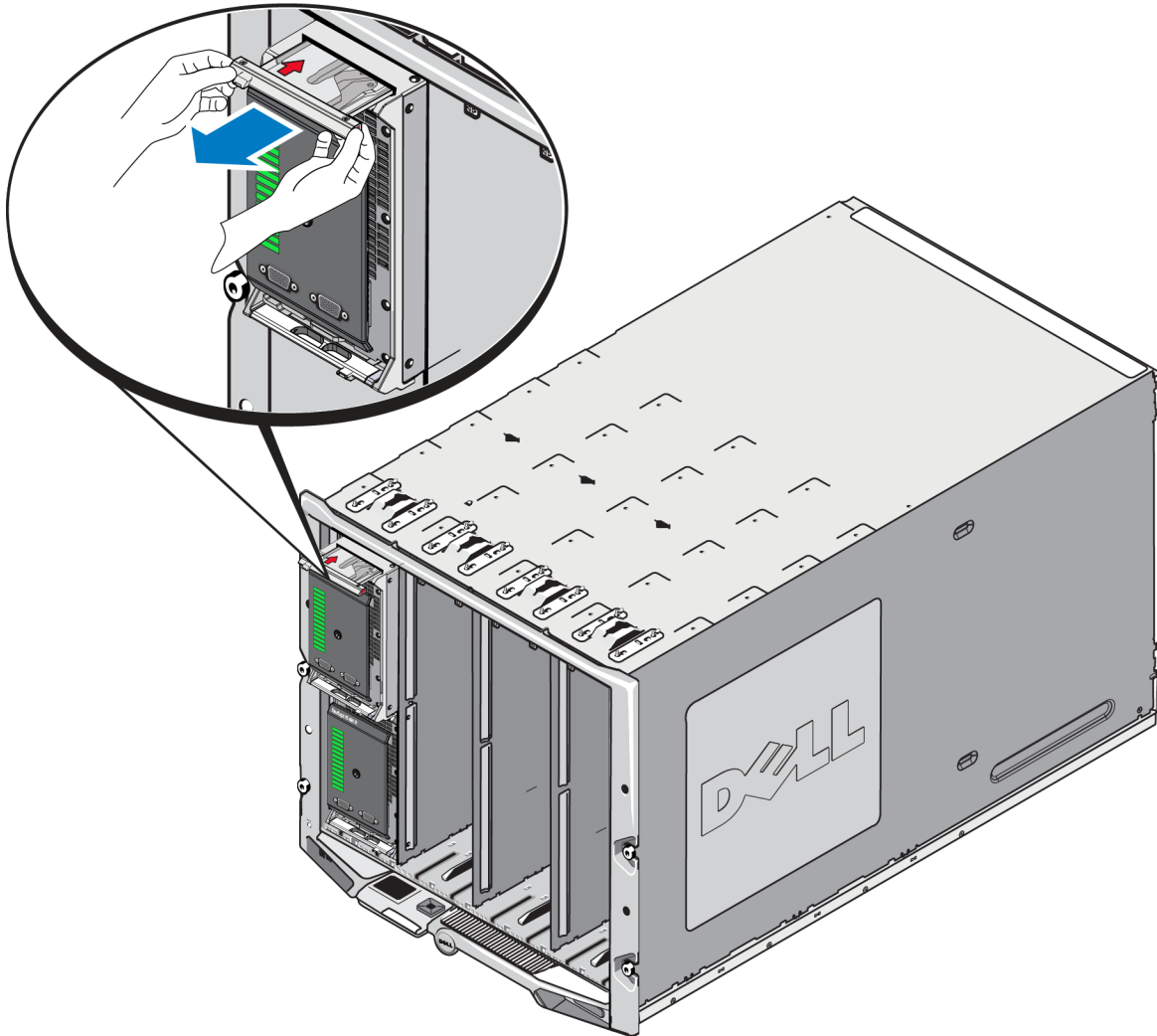
Removing the Blade Drawer From the Upper Chassis

1. Push the array handle's release button, located above the front panel of the array. See [Figure 8](#). This releases the array handle, which you use to pull open the array drawer. The handle should spring open far enough for you to grip it with your hand.

Figure 8: Array Upper Release Button



2. Pull the array handle outward to begin sliding the array out of the M1000e enclosure. See [Figure 9](#).

Figure 9: Using Array Handle to Remove the Array

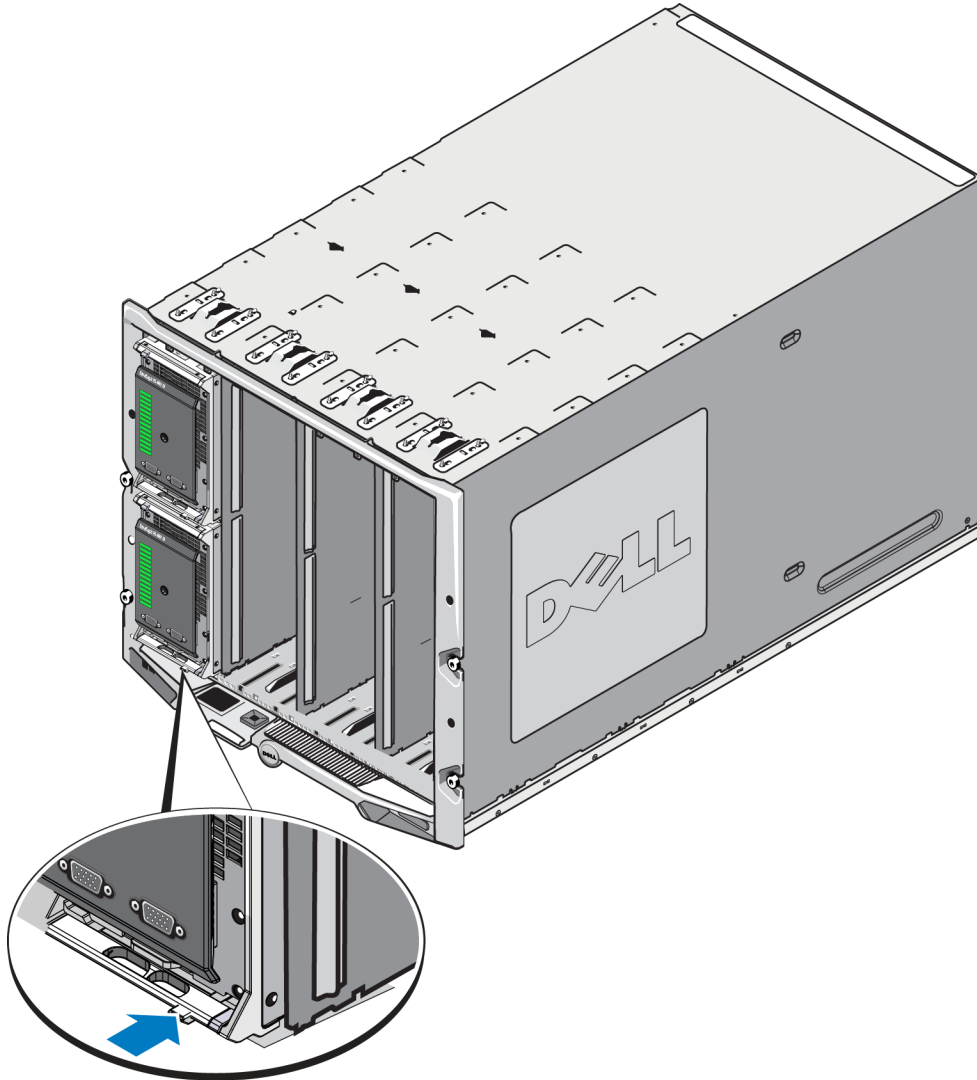
3. Support the weight of the array with one hand underneath it while you use its handle to pull the array out of the M1000e enclosure. Pull the array out slowly and carefully. When the array enclosure is far enough out of the chassis, use both hands to support it and remove it from the chassis.

Caution: The array is heavy. Be sure to support it with both hands when you remove it from the M1000e enclosure. After the array is out of the enclosure, place it on a sturdy, flat surface.

Removing the Array Drawer from a Lower Slot

1. Push the array handle's release button, just below the front panel of the array. See [Figure 10](#). This releases the array handle, which you use to pull open the array drawer. The handle should spring open far enough for you to grip it with your hand.

Figure 10: Array Lower Release Button



2. Pull the array handle outward, to begin sliding the array out of the M1000e enclosure. See [Figure 9](#).

Caution: Be careful not to pinch your fingers when removing the array from the lower slots.

3. Support the weight of the array with one hand underneath it while you use its handle to pull the array out of the M1000e enclosure. Pull the array out slowly and carefully. When the array enclosure is far enough out of the chassis, use both hands to support it and remove it from the chassis.

Caution: The array is heavy. Be sure to support it with both hands when you remove it from the enclosure. After the array is out of the enclosure, place it on a sturdy, flat surface.

Inserting the Array into the M1000e Chassis

The PS-M4110 storage blade array can operate only when properly installed in a Dell PowerEdge M1000e Blade Enclosure. The M1000e chassis provides power and network connectivity for the PS-M4110 array.

The PowerEdge M1000e Blade Enclosure has 16 single-wide half-height slots.

The PS-M4110 storage blade array is double-wide and half-height.

You can install up to four PS-M4110 blade arrays (shown in [Figure 11](#)) in a PowerEdge M1000e Blade Enclosure (shown in [Figure 12](#)). Arrays can be installed in any available top or bottom slots in the M1000e chassis.

Figure 11: PS-M4110 Blade Storage Array

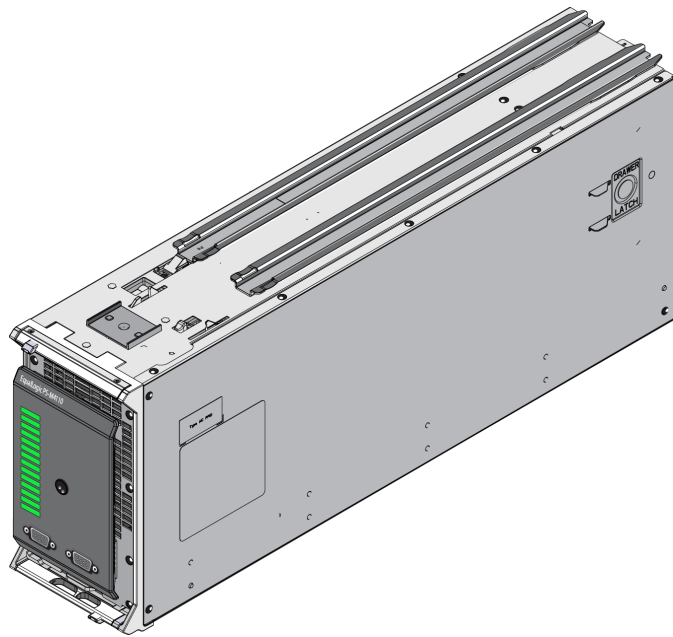
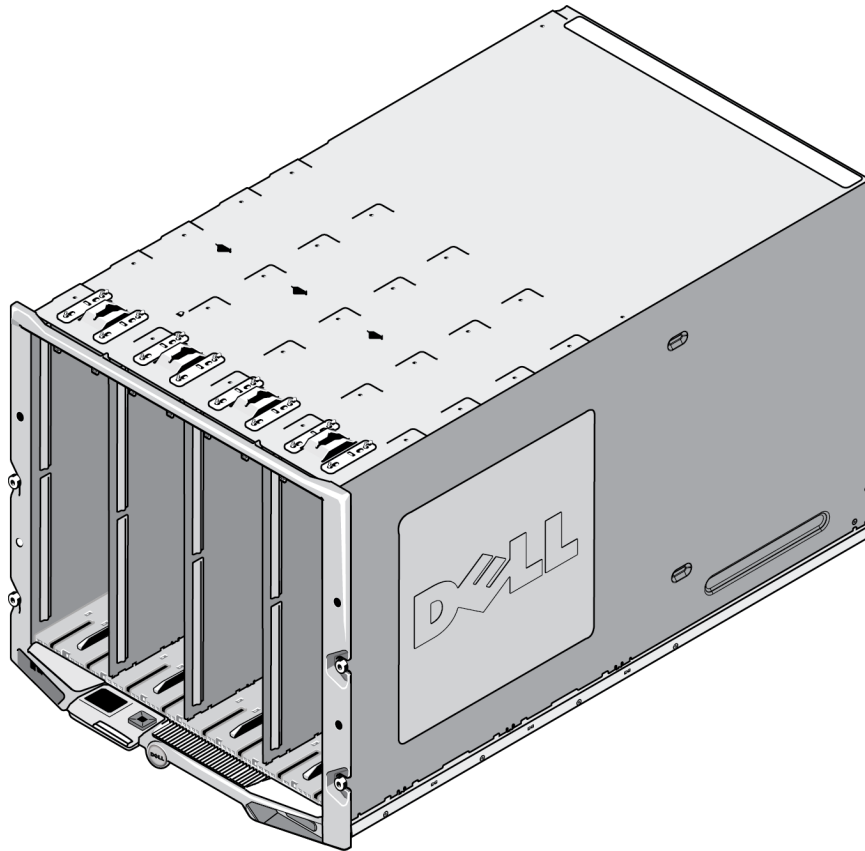


Figure 12: PowerEdge M1000e Chassis

Before installing the PS-M4110 in an M1000e chassis, note:

- You should wear an electrostatic strap to prevent electrostatic damage. See [Protecting Hardware on page 6](#).
- When shipped by itself, the PS-M4110 includes a retaining clip on the front to prevent the array drawer from sliding out of the array. It also includes protective plastic covers on the back to protect the rear connectors from damage. You must remove the retaining clip and protective covers before installing the array in the M1000e chassis. Optionally, you can also remove the protective caps covering the serial ports on the front. Save the clip and protective covers for future use.

Install the Array in the M1000e

To install the PS-M4110 blade array in an M1000e chassis:

1. Remove the retaining clip from the front of the array and the plastic protective covers from the back of the array.
2. Lift the PS-M4110 array to align it with either a top or bottom slot in the enclosure, supporting the array with both hands.

If installing the array into a top slot in the M1000e chassis

- a. Align the guide rails on the top of the PS-M4110 array with the guide rails at the top of the inside of M1000e chassis, as shown in [Figure 13](#).
- b. Begin to slide the array into the enclosure slot, making sure that the array's guide rails insert into the guide rails within the M1000e chassis, as shown in [Figure 13](#). When properly inserted, the array should hang from the enclosure guide rails and slide smoothly into the enclosure.

If installing the array into a bottom slot in the M1000e chassis

- a. Align the guide rails on the bottom of the PS-M4110 array with the guide rails at the bottom-inside of M1000e enclosure, as shown in [Figure 14](#).
- b. Begin to slide the array into the M1000e enclosure slot, making sure that the array's guide rails rest on top of the guide rails within the M1000e enclosure, as shown in [Figure 14](#). Be sure to support the front of the array as you slide it into the enclosure. When properly inserted, the array should ride on top of the chassis rails and slide smoothly into the slot.

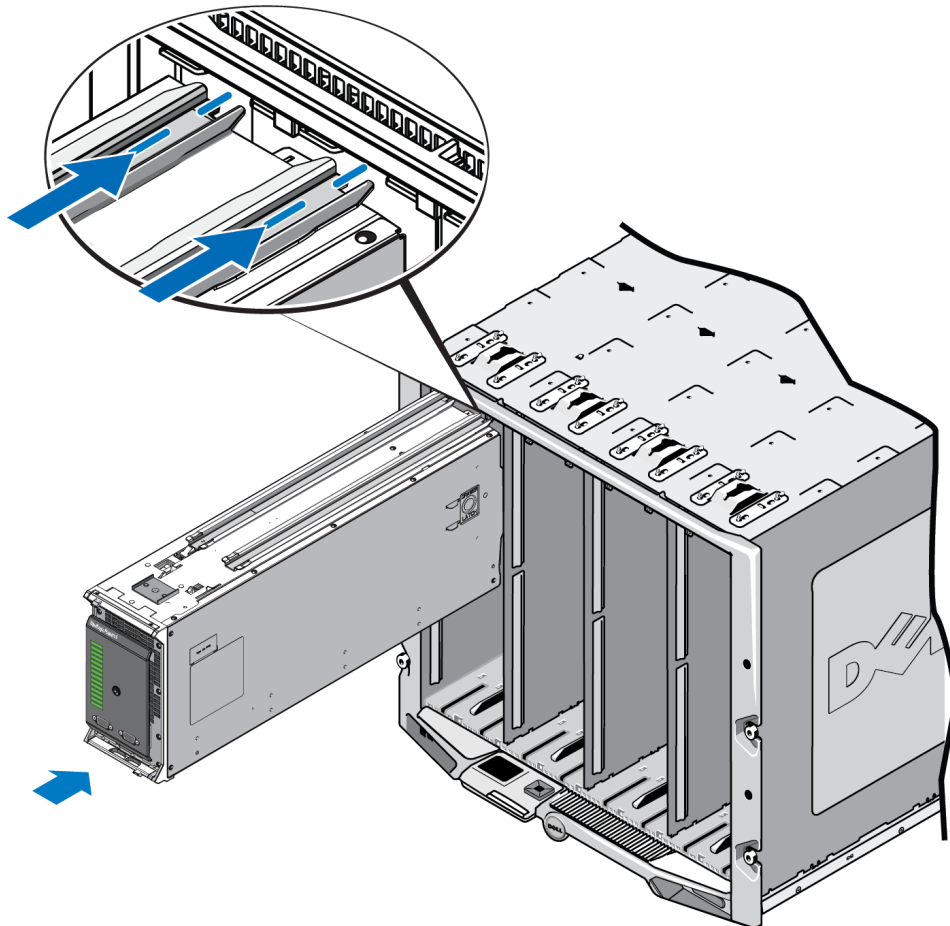
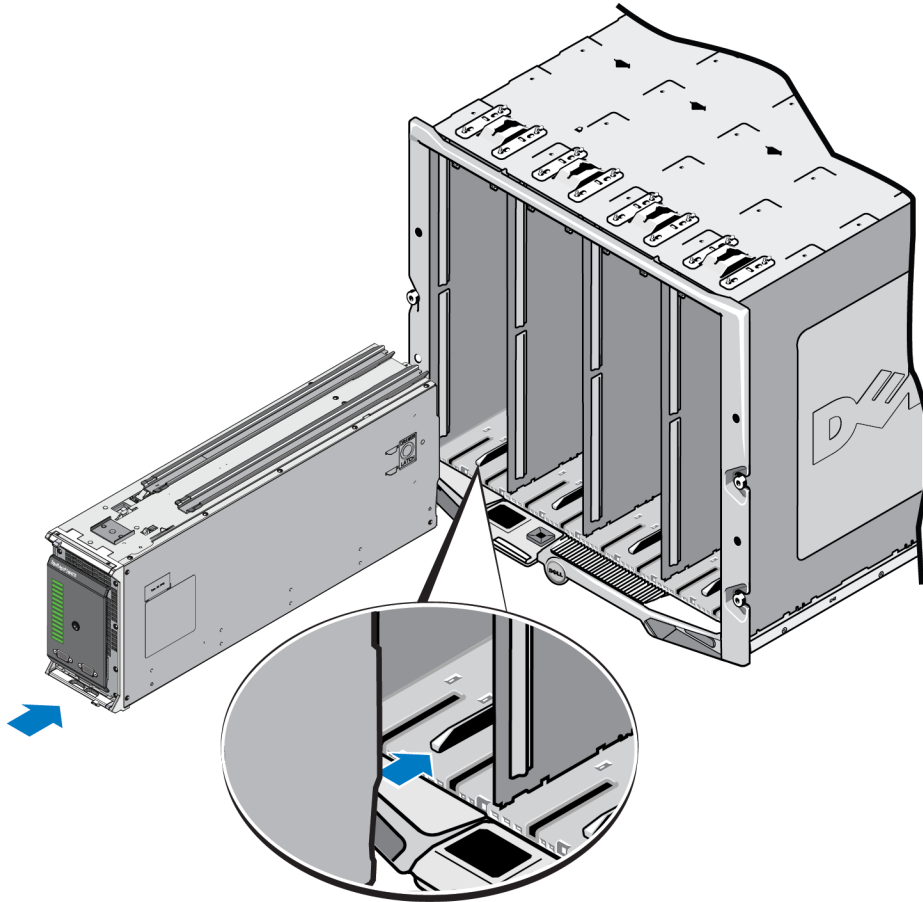
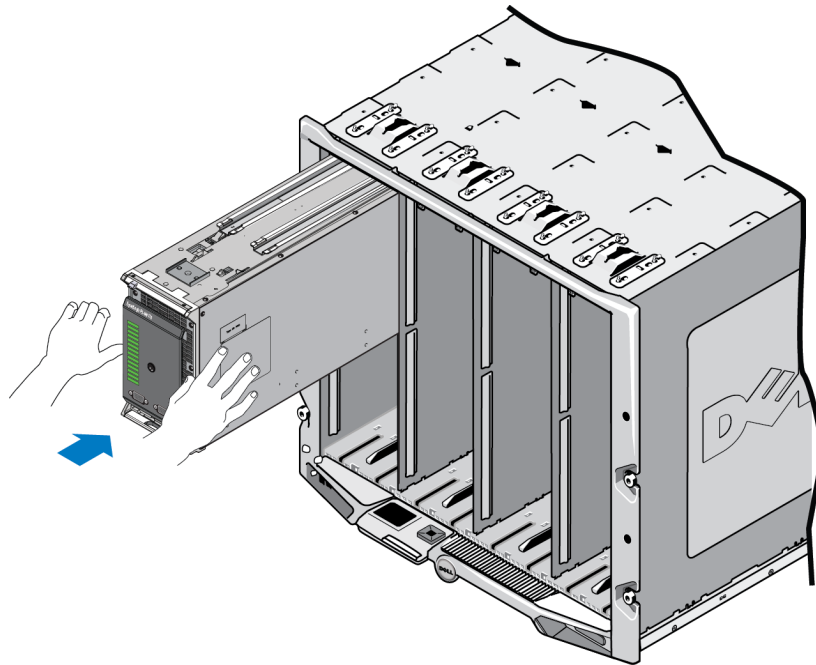
Figure 13: Installing the Array in a Top Slot

Figure 14: Installing the Array in a Bottom Slot

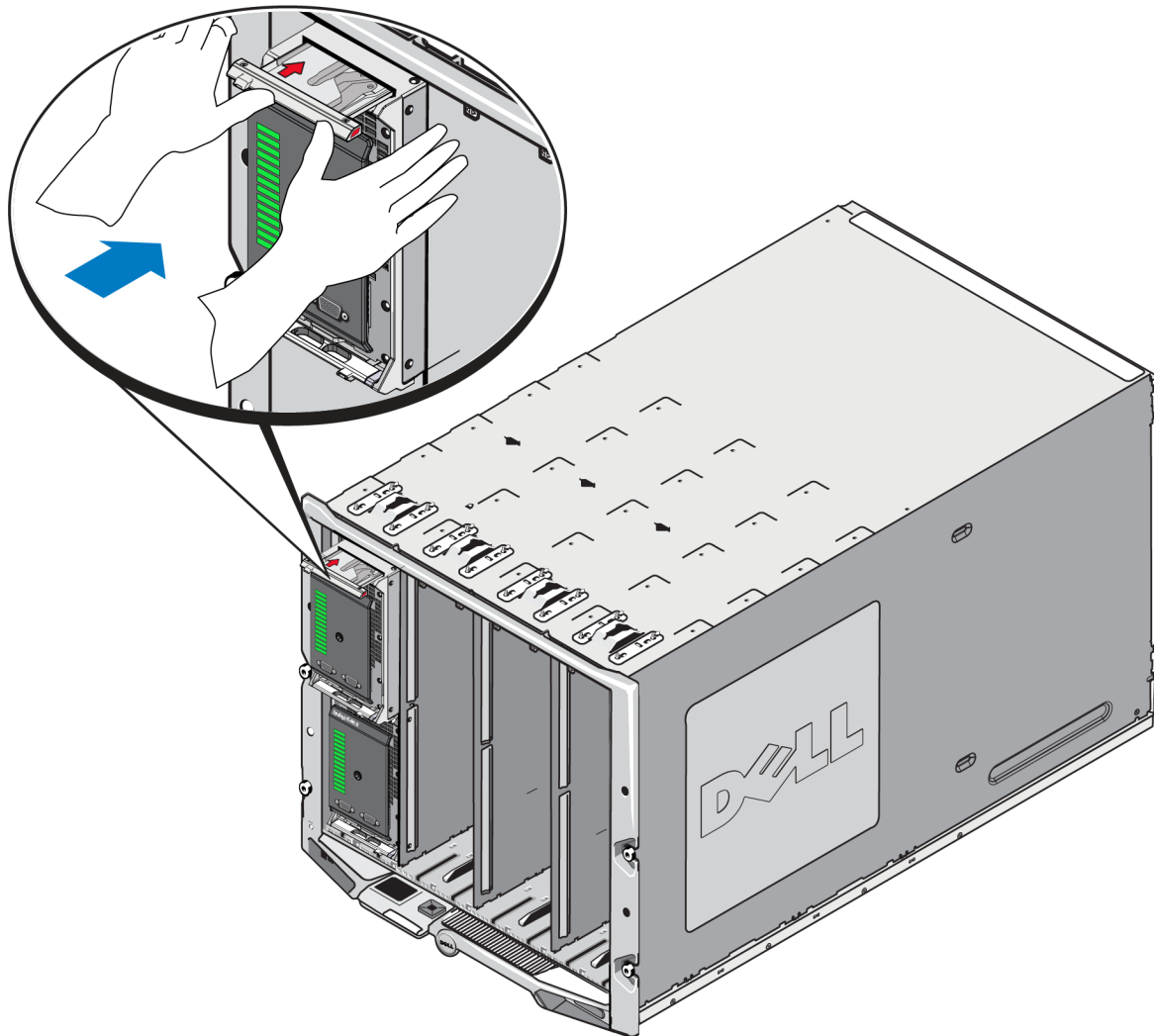
3. Push the PS-M4110 array into the slot until the array handle opens. To push, place your thumbs on the front sides of the array, on the array's metal housing, as shown in [Figure 15](#).
 - Do not push on the plastic front of the array drawer.
 - Stop pushing when the array handle slides open.
 - The handle will open towards you when the array is inserted most of the way into the slot.



Note: If installing the array into a top slot, the top array handle opens; in a bottom slot, the bottom array handle opens.

Figure 15: Pushing the Array into the Slot

4. Using the opened array handle, push the array the rest of the way into the slot. To push, place your thumbs on the array handle as shown in [Figure 16](#). Continue pushing on the array handle until the array slides all the way into place in the slot. The array handle will slide back into place within the array drawer, and you will feel and hear the array click securely into place within the slot.

Figure 16: Seating the Array in the Slot

Verify Proper Installation

After you have installed the PS-M4110 into the M1000e chassis, you can verify proper installation by turning power ON to the M1000e chassis.

- If the PS-M4110 is properly installed, the Blade System Status LED on the unit's front panel will light up shortly after the M1000e is powered on. See [Figure 2](#) and [Table 2](#) to identify the correct LED.
- If the M1000e is connected to power and turned ON when the PS-M4110 is inserted, the PS-M4110 will power up as soon as it is fully seated in the M1000e, but the array's Blade System Status front panel LED may not light up immediately.

Releasing the Array Inner Drawer Safety Latch

It may be necessary to open the PS-M4110 array's inner drawer (containing the drives and control modules) when it is removed from the M1000e enclosure.

When the PS-M4110 is out of the M1000 enclosure, the array's drawer cannot be opened unless its safety locking mechanism is released.

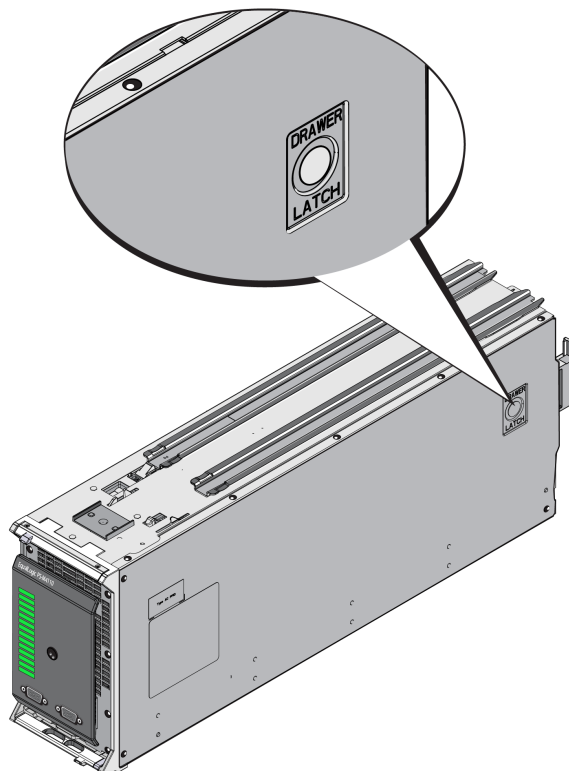
There is a release button located on the side of the PS-M4110 array that releases the latch that secures the array's drawer to its outer housing. This prevents the array's drawer from opening accidentally during handling when outside of the M1000e enclosure.

To open the array drawer, press and hold the release button to manually unlock the safety latch.

The location of the release button is shown in [Figure 17](#).

△ Caution: The release button should only be used when the PS-M4110 array is on a level surface that is large enough to support the array drawer when it is fully extended from the array.

Figure 17: Array Inner Drawer Release Button



3 Maintaining Drives

This section describes the drives used in the PS-M4110 blade storage array. It includes information about how to identify failed drives, how to interpret drive LEDs, array behavior when a drive fails, drive handling requirements, and how to install and remove drives.

About Drives

The PS-M4110 blade storage array drives are located within the array drawer. They connect to the array, and to the M1000e, through a bottomplane in the drawer.

The array drives are hot-swappable. You can replace a failed drive while the array remains running.

Drives are supplied in a carrier that is keyed to fit into specific array models and cannot be installed in other Dell arrays or arrays that are not supplied by Dell Inc.

All the procedures for replacing, handling, and identifying a failed drive are the same for a PS-M4110 as they are for any other Dell EqualLogicPS Series array.

About Mixed-Drive Arrays (Rotational and Solid State)

The PS-M4110 can support a combination of five solid state drives (SSDs) and 9 rotational drives (HDs) in the array. The proportion of SSDs to HDs cannot be changed.

The SSDs occupy slots 0-4 by default, but may be used in any drive slot.

Identifying Failed Drives

The drives are numbered 0 through 13 from the front of the array to back.

A drive failure is indicated by:

- LEDs on the drive. See [Interpreting Drive LEDs on page 28](#).
- LEDs on the front panel of the array. See [Chapter , Interpreting Control Module LEDs on page 37](#).
- A message on the console, in the event log, or in the Group Manager Alarms panel.

- Indications in the Group Manager Member Disks window
- The output of the `member select show disks` command in the CLI.

Interpreting Drive LEDs

The LEDs on a drive are shown in [Figure 18](#). Drive LED states are described in [Table 4](#).

Figure 18: Drive LEDs

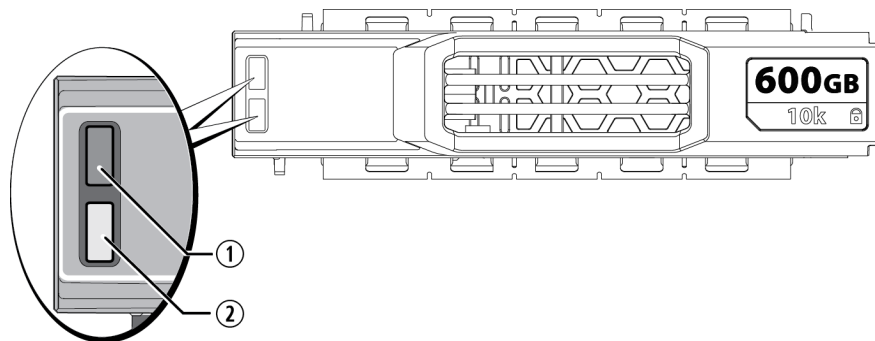


Table 4: Drive LED States

Callout	LED Name	Description
1	ACT (Drive activity)	Blinking green: Drive is busy Steady green: No drive activity Off: No power to drive
2	STAT (Power state)	Green: Drive OK Amber: Drive failed Off: No power to drive

Array Behavior When a Drive Fails

How an array handles a drive failure depends on whether a spare drive is available and whether the RAID set containing the failed drive is degraded.

For example:

- If a spare drive is available, the array automatically uses it to replace the failed drive. Performance is normal after reconstruction completes.
- If a spare drive is not available, the RAID set will become degraded (except a RAID 6 set). Performance may be impaired. A RAID 6 set can survive two simultaneous drive failures.
- If a spare drive is not available, and the failed drive is in a RAID set that is already degraded, data may be lost and must be recovered from a backup.

If a drive fails, replace it immediately. Do not re-install it in the array.

Drive Handling Requirements

When handling PS-M4110 drives, follow these requirements and best-practices:

- **Store drives properly.** Store replacement drives in the packaging in which they were shipped. Do not stack drives or place anything on top of a drive.
- **Protect drives from electrostatic discharge.** Wear an electrostatic wrist strap when handling a drive, unless it is protected from electrostatic discharge. See [Protecting Hardware on page 6](#).
- **Handle drives carefully.** Hold a drive only by the plastic part of the carrier or the handle. Do not drop or jolt a drive or force a drive into a slot.
- **Warm replacement drives to room temperature before installation.** For example, let a drive sit overnight before installing it in an array.
- **Do not leave drive slots empty.** Each drive slot in an array must contain a drive assembly. Operating an array with an empty slot can cause damage to the array and will void your warranty and support contract.
- **Do not remove a functioning drive (other than a spare) from an array.** If the drive is not a spare, the RAID set may become degraded if you remove a functioning drive. If you remove a spare, replace the drive as soon as possible.
- **Do not remove a drive from its carrier.** This action will void your warranty and support contract.
- **Keep the shipping material.** Return a failed drive to your array support provider in the packaging in which the replacement drive was shipped. Shipping drives in unauthorized packaging may void your warranty.
- **Do not pull on the drive release latch.** When removing a drive from the array, do not use the drive release latch to pull the drive out of its slot in the array. Grip the drive by its sides to pull it out.

Replacing Drives

This section describes how to remove and install drives and provides general guidelines and restrictions for handling drives.

Drive Installation Guidelines and Restrictions

When installing PS-M4110 drives, observe these guidelines and restrictions:

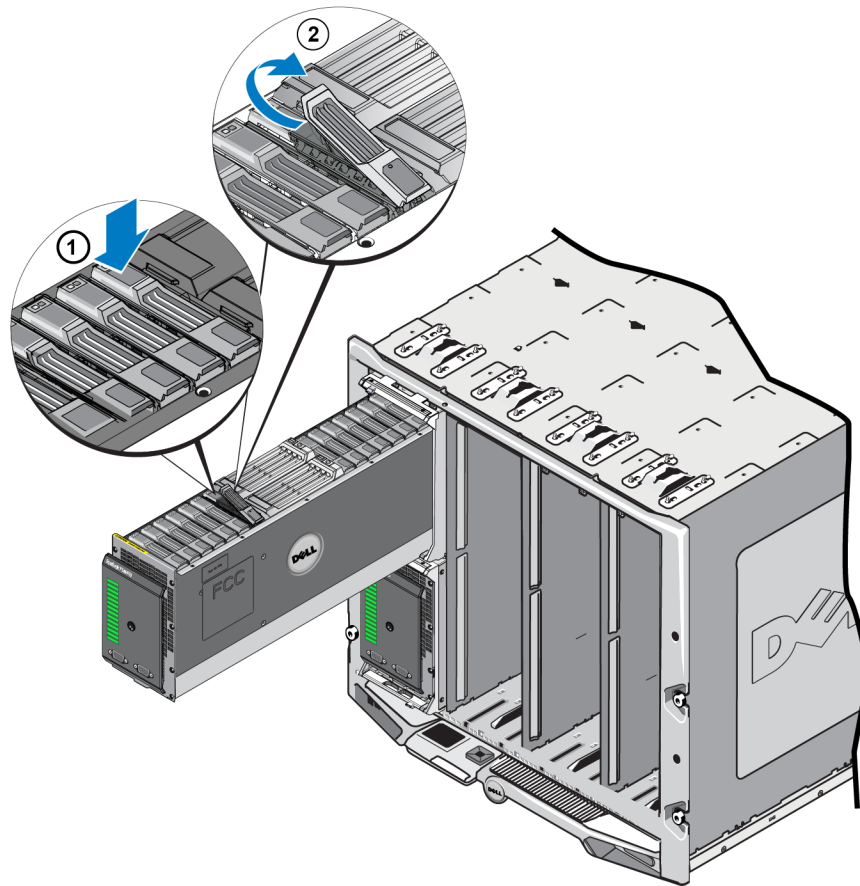
- Replace a failed drive as soon as possible to provide the highest reliability and availability to data.
- Install only drives of the same type, speed, and spin rate in an array.

- Make sure the drive is oriented in the correct position for the array model. See [Front Panel Features and Indicators on page 2](#).
- You can use drives of different capacities in the same array. However, the smallest drive in the array will determine how much space can be used on each drive. For example, if the smallest drive is 400GB, only 400GB of space will be available for use on each drive. (If your array uses a combination of solid-state and rotational drives, this rule does not apply.)
- Make sure to insert a drive fully in the chassis before pushing in the handle.
- When correctly installed, a drive will be flush with the top of the array. If the drive is protruding from the array, reinstall the drive.
- After installation, make sure the status LED is green. (The Activity LED will flash green during spin-up.) See [Identifying Failed Drives on page 27](#).
- Work with one drive at a time, so that only a single drive is removed or being inserted at any point in a replacement operation.
- There is a two-minute delay between the time you insert a drive and the time the drive is automatically configured into a RAID set. This time interval allows multiple drives to be simultaneously configured in an array, which is more efficient than installing a single drive, configuring it, and then repeating the process. For example, when you install a drive, the timer starts. If no other drives are installed, the drive is configured after a delay of two minutes. If you install another drive before two minutes have elapsed, the timer is restarted.
- If you install a drive during RAID reconstruction or verification, the new drive will not be configured until the operation completes.
- When removing or installing a drive in the array, do not use the drive release latch to pull or push the drive into or out of its slot in the array. Grip the drive by its sides to insert or remove it.

Removing a Drive

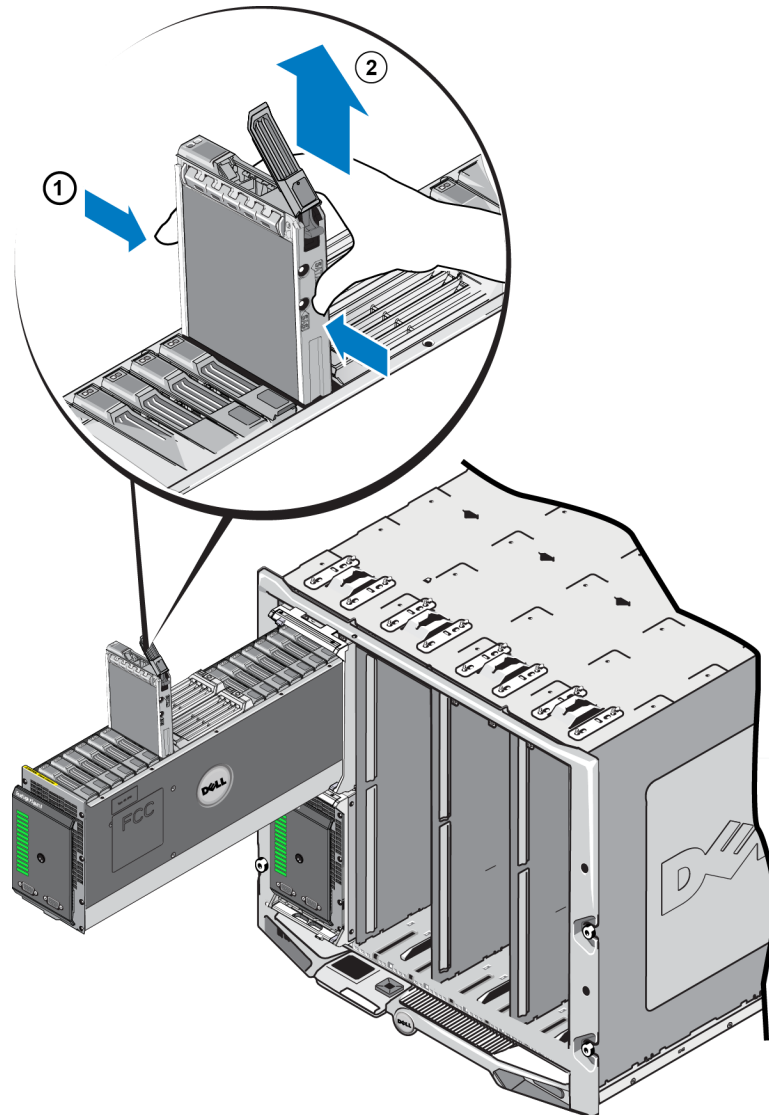
To remove a drive from a PS-M4110 blade storage array:

1. Open the array drawer to expose the drive that you want to remove. See [Opening the Array Drawer on page 12](#).
2. Press the drive release button, as shown in callout 1 in [Figure 19](#). The drive latch will spring open partway, releasing the drive from the slot.

Figure 19: Removing a Drive - Using the Release Latch

3. Open the drive release latch the rest of the way, so that it is fully open, as shown in callout 2 in [Figure 19](#). As you do this, the drive will rise partially out of its slot, exposing enough of the drive to grip with your hands.
4. Grip the sides of the drive with your hand to pull it up and out, until it is completely free of its slot, as shown in [Figure 20](#).

Caution: Do not pull the drive out of its slot by pulling on the drive release latch. This could damage the latch and the drive.

Figure 20: Removing a Drive - Lifting it Out

Installing a Drive

Before you begin to install a drive, open the array's inner drawer to expose the array drive slot where you intend to install the drive, as described in [Opening the Array Drawer on page 12](#).

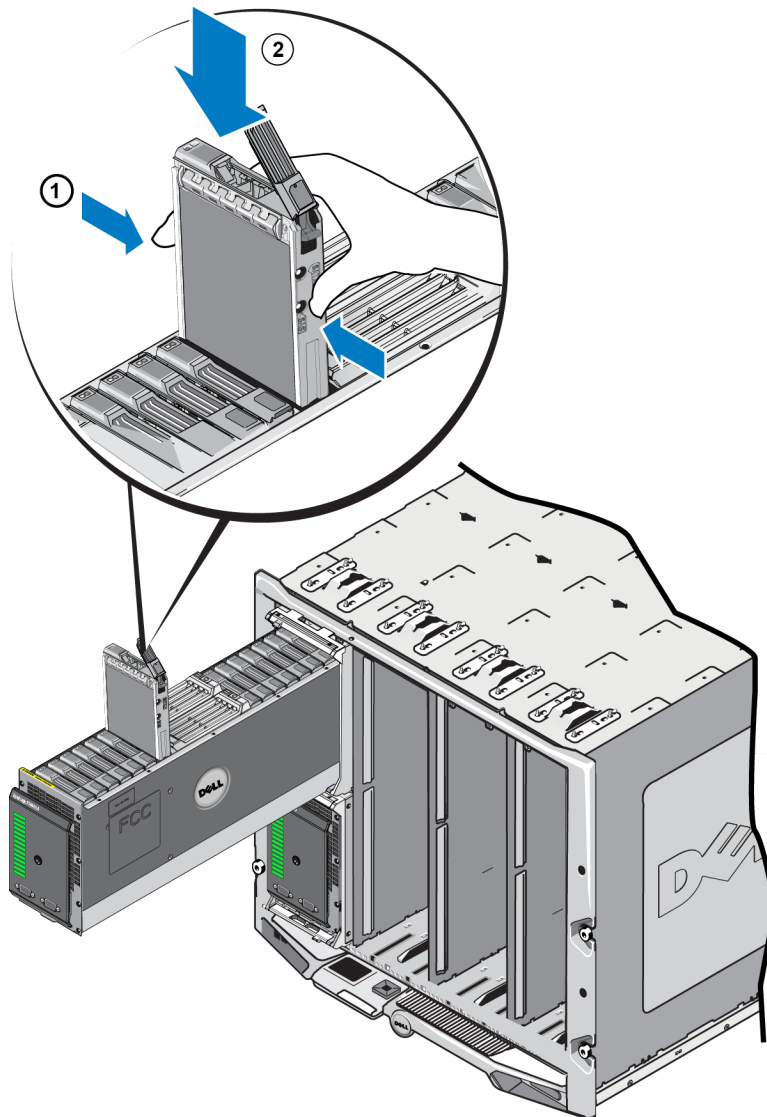
The array drives are installed with the drive's release latch and LEDs facing upward, and the drive's connections facing downward. The drive release latch must be fully opened before inserting the drive into the slot.

To install a drive into the array:

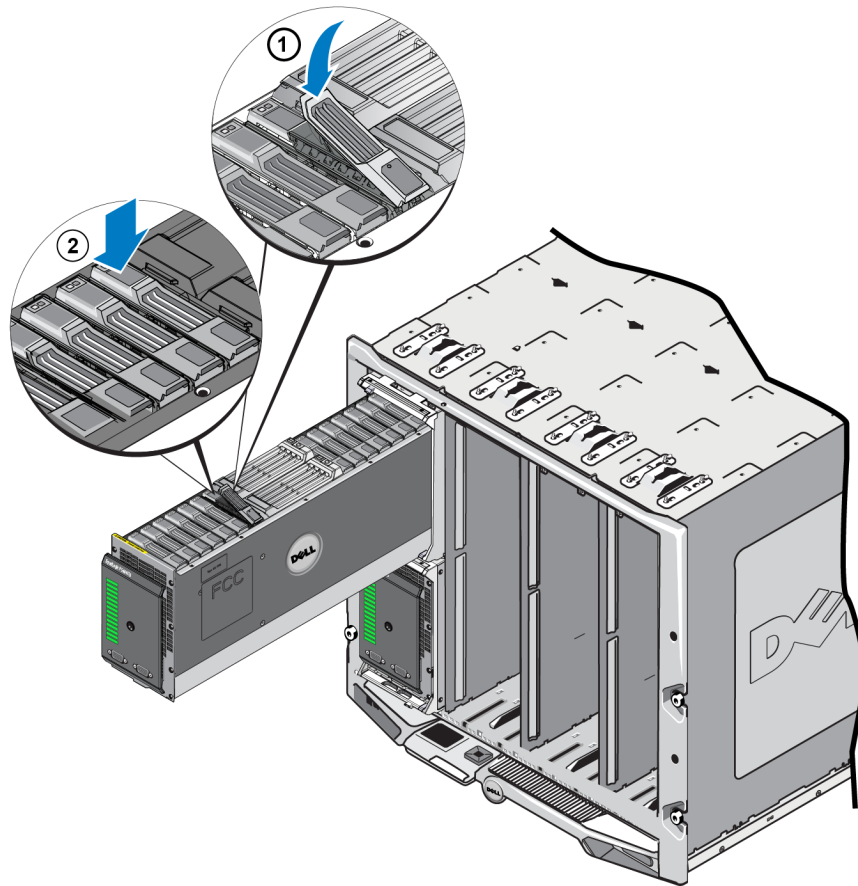
1. Wear electrostatic protection when handling a drive. See [Protecting Hardware on page 6](#)

2. Open the drive release latch by pressing the latch release button. The release latch should spring partially open. See [Removing a Drive on page 30](#) for an illustration of the release button location.
3. Lift the drive release latch to its fully open position before inserting the drive into the slot. See [Removing a Drive on page 30](#) for an illustration of the release latch movement.
4. Hold the drive by its carrier and insert the drive into an empty slot as shown in [Figure 21](#).

Figure 21: Installing a Drive - Placing in Array Slot



5. Push the drive into the slot. The drive handle will begin to close onto the drive as it is inserted.
6. When the drive is fully inserted as far as it can go, rotate the drive release latch to its fully closed position. Push down on the latch until you hear and feel a click. See [Figure 22](#).

Figure 22: Installing a Drive - Securing the Latch

Verify that the new drive is operational by examining the LEDs on the front panel, as described in [Front Panel Features and Indicators on page 2](#). In addition, examine the GUI Member Disks window and the CLI `member select show disks` command output.

4 Maintaining Control Modules

Different PS Series array models contain different control module types. The combination of chassis type, control module pair, and drives determines the PS Series array model number.

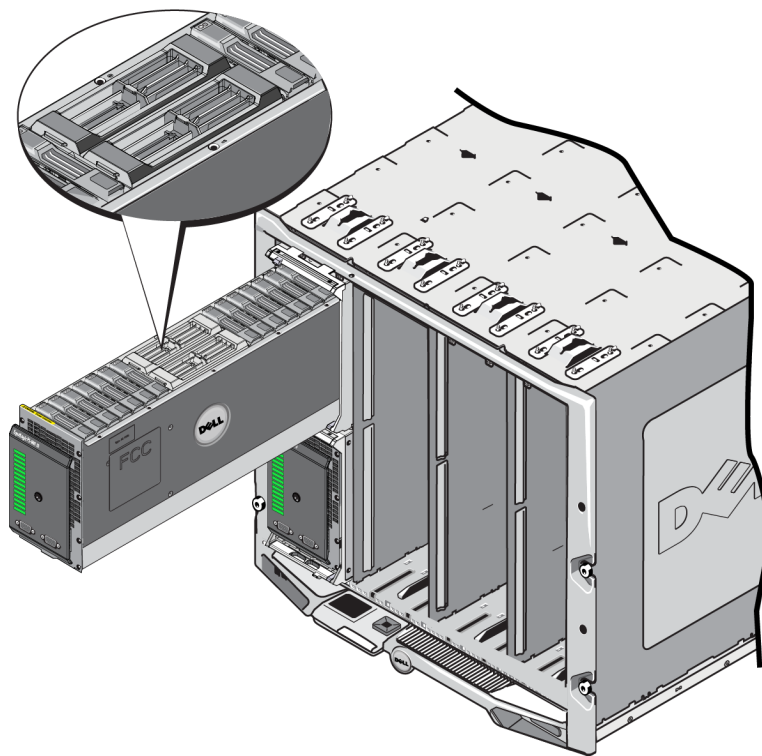
Ideally, an array has two control modules (which must be of the same type) to avoid a single point of failure for the array. However, only one functioning control module is required for array operation.

The control modules in a PS Series array contain the PS Series firmware which provides the Group Manager GUI, the Command Line Reference, and all the array and storage management functions and features.

A PS-M4110 blade storage array includes one or two hot-swappable Type13 control modules.

Access PS-M4110 control modules by opening the array drawer. [Figure 23](#) shows control modules between groups of drives in the middle of an open array drawer.

Figure 23: Location of Array Control Modules



Control Module Description

The PS-M4110 uses a Type 13 control module that includes:

- Ethernet port - A 10Gb/s iSCSI Ethernet port (Ethernet 0) for communication on one of two redundant fabrics.
- Management port - Ethernet port 1 can optionally be set up as a management port.
- Status and Power LEDs - Indicate status of the control module. ACT LED for activity and PWR LED for power.
- Serial port - The serial port on the front of the array connects to the control module so you can connect a computer directly to the array, without network access.
- microSD card - A field-replaceable microSD card containing the PS Series firmware.
- Release button and latch - Releases the control module from the array for replacement.

Do *not* mix control module types in an array. Always make sure both control modules are the same type and color. See the latest PS Series *Release Notes* for information about other supported control modules.

About Control Module Configurations

While an array can run using only one control module, it is not recommended because this creates a single point of failure. If a control module fails and a secondary is not available to take over, all access to your volumes stops until you replace it.

Do *not* mix control module types in an array. Always make sure both control modules are the same type.

Only one control module is active and serving network traffic at a time. The secondary (redundant) control module mirrors cache data from the active control module. If the active control module fails, the secondary will take over network operations.

Single Controller Configuration

A single control module is a single point of failure. If the control module fails, the entire array (and all the volumes on it) becomes unavailable. Dell strongly recommends buying an array with two control modules, or installing a second control module in a single-controller array.

In an array with a single control module, the module must be in slot CM0.

Caution: For proper array cooling and airflow requirements, there must be a blank control module filler in the empty control module slot.

Dual Controller Configuration

A dual control module configuration eliminates a single point of failure in the array. If the active control module fails, the secondary control module takes over immediately with no interruption of service. This gives you time to replace the failed control module while your volumes and data remain accessible.

Interpreting Control Module LEDs

Control module status LEDs are shown in [Figure 24](#). Control module status LEDs are described in [Table 5](#).

Figure 24: Control Module Status LEDs

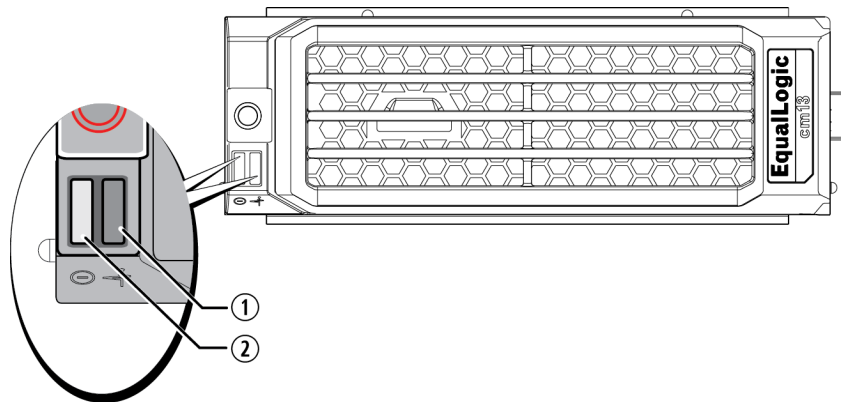


Table 5: Control Module LED Descriptions

Callout	LED Name	State	Description
1	Power	Off	No power.
		On (steady green)	Power/OK.
2	Activity	Off	No power, secondary control module is not synchronized with active control module, or error.
		Steady green	Active control module (serving network I/O).
		Steady amber	Secondary control module. Cache is synchronized with active control module.

Identifying Control Module Failures

You can identify a failure in a control module by:

- **LEDs** on the control module itself. See [Interpreting Control Module LEDs on page 37](#)

- **LEDs** on the front panel of the array. See [Front Panel Features and Indicators on page 2](#)
- **Messages** on the console, in the event log, the CMC Array Status page, or in the Group Manager GUI Alarms panel.
- **Group Manager GUI and CLI output.** The Member Controllers window or the `member select show controllers` command output shows the control module status `not installed`.
- **CMC GUI Health Conditions** of the array are reported on the CMC GUI. Events associated with the condition of a control module can be viewed on the CMC Storage Blade Status page.

When viewed from the front of the opened array drawer, CM0 is on the left side of the drawer, and CM1 is on the right side.

If a control module fails, contact your PS Series support provider for a replacement.

Understanding Failover Behavior

In a dual control module array, only one control module is active (serving network traffic) at one time.

Each control module includes a cache-to-flash module for storing recently-used data. For redundancy, the cache on the secondary control module mirrors the data that is stored in the cache on the active control module.

If the active control module fails, the secondary control module automatically takes over and becomes active. Control module failover is transparent to applications, but iSCSI initiators must reconnect to the group IP address.

Failover behavior for the PS-M4110 in the M1000e enclosure is described in detail in the *Network Requirements* section in [Array Networking Considerations on page 6](#).

Maintaining Control Module Firmware

A Type13 control module uses a microSD card to run the array firmware. You should run the latest firmware version to take advantage of new product features and enhancements.

Caution: In a dual control module array, both control modules must run the same firmware version or only one control module will function. When you update the array firmware, both control modules are updated to the same firmware version.

Group members should run the same firmware version; otherwise, only the functionality common to all versions will be available in the group. See the PS Series *Release Notes* for information about mixed-firmware groups.

If you are adding a second control module, upgrading a control module, or replacing a failed microSD card, contact your PS Series support provider for a replacement. Inform your provider of the current PS Series firmware version on your system. If you are replacing a failed control module, remove the microSD card from the failed control module and install it in the replacement control module. This will make sure that you keep the correct firmware.

To display the firmware version running on an array, examine the GUI Member Controllers window, the CMC Array Status page, or execute this CLI command:

```
member select show controllers
```

If the firmware on a microSD card does not match the firmware running on an array, do not install it. Instead, contact your array support provider.

Control Module Handling Requirements

Follow these control module handling requirements:

- **Do not remove an active control module.**
- **Do not remove a control module from an array while the control modules are synchronizing.** When synchronization completes, a console message will appear. Also, the ACT LED on the secondary control module will be orange.
- **Do not leave a control module slot empty.** In an array with one control module, insert a filler, a controller blank, into the empty control module slot to maintain correct air flow and cooling.
- **Protect control modules from electrostatic discharge.** Always wear an electrostatic wrist strap when handling a control module, as described in [Protecting Hardware on page 6](#).
- **Store control modules properly.** Store a control module in its original packaging or in an anti-static bag or place the control module on a surface protected from electrostatic discharge.

Replacing a Control Module

If a control module fails, remove it and replace it with a functioning control module, as described in this section.

You will also need to temporarily remove a control module when you want to replace its microSD card. Refer to [Replacing the microSD Card on page 46](#) for information about replacing the microSD card.

You can partially or completely remove a control module without shutting down the array if the remaining control module has at least one connected and functioning network interface. The procedures for doing this type of control module replacement are described in [Control Module Replacement Procedures on page 40](#).

When you remove a control module, wear an electrostatic wrist strap, as described in [Protecting Hardware on page 6](#), and be sure to place it on a surface that is protected from electrostatic discharge.

Control Module Cautions:

- Do not remove an active control module.
- Do not remove a control module from an array while the control modules are synchronizing. A message will appear on the console when synchronization completes. The ACT LED on the secondary control module will be orange when synchronization is complete.

- For proper cooling, do not leave a control module slot empty. If an array will operate for a long time with only one control module, you must install a blank in the empty slot. You can order a control module blank from your PS Series array service provider.
- Do not remove a failed control module until you are ready to replace it.

Control Module Replacement Procedures

This section describes the procedures for removing and replacing one or both control modules in your PS Series array. These replacement scenarios are covered:

- Replacing the secondary control module in an array.
- Replacing the active control module in an array.
- Replacing both control modules in an array.

Replacing the Secondary Control Module

Use this procedure to replace the secondary control module in the array:

1. Remove the control module from the array. (As described in [Removing a Control Module on page 41.](#))
2. Remove the SD card from the control module. (As described in [Removing the microSD Card on page 47.](#))
3. Install the SD card in the replacement control module. (As described in [Inserting the microSD Card on page 48.](#))
4. Insert the replacement control module into the array. (As described in [Installing a Control Module on page 44.](#))

Replacing the Active Control Module

Use one of these procedures to replace the active control module in the array:

- **One Controller Array:**
 1. Shut down the system with a full shutdown. (As described in [Shutting Down and Restarting the Array on page 4.](#))
 2. Replace the control module. (As described in [Replacing the Secondary Control Module on page 40.](#))
- **Two Controller Array:**
 1. Use the “restart” command to make the active control module secondary.
 2. Replace the control module that is now secondary (was active before the restart). (As described in [Replacing the Secondary Control Module on page 40.](#))
- **Two Controller Array - One Controller Defective:**

1. Replace the defective control module first, so the array has two good control modules.
2. Use the “restart” command to make the active control module secondary.
3. Replace the control module that is now secondary (was active before the restart). (As described in [Replacing the Secondary Control Module on page 40.](#))

Replacing Both Control Modules

Use this procedure to replace both control modules in the array:

1. Replace the secondary control module first. (As described in [Replacing the Secondary Control Module on page 40.](#))
2. Use the “restart” command to make the active control module secondary.
3. Replace the control module that is now secondary (was active before the restart). (As described in [Replacing the Secondary Control Module on page 40.](#))

Removing a Control Module

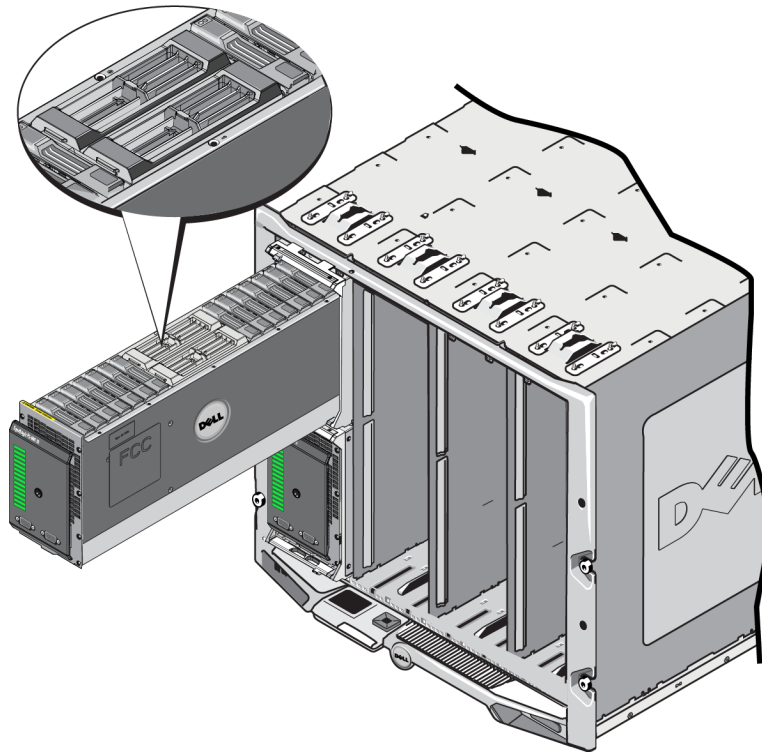
Before removing a control module from a PS-M4110 blade storage array:

- Review the information at the beginning of [Replacing a Control Module on page 39.](#)
- Attach an electrostatic wrist strap. See [Protecting Hardware on page 6.](#)

Caution: Do not remove an active control module.

Control modules are located in the large center slots of the array drawer. The control module slots are positioned lengthwise between the storage drives, as shown in [Figure 25.](#)

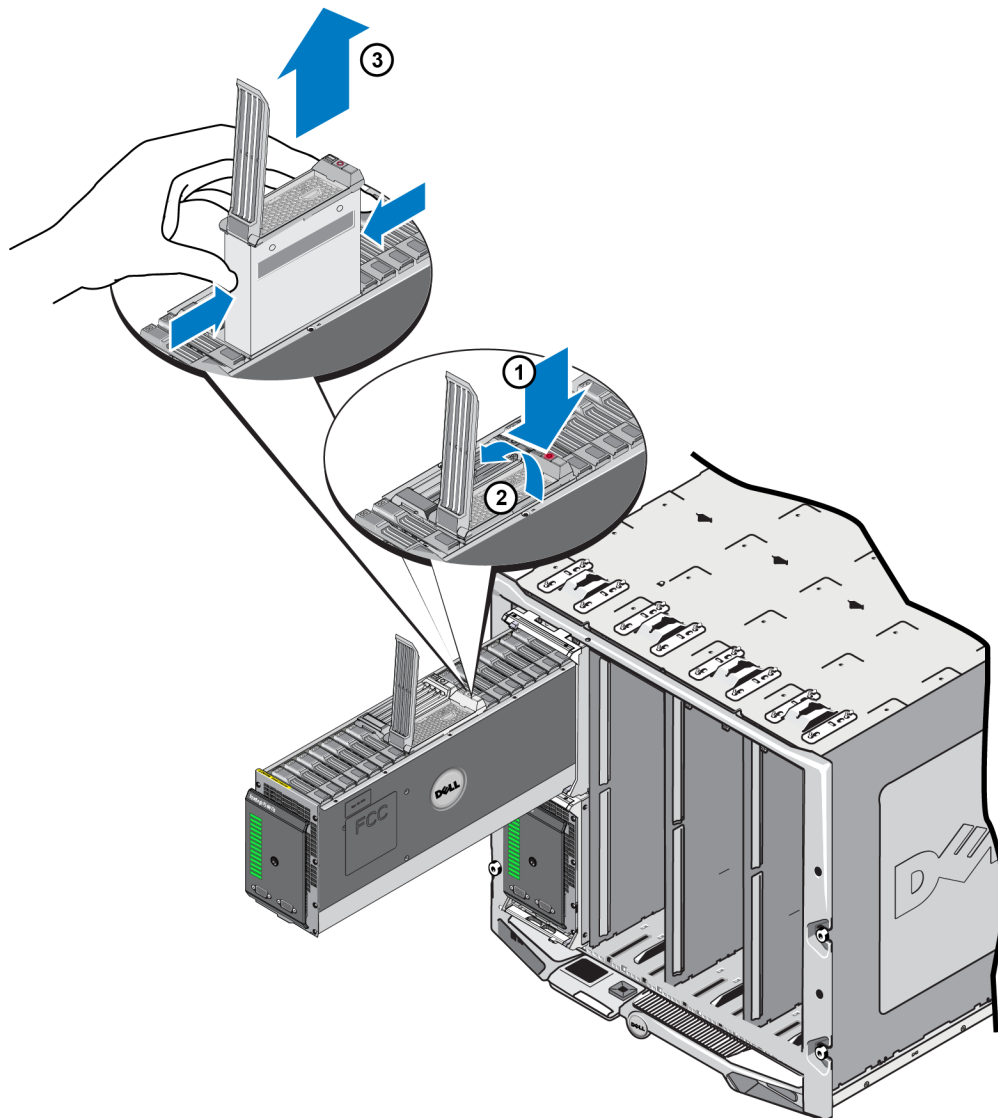
Facing the front of the array drawer, the left-side control module is CM0 and the right-side control module is CM1.

Figure 25: Location of Control Modules

To remove a control module from a PS-M4110 blade storage array:

1. Open the array drawer to expose the control modules. See [Opening the Array Drawer on page 12](#).
2. Push down on the control module's release button (shown in callout 1 of [Figure 26](#)). The control module's release latch will spring open partway to release the control module from the slot.
3. Hold down the release button and swing the control module's release latch to its fully open position (callout 2 of [Figure 26](#)). This begins to eject the control module from the array. The control module rises enough out of its slot for you to grip it with your hands.
4. Remove the control module. Grip it by its sides and pull it up and out of its slot (callout 3 of [Figure 26](#)) until it is completely free.

Caution: Do not pull the control module by its release latch. This could damage the latch.

Figure 26: Removing a Control Module

5. Place the control module on a flat surface where it is protected from electrostatic charge. To avoid damage, do not place anything on top of the control module.
6. If you are replacing a failed control module, remove the microSD card from the failed control module and install it in the replacement control module. This ensures that the new control module runs the correct firmware. See [Replacing the microSD Card on page 46](#).

Caution: Do not operate an array with an empty control module slot. If necessary, insert a controller blank as a filler to maintain the correct airflow and cooling.

Return the failed control module in the packaging in which the replacement module was shipped. Contact your PS Series support provider for information about returning hardware.

Installing a Control Module

You can install a control module without shutting down the array.

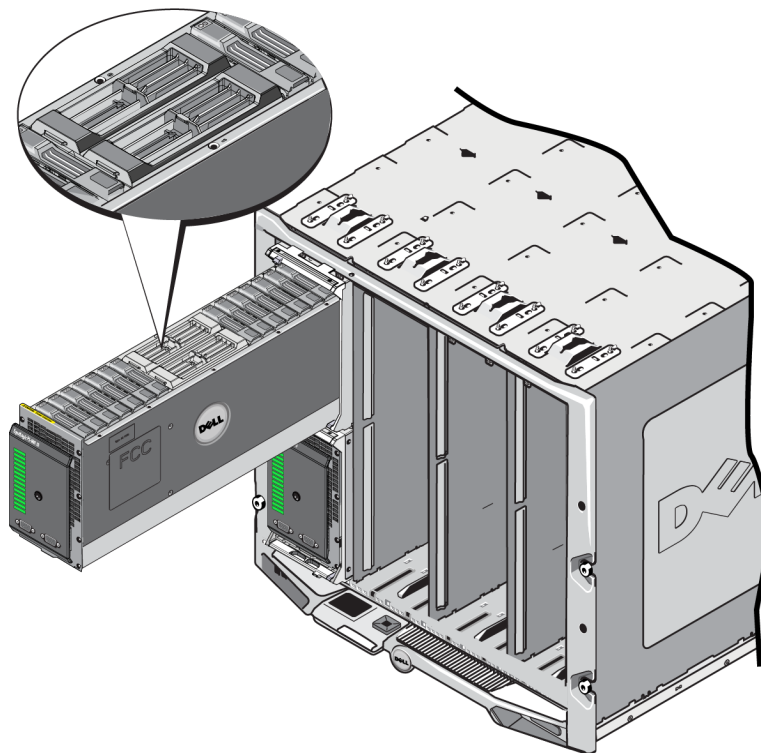
Caution: Do not mix control module types in an array.

Caution: Do not remove an active control module.

Control modules are located in the large center slots of the array drawer. The control module slots are positioned lengthwise between the storage drives, as shown in [Figure 27](#).

Facing the front of the array drawer, the left-side control module is CM0 and the right-side control module is CM1.

Figure 27: Location of Control Modules



Before removing a control module from a PS-M4110 blade storage array:

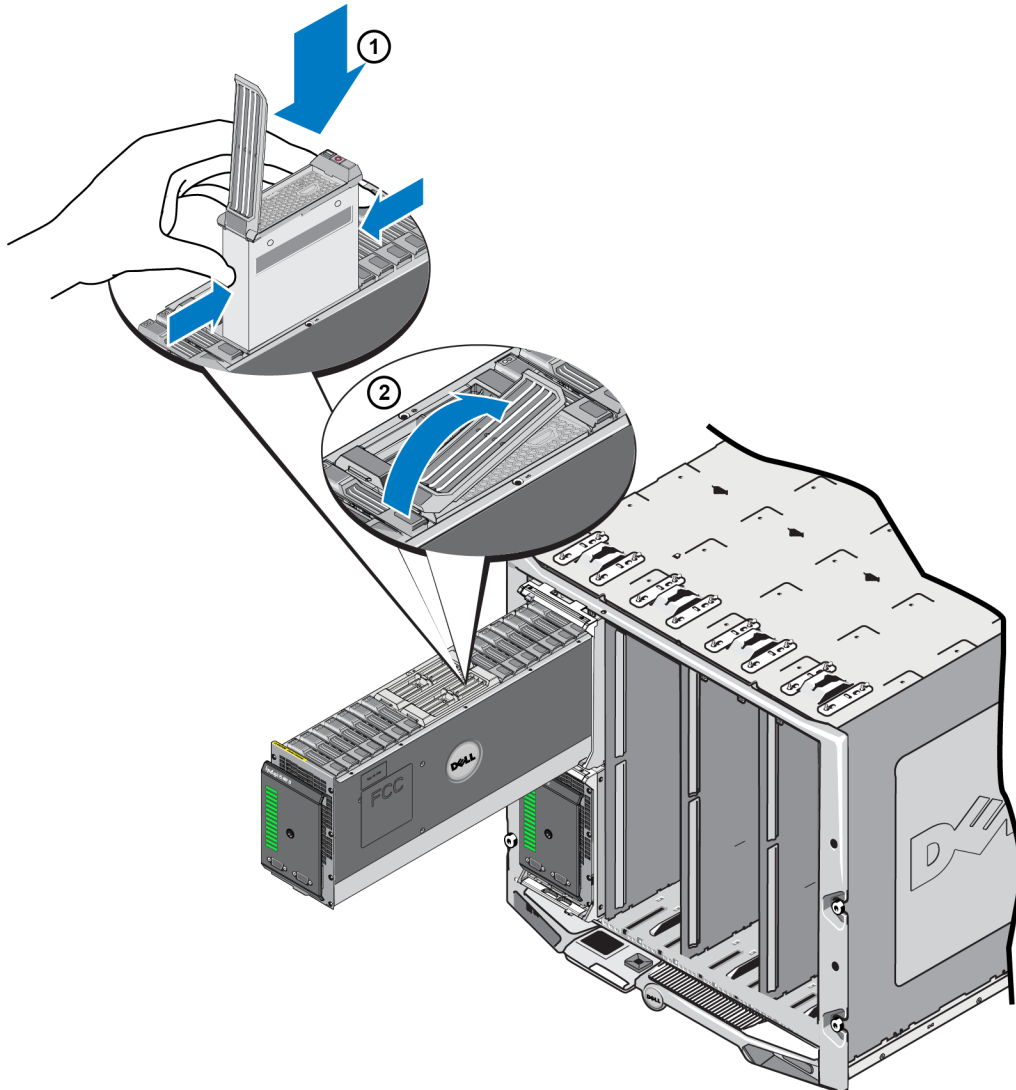
- Review the information at the beginning of [Replacing a Control Module on page 39](#).
- Attach an electrostatic wrist strap. [Protecting Hardware on page 6](#).

Control modules are installed with the release latch and LEDs facing upward, and connections facing downward. The release latch must be fully opened before inserting the control module into the slot.

To install a control module:

1. Open the control module release latch by pressing the latch release button. The release latch should spring partially open. Refer to [Removing a Control Module on page 41](#) for an illustration of opening the release latch.
2. Lift the control module release latch to its fully open position before inserting it into the slot, as shown in callout 1 of [Figure 28](#).
3. Hold the control module by its sides and insert it into an empty slot, as shown in callout 1 of [Figure 28](#).

Figure 28: Inserting a Control Module



4. Continue to slide the control module into the chassis until you feel resistance.
5. Rotate the release lever inward and down, which pushes the control module completely into the slot. The latch on the lever will snap into place. See callout 2 of [Figure 28](#).
6. Check to make sure the control module is operational. See [Interpreting Control Module LEDs on page 37](#).

If two control modules are installed in the array, but only one is shown in the GUI (or CLI), make sure that you have allowed enough time (two to five minutes) for the two control modules to boot and synchronize.

When synchronization completes, a message will appear on the serial console (if connected), and the ACT LED on the secondary module will be orange.

If the GUI (or CLI) still shows only one control module after appropriate time has elapsed, the control module may not be properly installed. In this case, reinstall the control module.

After reinstalling the control module, if both control modules still do not appear in the GUI (or CLI), contact your support provider.

Warning: After a control module is installed in an array, do not restart or reinstall it, or upgrade firmware on the array, until the control module has finished synchronizing its internal firmware with the primary control module. If you interrupt the synchronization process, you will corrupt the control module's internal firmware, and the control module will no longer function properly. In this case, contact your support provider

Replacing the microSD Card

Each control module includes a microSD card that contains the PS Series firmware.

If a control module fails, you need to remove the microSD card from the failed control module and install the card in the replacement control module. This will make sure that the new control module is running the same firmware as the other control module in the array.

Before you begin the procedure to replace a microSD card:

- Review [Replacing a Control Module on page 39](#) for information about removing and replacing a control module.
- Attach an electrostatic wrist strap, as described in [Protecting Hardware on page 6](#).

microSD Card Replacement Procedure

Use this procedure to replace the microSD card in your control module:

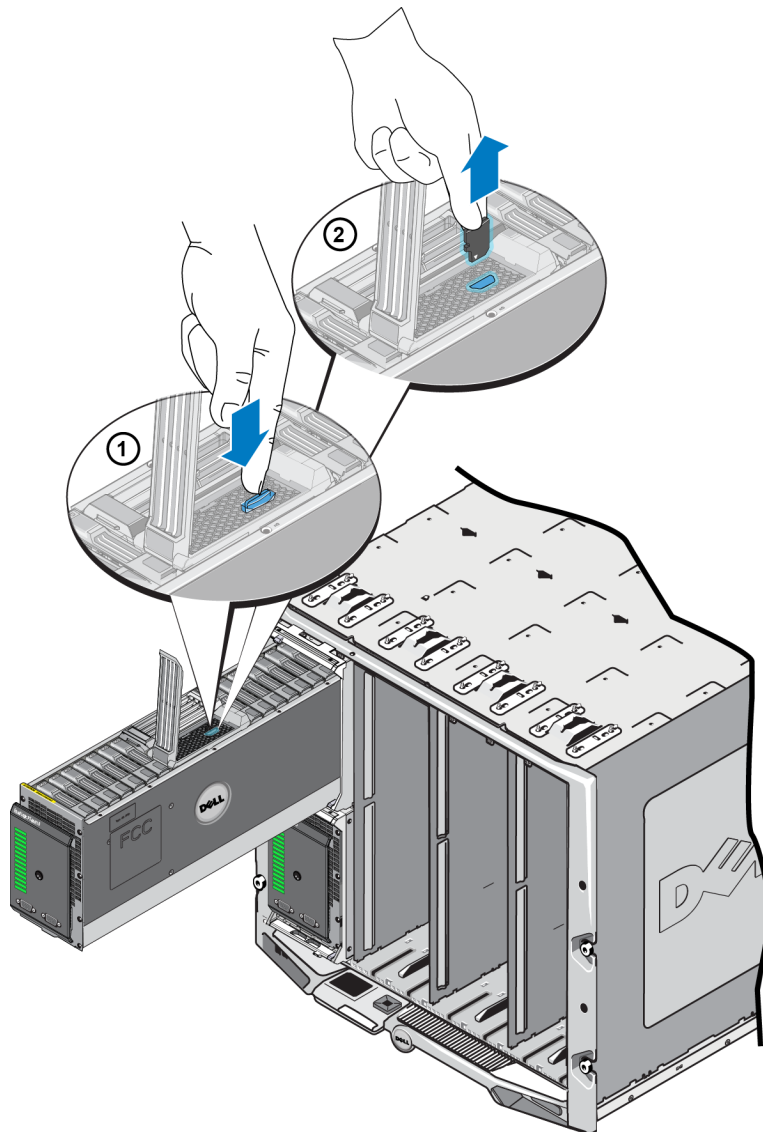
1. Remove the control module from the array. (As described in [Removing a Control Module on page 41](#).)
2. Remove the SD card from the control module. (As described in [Removing the microSD Card on page 47](#).)
3. Install the replacement SD card in the control module. (As described in [Inserting the microSD Card on page 48](#).)
4. Insert the control module into the array. (As described in [Installing a Control Module on page 44](#).)

Removing the microSD Card

Caution: To reduce the risk of losing or damaging the microSD card, do not remove it until you are ready to install it in the replacement control module.

1. Firmly push on the microSD card in its slot to release the spring mechanism (callout 1 in [Figure 29](#)). The microSD card will partially eject itself from the housing.
2. Gently pull the card straight out of the slot (callout 2 in [Figure 29](#)).
3. Place the microSD card on a flat surface where it will be protected from electrostatic charge.

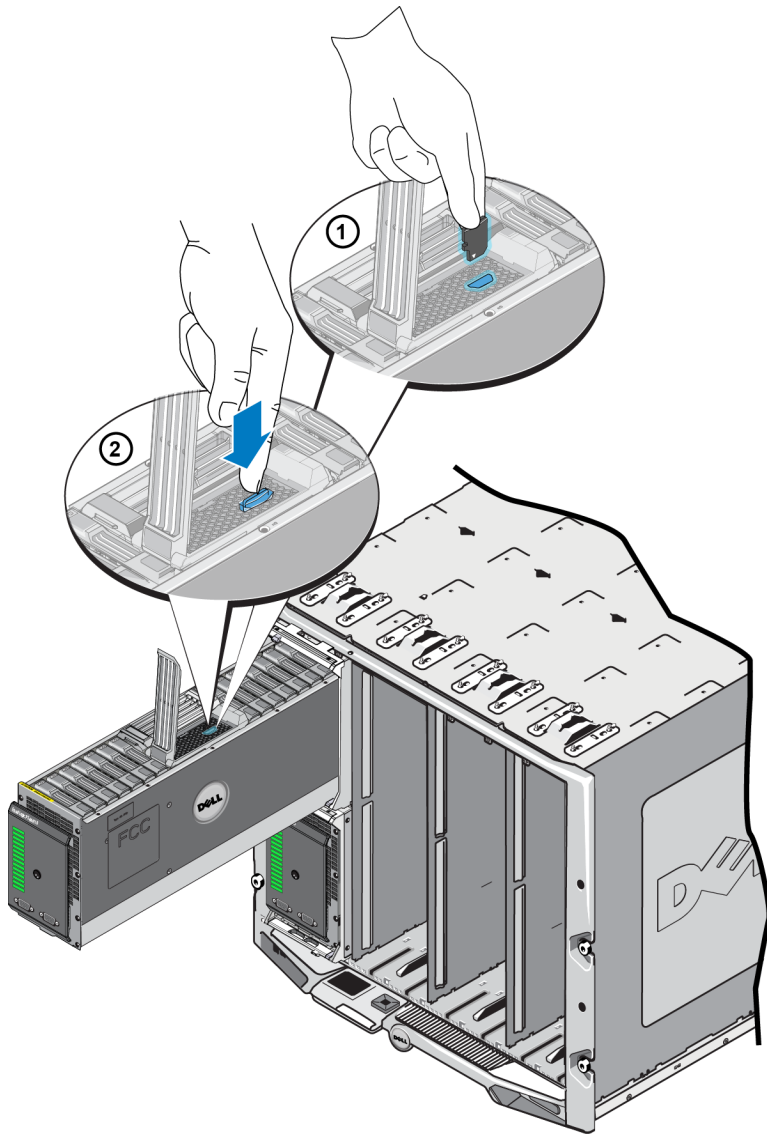
Figure 29: Removing the microSD Card



Inserting the microSD Card

1. Align the microSD card so the arrow on the card points towards the microSD card slot in the control module (callout 1 in [Figure 30](#)). When correctly positioned, the notch on the card will correspond to the slot.

Figure 30: Inserting the microSD Card



2. Firmly press the card into the slot until it clicks into place (callout 2 in [Figure 30](#)).
3. Install the control module in the array. See [Installing a Control Module on page 44](#).
4. Make sure the control module is operational. See [Interpreting Control Module LEDs on page 37](#).

5 Troubleshooting Your Array

Many repairs may only be done by a certified service technician. You should only perform troubleshooting and simple repairs as authorized in your product documentation, or as directed by the online or telephone service and support team.

Damage due to servicing that is not authorized by Dell is not covered by your warranty. Read and follow the safety instructions that came with the product.

Obtaining Technical Support and Customer Service

Dell's support service is available to answer your questions about PS-M4110 blade storage arrays.

Dell provides several online and telephone-based support and service options. Availability varies by country and product, and some services might not be available in your area.

Refer to the [Preface on page vi](#) for information about the warranty and how to obtain technical support and customer service.

Express Service Tag Information

Each PS-M4110 blade storage array has an Express Service Tag number on a pull-out "luggage tag" labeled EST near the front bottom edge of the array drawer. (See [Figure 2 on page 2](#).) Have the number available for customer support when you contact us.

Obtaining Component Diagnostics

You can collect diagnostic information for the PS-M4110 through the EqualLogic Group Manager GUI or CLI, and the Dell PowerEdge M1000e CMC GUI.

See the *EqualLogic Group Administration* guide or *CLI Reference* manual for the diagnostic information available through the EqualLogic Group Manager GUI or CLI.

See the *Dell PowerEdge M1000e Enclosure Owner's Manual* for information about the Health Conditions available through the CMC GUI.

Troubleshooting Array Startup Failure

If your system halts during startup, check the array's front panel indicators. See [Front Panel Features and Indicators on page 2](#).

There are a few reasons that an array could be denied power ON. In this case, the “Power On Enclosure” option in the CMC GUI should be used to power on the array once the reason has been addressed.

Be sure to check for:

- Fabric Mismatch—If the array is configured for a fabric that does not have a 10 Gb –KR IOM installed.
- Not enough power available—more or higher-wattage power supplies are needed
- 110 V AC—If power supplies in the enclosure support 110 V AC, when the enclosure is powered on, the array will not power on right away like other blades and IOMs. A Power On Enclosure action is needed.

Troubleshooting Loss of Communication

For information about troubleshooting loss of communication, see [Array Networking Considerations on page 6](#).

Troubleshooting Array Connections

The PS-M4110 is connected to the M1000e enclosure by internal connections between the array and the enclosure. There are no cable connections that you can check for problems, but you can:

- Confirm that the PS-M4110 blade array is properly seated within the M1000e enclosure.
- Confirm that the array's control modules and drives are properly seated within the PS-M4110 array drawer.

Troubleshooting External Connections

The PS-M4110 does not have direct external connections that you can troubleshoot. The PS-M4110 is connected to power, Ethernet, and other devices through its internal connections to the M1000e enclosure.

However, you can check or confirm:

- If Pass-Through IOMs are in use, verify that all four network ports connecting the PS-M4110 are cabled into the SAN network.
- If Switch IOMs are in use, verify that the IOM switches are connected to the SAN network, and that the four internal ports connecting to the PS-M4110 are allocated to the SAN network.

- The PS-M4110 blade array is properly seated within the M1000e enclosure.
- The array's control modules and drives are properly seated within the PS-M4110 array drawer.

Troubleshooting Control Modules

1. Remove the PS-M1000e array from the chassis and verify that the connections to the M1000e are not damaged. See [Handling the Array on page 11](#).
2. Remove the control module from the array drawer and verify that the pins on the control module and the backplane to which it connects are not bent or otherwise damaged. See [Replacing a Control Module on page 39](#).
3. Reinstall the control module and wait for 30 seconds. See [Replacing a Control Module on page 39](#).
4. Check the control module status LEDs. See [Interpreting Control Module LEDs on page 37](#).
5. If the control module ACT LED is blinking amber (5 times per sequence), update the firmware to the latest supported firmware on both control modules.

For more information about downloading the latest firmware, see the PS Series *Release Notes* and the document *Updating PS Series Storage Array Firmware*. These documents are available on the customer support web site. See the [Chapter , Preface on page vi](#) for information about accessing the customer support web site.

If the control module problem cannot be resolved, contact customer support as described in the [Preface on page vi](#)

Troubleshooting Array Drives

Check the hard drive indicators before removing a suspected faulty drive from the array. See [Interpreting Drive LEDs on page 28](#).

1. Remove the PS-M1000e array from the chassis and verify that the connections to the M1000e are not damaged. See [Handling the Array on page 11](#).
2. Remove the drive from the array. See [Removing a Drive on page 30](#).
3. Check the drive to verify that the pins on the drive and the bottomplane to which it connects are not bent or otherwise damaged.

If external damage is discovered, replace the defective part. Contact customer support for a replacement, as described in the [Preface on page vi](#)

If the array drive problem is not resolved, contact customer support as described in the [Preface on page vi](#)

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