



**Hewlett Packard  
Enterprise**

# **MSA 1040 User Guide**

**For firmware release GL220 and GL225**

## **Abstract**

This document describes initial hardware setup for HPE MSA 1040 controller enclosures, and is intended for use by storage system administrators familiar with servers and computer networks, network administration, storage system installation and configuration, storage area network management, and relevant protocols.

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# 1 Overview

HPE MSA Storage models are high-performance storage solutions combining outstanding performance with high reliability, availability, flexibility, and manageability. MSA 1040 enclosure models blend economy with utility for scalable storage applications.

## MSA 1040 Storage models

The MSA 1040 controller enclosures support either large form factor (LFF 12-disk) or small form factor (SFF 24-disk) 2U chassis, using AC power supplies. MSA 1040 Storage models are pre-configured at the factory to support one of these host interface protocols:

- 8 Gb FC
- 4 Gb FC
- 10 GbE iSCSI
- 1 GbE iSCSI
- 6 Gb HD mini-SAS
- 12 Gb HD mini-SAS

For FC and iSCSI host interfaces, the small form-factor pluggable (SFP transceiver or SFP) connector supporting the pre-configured host interface protocol is pre-installed in the controller module. MSA 1040 controller enclosures do not allow you to change host interface protocols or increase speeds. Always use qualified SFP connectors and cables required for supporting the host interface protocol as described in the QuickSpecs.

<http://www.hpe.com/support/msa1040/QuickSpecs>

(If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.)

For the HD mini-SAS host interface, both standard and fan-out cables are supported, with options for 12 Gb (SFF-8644 connector) or 6 Gb (SFF-8088 connector) host connection. Always use qualified SAS cable options for supporting the host interface protocol as described in the QuickSpecs. Host connection for this controller module is described by cabling diagrams in [Connecting hosts](#). Connection information for the SAS fan-out cable options is provided in [SAS fan-out cable option](#).

---

**NOTE:** For additional information about MSA 1040 controller modules, see the following subsections:

- [“Controller enclosure—rear panel layout” \(page 12\)](#)
  - [“Rear panel LEDs” \(page 67\)](#)
- 

The MSA 1040 enclosures support both traditional linear storage and, if licensed, virtual storage, which uses paged-storage technology. For linear storage, a group of disks with an assigned RAID level is called a *vdisk* or *linear disk group*. For virtual storage, a group of disks with an assigned RAID level is called a *virtual disk group*. This guide uses the term *vdisk* when specifically referring to linear storage, and uses the term *disk group* otherwise.

## MSA 1040 enclosure user interfaces

The MSA 1040 enclosures support two versions of the Storage Management Utility (SMU), which is a web-based application for configuring, monitoring, and managing the storage system. Both SMU versions (v3 and v2) and the command-line interface are briefly described.

- v3 is the primary web interface to manage virtual storage.
- v2 is a secondary web interface to manage linear storage. This legacy interface provides certain functionality that is not available in the v3 interface.
- The command-line interface (CLI) enables you to interact with the storage system using command syntax entered via the keyboard or scripting. You can set a CLI preference to use v3 commands to manage virtual storage or to use v2 commands to manage linear storage.

---

**NOTE:** For more information about the web-based application, see the *HPE MSA 1040/2040 SMU Reference Guide* or online help. For more information about the CLI, see the *HPE MSA 1040/2040 CLI Reference Guide*.

---

## Features and benefits

Product features and supported options are subject to change. Online documentation describes the latest product and product family characteristics, including currently supported features, options, technical specifications, configuration data, related optional software, and product warranty information.

---

**NOTE:** Check the QuickSpecs for a complete list of supported servers, operating systems, disk drives, and options. See <http://www.hpe.com/support/msa1040/QuickSpecs>.

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If a website has changed, a Google search for HPE 1040 quickspecs will provide a link.

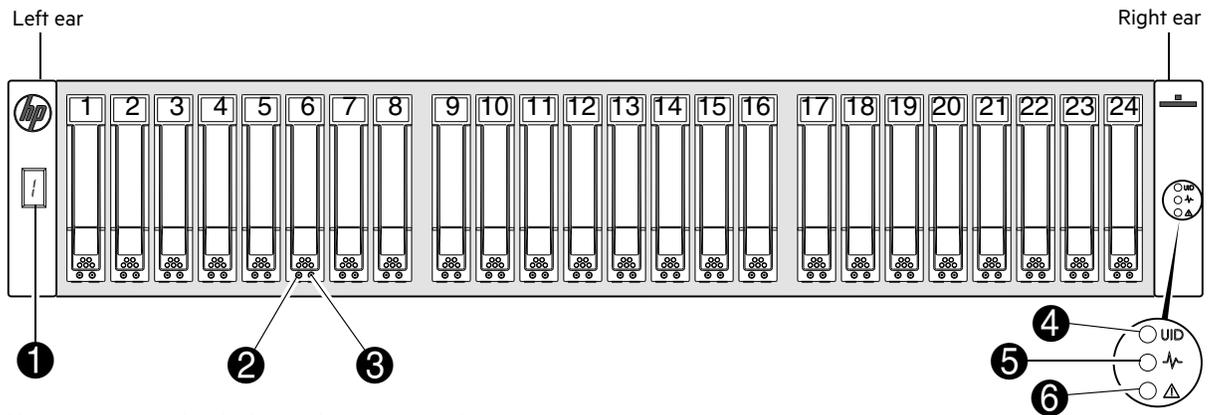
## 2 Components

### Front panel components

HPE MSA 1040 models support small form factor (SFF) and large form factor (LFF) enclosures. The SFF chassis, configured with 24 2.5" SFF disks, is used as a controller enclosure. The LFF chassis, configured with 12 3.5" LFF disks, is used as either a controller enclosure or a drive enclosure.

Supported drive enclosures, used for adding storage, are available in LFF or SFF chassis. The MSA 2040 6 Gb 3.5" 12-drive enclosure is the large form factor drive enclosure used for storage expansion. The HPE D2700 6 Gb enclosure, configured with 25 2.5" SFF disks, is the small form factor drive enclosure used for storage expansion. See “[SFF drive enclosure](#)” (page 15) for a description of the D2700.

### MSA 1040 Array SFF enclosure

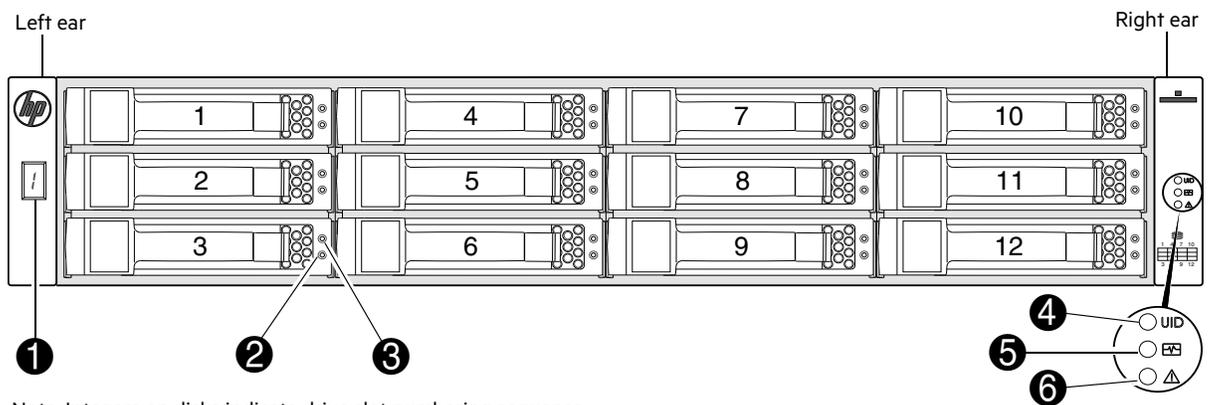


Note: Integers on disks indicate drive slot numbering sequence.

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1 Enclosure ID LED               | 4 Unit Identification (UID) LED |
| 2 Disk drive Online/Activity LED | 5 Heartbeat LED                 |
| 3 Disk drive Fault/UID LED       | 6 Fault ID LED                  |

**Figure 1 MSA 1040 Array SFF Enclosure: Front Panel**

### MSA 1040 Array LFF or supported 12-drive expansion enclosure



Note: Integers on disks indicate drive slot numbering sequence.

- |                                  |                                 |
|----------------------------------|---------------------------------|
| 1 Enclosure ID LED               | 4 Unit Identification (UID) LED |
| 2 Disk drive Online/Activity LED | 5 Heartbeat LED                 |
| 3 Disk drive Fault/UID LED       | 6 Fault ID LED                  |

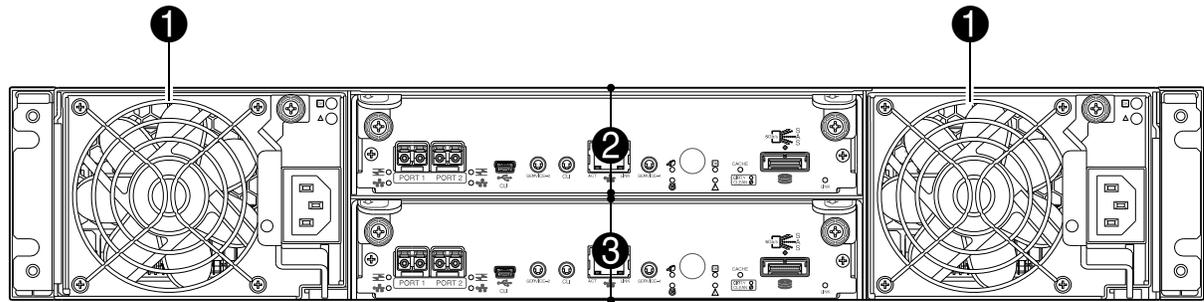
**Figure 2 MSA 1040 Array LFF or supported 12-drive enclosure: front panel**

## Disk drives used in MSA 1040 enclosures

MSA 1040 enclosures support LFF/SFF Midline SAS and LFF/SFF Enterprise SAS disks. For information about creating disk groups and adding spares using these different disk drive types, see the SMU Reference Guide.

## Controller enclosure—rear panel layout

The diagram and table below display and identify important component items comprising the rear panel layout of the MSA 1040 controller enclosure.



- 1 AC Power supplies
- 2 Controller module A (see face plate detail figures)
- 3 Controller module B (see face plate detail figures)

**Figure 3 MSA 1040 Array: rear panel**

A controller enclosure accommodates two power supply FRUs within the two power supply slots (see two instances of callout 1 above). The controller enclosure accommodates two controller module FRUs of the same type within the I/O module slots (see callouts 2 and 3 above).

- 
- ⓘ **IMPORTANT:** MSA 1040 controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.
- 

The diagrams with tables that immediately follow provide descriptions of the different controller modules that can be installed into the rear panel of an MSA 1040 controller enclosure. Showing controller modules separately from the enclosure provides improved clarity in identifying the component items called out in the diagrams and described in the tables. Descriptions are also provided for optional drive enclosures supported by MSA 1040 controller enclosures for expanding storage capacity.

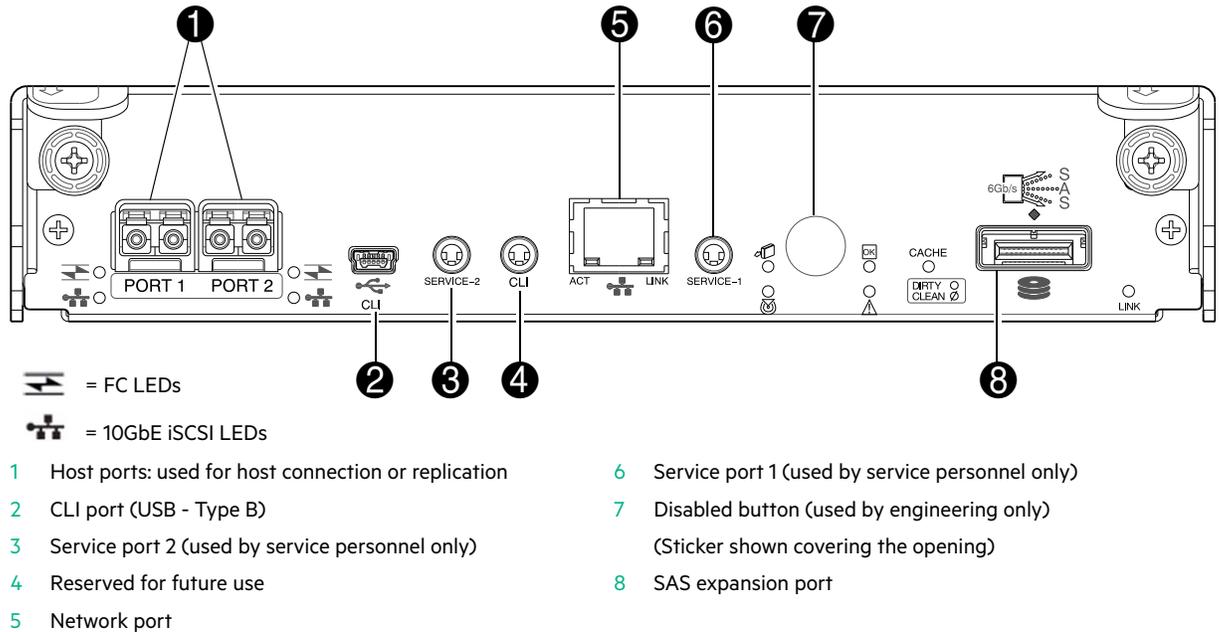
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**NOTE:** MSA 1040 controller enclosures support hot-plug replacement of redundant controller modules, fans, power supplies, and I/O modules. Hot-add of drive enclosures is also supported.

---

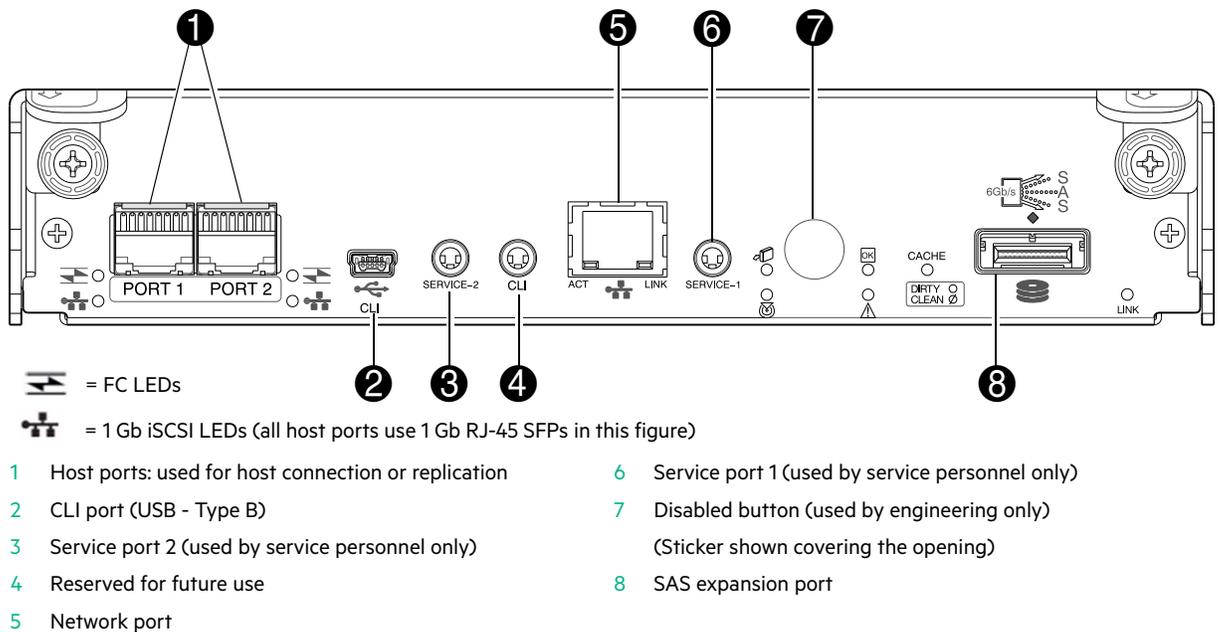
## MSA 1040 controller module—rear panel components

Figure 4 shows host ports configured with either 8 Gb FC or 10GbE iSCSI SFPs. The SFPs look identical. Refer to the LEDs that apply to the specific configuration of your host ports.



**Figure 4 MSA 1040 controller module face plate (FC or 10GbE iSCSI)**

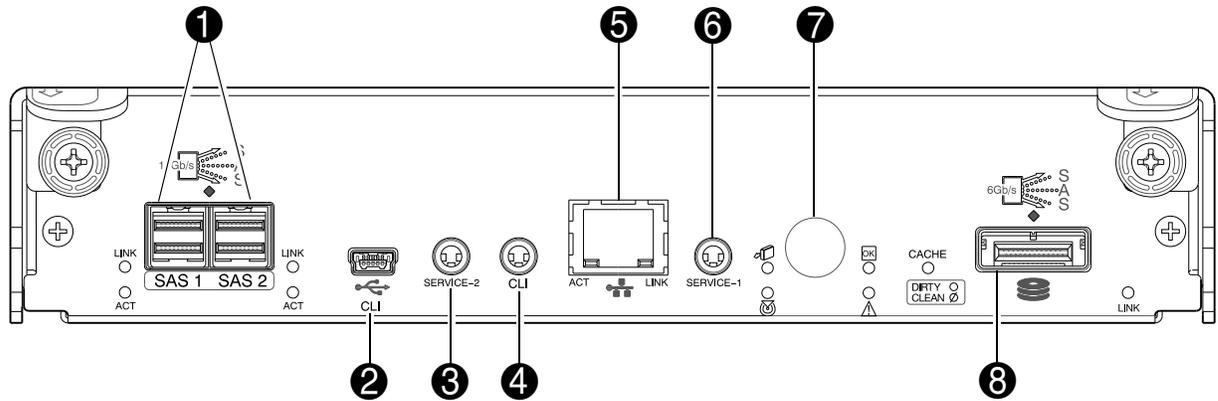
Figure 5 shows host ports configured with 1 Gb RJ-45 SFPs.



**Figure 5 MSA 1040 controller module face plate (1 Gb RJ-45)**

**NOTE:** For information about host port configuration, see the topic about configuring host ports within the SMU Reference Guide or online help.

Figure 6 shows host interface ports configured with 12 Gbit/s HD mini-SAS (SFF-8644) connectors.



- |   |  |
|---|--|
| 1 Host ports: used for host connection            | 6 Service port 1 (used by service personnel only)                                    |
| 2 CLI port (USB - Type B)                         | 7 Disabled button (used by engineering only)<br>(Sticker shown covering the opening) |
| 3 Service port 2 (used by service personnel only) | 8 SAS expansion port   |
| 4 Reserved for future use                         |  |
| 5 Network port                                    |  |

**Figure 6 MSA 1040 controller module face plate (HD mini-SAS)**

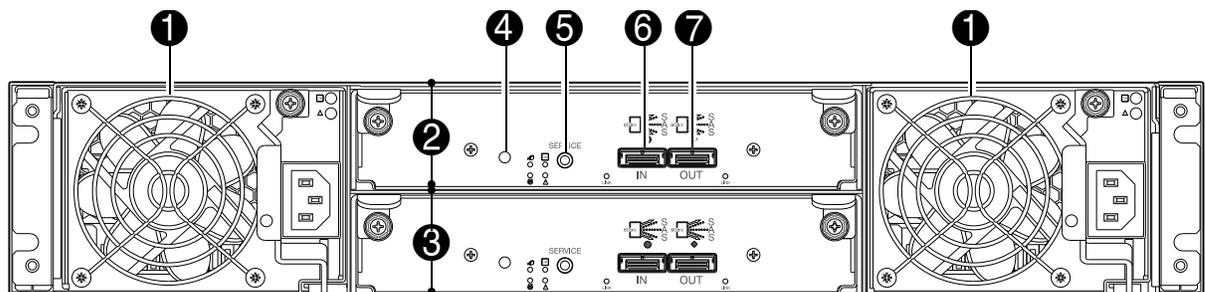
① **IMPORTANT:** See [Connecting to the controller CLI port](#) for information about enabling the controller enclosure USB Type - B CLI port for accessing the CLI to perform initial configuration tasks.

## Drive enclosures

Drive enclosure expansion modules attach to MSA 1040 controller modules via the mini-SAS expansion port, allowing addition of disk drives to the system. MSA 1040 controller enclosures support adding the 6 Gb drive enclosures described below.

### LFF drive enclosure — rear panel layout

MSA 1040 controllers support the MSA 2040 6 Gb 3.5" 12-drive enclosure shown below.



- |  |   |
|--|---|
| 1 AC power supplies                          | 5 Service port (used by service personnel only) |
| 2 I/O module A                               | 6 SAS In port                                   |
| 3 I/O module B                               | 7 SAS Out port                                  |
| 4 Disabled button (used by engineering only) |   |

**Figure 7 LFF 12-drive enclosure: rear panel**

## SFF drive enclosure

MSA 1040 controllers support the D2700 6 Gb drive enclosure for adding storage. For information about D2700 components and LEDs, see the user guide for the D2700 disk enclosure at [www.hpe.com](http://www.hpe.com). Pictorial representations of this drive enclosure are also provided in the *MSA 1040 Quick Start Instructions* and *MSA 1040 Cable Configuration Guide*.

## Cache

To enable faster data access from disk storage, the following types of caching are performed:

- Write-back or write-through caching. The controller writes user data in the cache memory on the module rather than directly to the drives. Later, when the storage system is either idle or aging—and continuing to receive new I/O data—the controller writes the data to the drive array.
- Read-ahead caching. The controller detects sequential array access, reads ahead into the next sequence of data, and stores the data in the read-ahead cache. Then, if the next read access is for cached data, the controller immediately loads the data into the system memory, avoiding the latency of a disk access.

---

**NOTE:** See the SMU Reference Guide for more information about volume cache options.

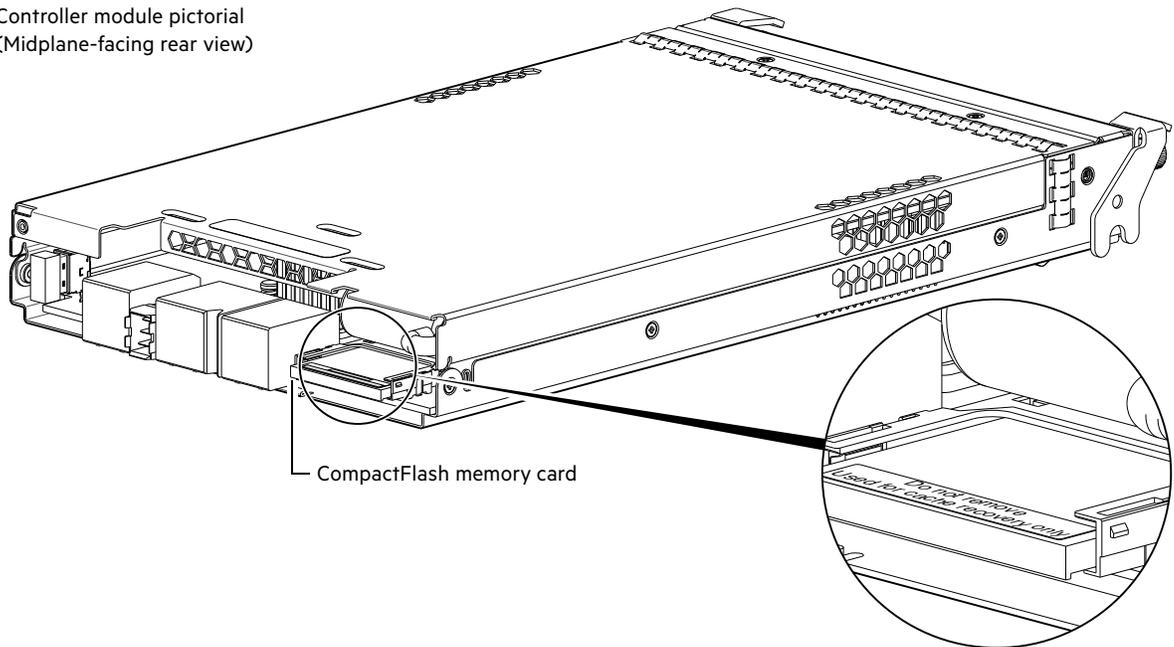
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## Transportable CompactFlash

During a power loss or array controller failure, data stored in cache is saved off to non-volatile memory (CompactFlash). The data is then written to disk after the issue is corrected. To protect against writing incomplete data to disk, the image stored on the CompactFlash is verified before committing to disk.

The CompactFlash memory card is located at the midplane-facing end of the controller module as shown below.

Controller module pictorial  
(Midplane-facing rear view)



**Figure 8 MSA 1040 CompactFlash memory card**

In single-controller configurations, if the controller has failed or does not start, and the Cache Status LED is on or blinking, the CompactFlash will need to be transported to a replacement controller to recover data not flushed to disk (see “[Controller failure in a single-controller configuration](#)” (page 48) for more information).

---

△ **CAUTION:** The CompactFlash memory card should only be removed for transportable purposes. To preserve the existing data stored in the CompactFlash, you must transport the CompactFlash from the failed controller to the replacement controller using a procedure outlined in the *HPE MSA Controller Module Replacement Instructions* shipped with the replacement controller module. Failure to use this procedure will result in the loss of data stored in the cache module. The CompactFlash must stay with the same enclosure. If the CompactFlash is used/installed in a different enclosure, data loss/data corruption will occur.

---

ⓘ **IMPORTANT:** In dual controller configurations featuring one healthy partner controller, there is no need to transport failed controller cache to a replacement controller because the cache is duplicated between the controllers (subject to volume write optimization setting).

---

## Supercapacitor pack

To protect RAID controller cache in case of power failure, MSA 1040 controllers are equipped with supercapacitor technology, in conjunction with CompactFlash memory, built into each controller module to provide extended cache memory backup time. The supercapacitor pack provides energy for backing up unwritten data in the write cache to the CompactFlash in the event of a power failure. Unwritten data in CompactFlash memory is automatically committed to disk media when power is restored. While the cache is being maintained by the supercapacitor, the Cache Status LED flashes at a rate of 1/10 second on and 9/10 second off.

## Upgrading to MSA 2040

For information about upgrading components for use with MSA controllers, see *Upgrading to the HP MSA 1040 or HP MSA 2040*.

# 3 Installing the enclosures

## Installation checklist

The following table outlines the steps required to install the enclosures and initially configure the system. To ensure a successful installation, perform the tasks in the order they are presented.

**Table 1 Installation checklist**

Step	Task	Where to find procedure
1.	Install the controller enclosure and optional drive enclosures in the rack, and attach ear caps.	See the racking instructions poster.
2.	Connect the controller enclosure and LFF/SFF drive enclosures.	See <a href="#">“Connecting controller and drive enclosures” (page 17)</a> .
3.	Connect power cords.	See the quick start instructions.
4.	Test enclosure connections.	See <a href="#">“Testing enclosure connections” (page 23)</a> .
5.	Install required host software.	See <a href="#">“Host system requirements” (page 26)</a> .
6.	Connect data hosts.	See <a href="#">“Connecting the enclosure to data hosts” (page 26)</a> . If using the optional Remote Snap feature, also see <a href="#">“Connecting two storage systems to replicate volumes” (page 31)</a> .
7.	Connect remote management hosts.	See <a href="#">“Connecting remote management hosts” (page 31)</a> .
8.	Obtain IP values and set management port IP properties on the controller enclosure.	See <a href="#">“Obtaining IP values” (page 36)</a> . See <a href="#">Connecting to the controller CLI port</a> ; with Linux and Windows topics.
9.	Perform initial configuration tasks <sup>1</sup> : <ul style="list-style-type: none"><li>• Sign in to the web-based Storage Management Utility (SMU).</li><li>• Initially configure and provision the storage system using the SMU.</li></ul>	Topics below correspond to bullets at left:  See topic about getting started in the <i>HPE MSA 1040/2040 SMU Reference Guide</i> .  See topics about configuring the system and provisioning the system (SMU Reference Guide or online help).

<sup>1</sup>The SMU is introduced in [“Accessing the SMU” \(page 41\)](#). See the SMU Reference Guide or online help for additional information.

## Connecting controller and drive enclosures

MSA 1040 controller enclosures support up to four enclosures (including the controller enclosure). You can cable drive enclosures of the same type or of mixed LFF/SFF model type.

The firmware supports both straight-through and fault-tolerant SAS cabling. Fault-tolerant cabling allows any drive enclosure to fail—or be removed—while maintaining access to other enclosures. Fault tolerance and performance requirements determine whether to optimize the configuration for high availability or high performance when cabling. MSA 1040 controller enclosures support 6 Gbit/s internal disk drive speeds, together with 6 Gbit/s (SAS2.0) expander link speeds. When connecting multiple drive enclosures, use fault-tolerant cabling to ensure the highest level of fault tolerance.

For example, the illustration on the left in [Figure 10 \(page 20\)](#) shows controller module 1A connected to expansion module 2A, with a chain of connections cascading down (blue). Controller module 1B is connected to the lower expansion module (4B) of the last drive enclosure, with connections moving in the opposite direction (green).

## Connecting the MSA 1040 controller to the SFF drive enclosure

The SFF D2700 25-drive enclosure, supporting 6 Gb internal disk drive and expander link speeds, can be attached to an MSA 1040 controller enclosure using supported mini-SAS to mini-SAS cables of 0.5 m (1.64') to 2 m (6.56') length [see [Figure 9 \(page 19\)](#)].

## Connecting the MSA 1040 controller to the LFF drive enclosure

The LFF MSA 2040 6 Gb 3.5" 12-drive enclosure, supporting 6 Gb internal disk drive and expander link speeds, can be attached to an MSA 1040 controller enclosure using supported mini-SAS to mini-SAS cables of 0.5 m (1.64') to 2 m (6.56') length [see [Figure 9 \(page 19\)](#)].

## Connecting the MSA 1040 controller to mixed model drive enclosures

MSA 1040 controllers support cabling of 6 Gb SAS link-rate LFF and SFF expansion modules—in mixed model fashion—as shown in [Figure 12 \(page 22\)](#), and further described in the *HPE MSA 1040 Cable Configuration Guide*; the *HPE MSA 1040 Quick Start Instructions*; the QuickSpecs; and HPE white papers (listed below).

## Cable requirements for MSA 1040 enclosures

---

### ① IMPORTANT:

- When installing SAS cables to expansion modules, use only supported mini-SAS x4 cables with SFF-8088 connectors supporting your 6 Gb application.
- Mini-SAS to mini-SAS 0.5 m (1.64') cables are used to connect cascaded enclosures in the rack.
- See the QuickSpecs for information about which cables are provided with your MSA 1040 products.  
<http://www.hpe.com/support/msa1040/QuickSpecs>  
(If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.)
- If additional or longer cables are required, they must be ordered separately (see relevant MSA 1040 QuickSpecs or P2000 G3 QuickSpecs for your products).
- The maximum expansion cable length allowed in any configuration is 2 m (6.56').
- Cables required, if not included, must be separately purchased.
- When adding more than two drive enclosures, you may need to purchase additional 1 m or 2 m cables, depending upon number of enclosures and cabling method used:  
Spanning 3 drive enclosures requires 1 m (3.28') cables.
- See the QuickSpecs (link provided above) regarding information about cables supported for host connection:
  - Qualified Fibre Channel cable options
  - Qualified 10GbE iSCSI cable options
  - Qualified 1 Gb RJ-45 cable options
  - Qualified HD mini-SAS standard cable and fan-out cable options supporting SFF-8644 and SFF-8088 host connection [also see [“12 Gb HD mini-SAS protocol” \(page 28\)](#)]:
    - SFF-8644 to SFF-8644 cable option is used for connecting to a 12 Gbit/s enabled host.
    - SFF-8644 to SFF-8088 cable option is used for connecting to a 6 Gbit/s enabled host.
    - A bifurcated SFF-8644 to SFF-8644 fan-out cable option is used for connecting to a 12 Gbit/s enabled host.
    - A bifurcated SFF-8644 to SFF-8088 fan-out cable option is used for connecting to a 6 Gbit/s enabled host.

---

**NOTE:** Using fan-out cables instead of standard cables will double the number of hosts that can be attached to a single system. Use of fan-out cables will halve the maximum bandwidth available to each host, but overall bandwidth available to all hosts is unchanged.

---

See [SAS fan-out cable option](#) for more information about bifurcated SAS cables.

---

For additional information concerning cabling of MSA 1040 controllers and D2700 drive enclosures, visit:

<http://www.hpe.com/support/msa1040>

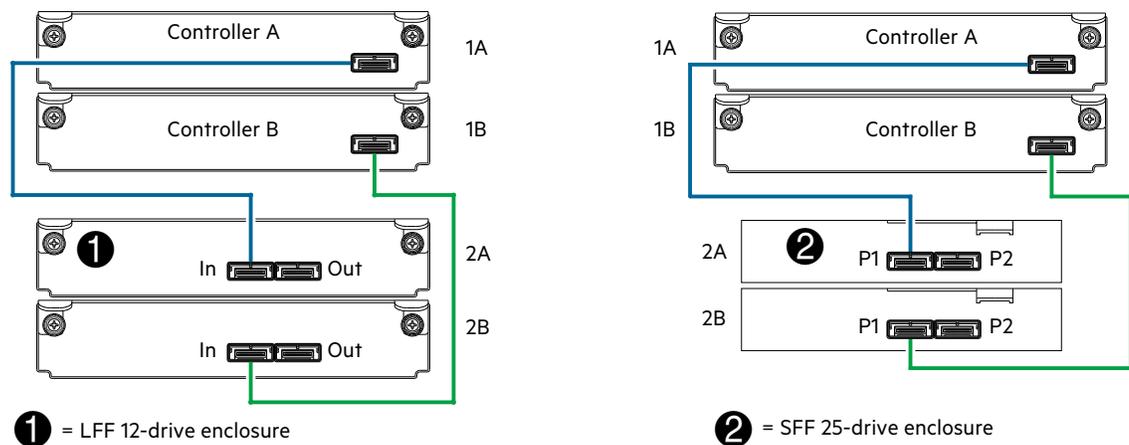
Browse for the following reference documents:

- HPE MSA 1040 Cable Configuration Guide
- HPE Remote Snap technical white paper
- HPE MSA 1040/2040 best practices

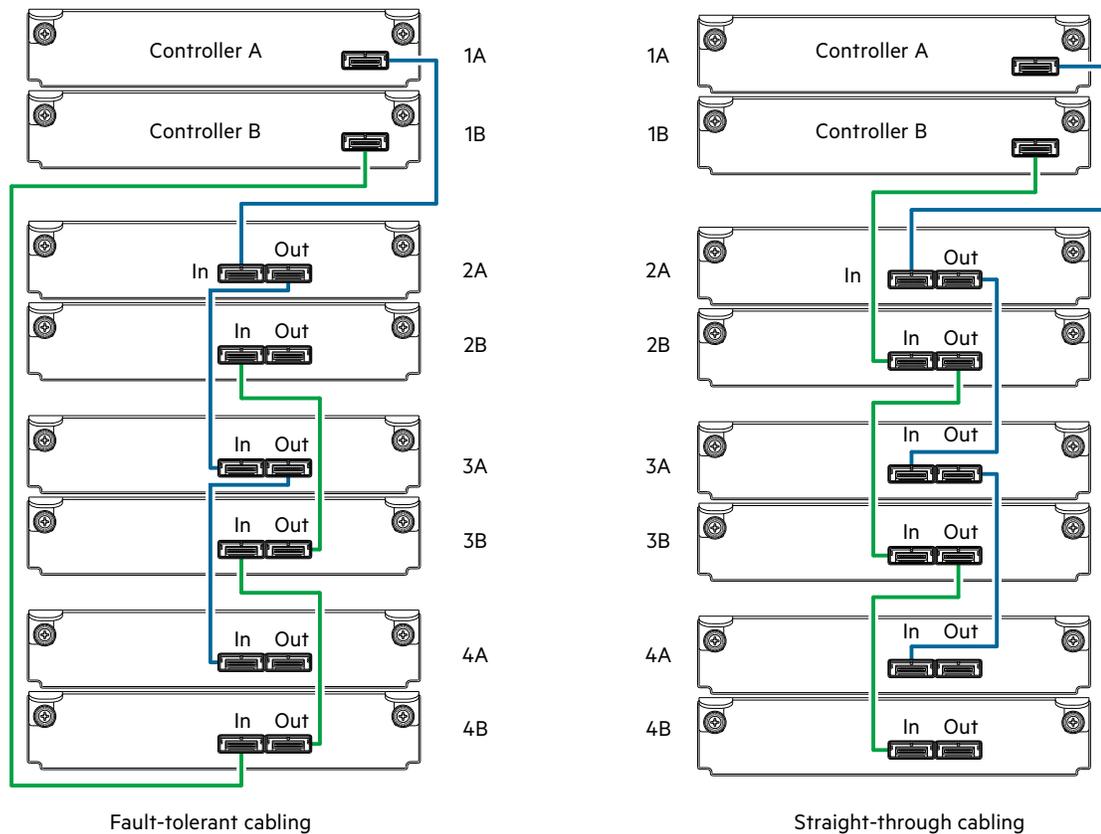
**NOTE:** For clarity, the schematic illustrations of controller and expansion modules shown in this section provide only relevant details such as expansion ports within the module face plate outline. For detailed illustrations showing all components, see “Controller enclosure—rear panel layout” (page 12).

MSA 1040 controller enclosure illustrations in the section feature enclosures equipped with dual IOMs.

ⓘ **IMPORTANT:** MSA 1040 controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.



**Figure 9 Cabling connections between the MSA 1040 controller and a single drive enclosure**

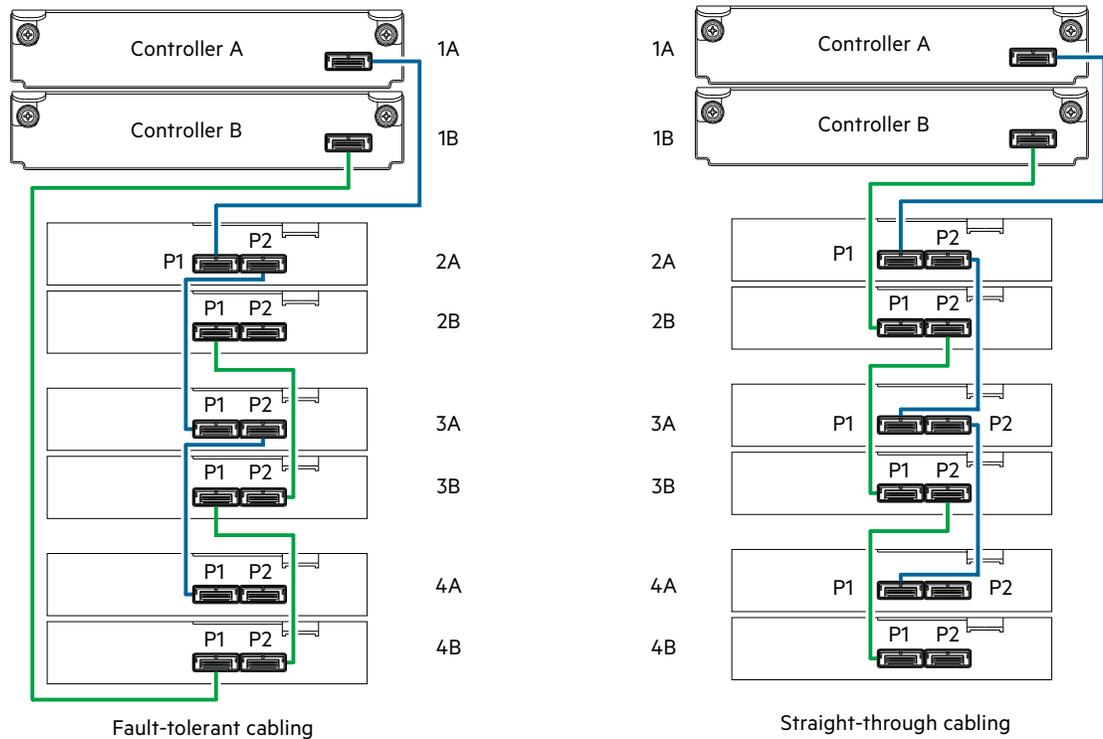


**Figure 10 Cabling connections between MSA 1040 controllers and LFF drive enclosures**

The diagram at left (above) shows fault-tolerant cabling of a dual-controller enclosure cabled to MSA 2040 6 Gb 3.5" 12-drive enclosures featuring dual-expansion modules. Controller module 1A is connected to expansion module 2A, with a chain of connections cascading down (blue). Controller module 1B is connected to the lower expansion module (4B) of the last drive enclosure, with connections moving in the opposite direction (green). Fault-tolerant cabling allows any drive enclosure to fail—or be removed—while maintaining access to other enclosures.

The diagram at right (above) shows the same storage components connected using straight-through cabling. Using this method, if a drive enclosure fails, the enclosures that follow the failed enclosure in the chain are no longer accessible until the failed enclosure is repaired or replaced.

Both illustrations in [Figure 10](#) show the maximum number of supported enclosures that can be cabled together in an MSA 1040 system configuration: up to four enclosures (including the controller enclosure).



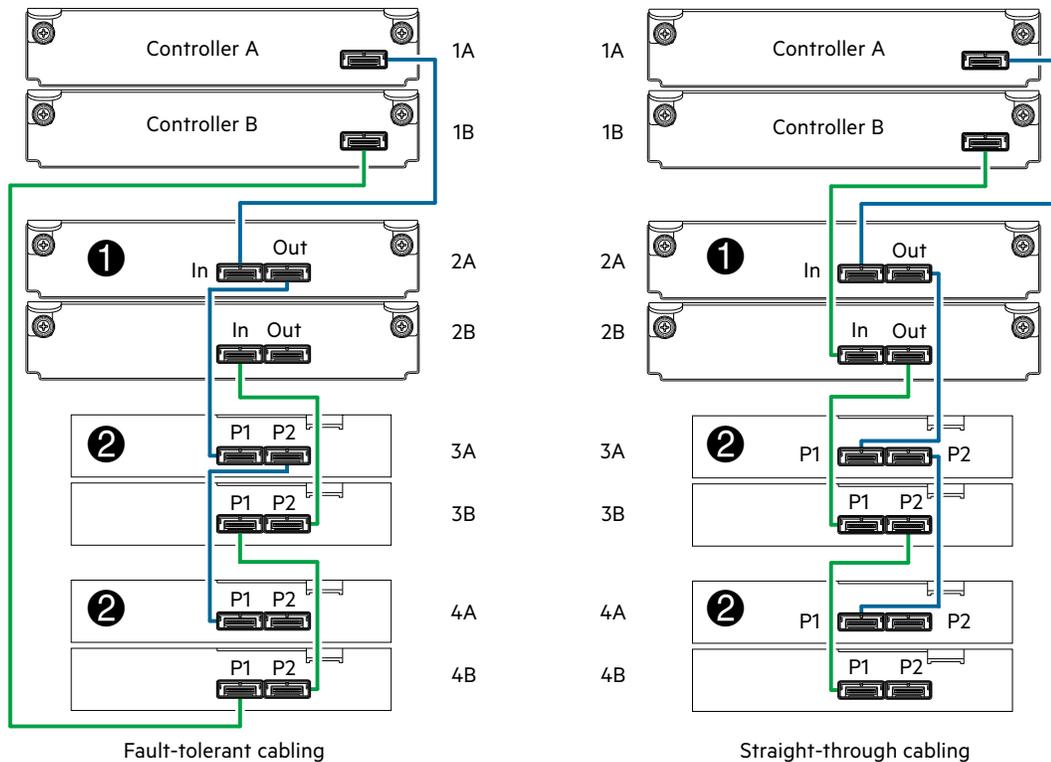
**Figure 11 Cabling connections between MSA 1040 controllers and SFF drive enclosures**

The figure above provides sample diagrams reflecting cabling of MSA 1040 controller enclosures and D2700 6 Gb drive enclosures.

The diagram at left shows fault-tolerant cabling of a dual-controller enclosure and D2700 6 Gb drive enclosures featuring dual-expansion modules. Controller module 1A is connected to expansion module 2A, with a chain of connections cascading down (blue). Controller module 1B is connected to the lower expansion module (4B) of the last drive enclosure, with connections moving in the opposite direction (green). Fault-tolerant cabling allows any drive enclosure to fail—or be removed—while maintaining access to other enclosures.

The diagram at right shows the same storage components connected using straight-through cabling. Using this method, if a drive enclosure fails, the enclosures that follow the failed enclosure in the chain are no longer accessible until the failed enclosure is repaired or replaced.

Both illustrations in [Figure 11](#) show the maximum number of supported enclosures that can be cabled together in an MSA 1040 system configuration: up to four enclosures (including the controller enclosure).



Drive enclosure IOM face plate key:

- ① = LFF 12-drive enclosure
- ② = SFF 25-drive enclosure

**Figure 12 Cabling connections between MSA 1040 controllers and drive enclosures of mixed model type**

The figure above provides sample diagrams reflecting cabling of MSA 1040 controller enclosures and supported mixed model drive enclosures. In this example, the SFF drive enclosures follow the LFF drive enclosures. Given that both drive enclosure models use 6 Gb SAS link-rate and SAS2.0 expanders, they can be ordered in desired sequence within the array, following the controller enclosure.

The diagram at left shows fault-tolerant cabling of a dual controller enclosure and mixed model drive enclosures, and the diagram at right shows the same storage components connected using straight-through cabling.

MSA 1040 controller enclosures support up to four enclosures (including the controller enclosure) for adding storage. Both illustrations in Figure 12 show the maximum number of supported enclosures that can be cabled together in an MSA 1040 system configuration.

---

① **IMPORTANT:** For comprehensive configuration options and associated illustrations, refer to the *HPE MSA 1040 Cable Configuration Guide*.

---

## Testing enclosure connections

---

**NOTE:** Once the power-on sequence for enclosures succeeds, the storage system is ready to be connected to hosts, as described in “[Connecting the enclosure to data hosts](#)” (page 26).

---

## Powering on/powering off

Before powering on the enclosure for the first time:

- Install all disk drives in the enclosure so the controller can identify and configure them at power-up.
  - Connect the cables and power cords to the enclosures as explained in the quick start instructions.
- 

**NOTE:** Power supplies used in MSA 1040 enclosures

- Many MSA 1040 controller enclosures and drive enclosures do not have power switches (they are switchless). They power on when connected to a power source, and they power off when disconnected.
  - Unlike other MSA 1040 enclosures, the D2700 provides a power button (see the user guide for D2700 disk enclosure at [www.hpe.com](http://www.hpe.com) for more information).
  - Compatible legacy drive enclosures equipped with AC power supplies may include power switches.
- 

- Generally, when powering up, make sure to power up the enclosures and associated data host in the following order:
    - Drive enclosures first  
This ensures that disks in each drive enclosure have enough time to completely spin up before being scanned by the controller modules within the controller enclosure.  
While enclosures power up, their LEDs blink. After the LEDs stop blinking—if no LEDs on the front and back of the enclosure are amber—the power-on sequence is complete, and no faults have been detected. See “[LED descriptions](#)” (page 64) for descriptions of LED behavior.
    - Controller enclosure next  
Depending upon the number and type of disks in the system, it may take several minutes for the system to become ready.
    - Data host last (if powered down for maintenance purposes)
- 

 **TIP:** Generally, when powering off, you will reverse the order of steps used for powering on.

---

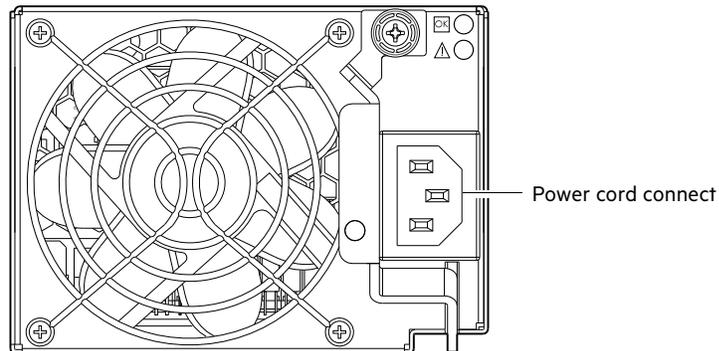
For controller and drive enclosures configured with the switchless AC power supplies, refer to the procedure described under [AC power supply](#) below.

---

- ⓘ **IMPORTANT:** See “[Power cord requirements](#)” (page 76) and the QuickSpecs for more information about power cords supported by MSA 1040 enclosures.
-

## AC power supply

Enclosures equipped with switchless power supplies rely on the power cord for power cycling. Connecting the cord from the power supply power cord connector to the appropriate power source facilitates power on, whereas disconnecting the cord from the power source facilitates power off.



**Figure 13 AC power supply**

### To power on the system:

1. Obtain a suitable AC power cord for each AC power supply that will connect to a power source.
2. Plug the power cord into the power cord connector on the back of the drive enclosure (see [Figure 13](#)). Plug the other end of the power cord into the rack power source. Wait several seconds to allow the disks to spin up.  
Repeat this sequence for each power supply within each drive enclosure.
3. Plug the power cord into the power cord connector on the back of the controller enclosure (see [Figure 13](#)). Plug the other end of the power cord into the rack power source.  
Repeat the sequence for the controller enclosure's other switchless power supply.

### To power off the system:

1. Stop all I/O from hosts to the system [see [“Stopping I/O” \(page 45\)](#)].
2. Shut down both controllers using *either* method described below:
  - o Use the SMU (Storage Management Utility) to shut down both controllers, as described in the online help and web-posted SMU Reference Guide.  
Proceed to [step 3](#).
  - o Use the command-line interface (CLI) to shut down both controllers, as described in the CLI Reference Guide.
3. Disconnect the power cord male plug from the power source.
4. Disconnect the power cord female plug from the power cord connector on the power supply.

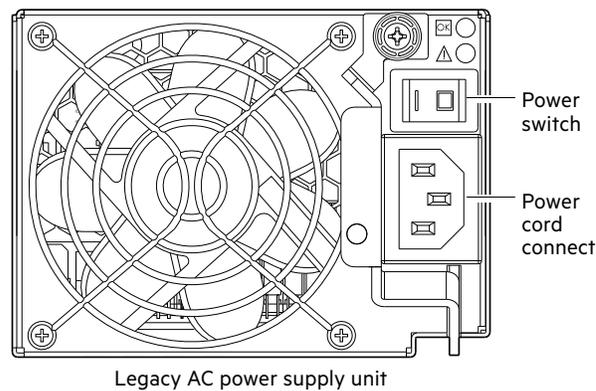
---

**NOTE:** Power cycling for enclosures equipped with a power switch is described below.

---

## AC power supply equipped with a power switch

Legacy AC power supply is shown below. Each model has a power switch.



**Figure 14 AC power supply with power switch**

### Connect power cord to legacy AC power supply

Obtain two suitable AC power cords: one for each AC power supply that will connect to a separate power source. See [Figure 14 \(page 25\)](#) when performing the following steps:

1. Verify that the enclosure power switches are in the **Off** position.
2. Identify the power cord connector on the power supply, and locate the target power source.
3. For each power supply, perform the following actions:
  - a. Plug one end of the cord into the power cord connector on the power supply.
  - b. Plug the other end of the power cord into the rack power source.
4. Verify connection of primary power cords from the rack to separate external power sources.

### Power cycle

#### To power on the system:

1. Power up drive enclosure(s).

Press the power switches at the back of each drive enclosure to the **On** position. Allow several seconds for the disks to spin up.
2. Power up the controller enclosure next.

Press the power switches at the back of the controller enclosure to the **On** position. Allow several seconds for the disks to spin up.

#### To power off the system:

1. Stop all I/O from hosts to the system [see [“Stopping I/O” \(page 45\)](#)].
2. Shut down both controllers using either method described below:
  - o Use the SMU to shut down both controllers, as described in the online help and SMU Reference Guide. Proceed to [step 3](#).
  - o Use the command-line interface to shut down both controllers, as described in the CLI Reference Guide.
3. Press the power switches at the back of the controller enclosure to the **Off** position.
4. Press the power switches at the back of each drive enclosure to the **Off** position.

## 4 Connecting hosts

### Host system requirements

Data hosts connected to HPE MSA 1040 arrays must meet requirements described herein. Depending on your system configuration, data host operating systems may require that multi-pathing is supported.

If fault-tolerance is required, then multi-pathing software may be required. Host-based multi-path software should be used in any configuration where two logical paths between the host and any storage volume may exist at the same time. This would include most configurations where there are multiple connections to the host or multiple connections between a switch and the storage.

- Use native Microsoft MPIO DSM support with **Windows Server 2008** and **Windows Server 2012**. Use either the Server Manager or the command-line interface (mpclaim CLI tool) to perform the installation. Refer to the following web sites for information about using Windows native MPIO DSM:

<http://support.microsoft.com>

<http://technet.microsoft.com> (search the site for “multipath I/O overview”)

- Use the HPE Multi-path Device Mapper for Linux Software with Linux servers. To download the appropriate device mapper multi-path enablement kit for your specific enterprise Linux operating system, go to <http://www.hpe.com/storage/spock>.

### Connecting the enclosure to data hosts

A host identifies an external port to which the storage system is attached. The external port may be a port in an I/O adapter (such as an FC HBA) in a server. Cable connections vary depending on configuration. Common cabling configurations are shown in this section. A list of supported configurations resides on the MSA 1040 manuals site at <http://www.hpe.com/support/msa1040/manuals>:

- HPE MSA 1040 Quick Start Instructions
- HPE MSA 1040 Cable Configuration Guide

These documents provide installation details and describe supported direct attach, switch-connect, and storage expansion configuration options for MSA 1040 products. For specific information about qualified host cabling options, see “[Cable requirements for MSA 1040 enclosures](#)” (page 18).

Any number or combination of LUNs can be shared among a maximum of 64 host ports (initiators), provided the total does not exceed 1,024 LUNs per MSA 1040 storage system.

### MSA 1040 Storage host interface protocols

The small form-factor pluggable (SFP transceiver or SFP) connectors used in pre-configured host ports of FC and iSCSI MSA 1040 models are further described in the subsections below. Also see “[MSA 1040 Storage models](#)” (page 9) for more information concerning use of these host ports.

---

**NOTE:** MSA 1040 FC and iSCSI controller enclosures support the optionally-licensed Remote Snap replication feature. Whereas linear storage supports FC and iSCSI host interface ports for replication, virtual storage supports iSCSI host interface ports for replication. Replication sets can also be created and viewed using CLI commands.

---

MSA 1040 SAS models use high-density mini-SAS (Serial Attached SCSI) interface protocol for host connection. These models do not support Remote Snap replication.

## Fibre Channel protocol

The MSA 1040 controller enclosures support two controller modules using the Fibre Channel interface protocol for host connection. Each controller module provides two host ports designed for use with an FC SFP supporting data rates up to 8 Gbit/s. When configured with FC SFPs, MSA 1040 controller enclosures can also be cabled to support the optionally-licensed Remote Snap replication feature via the FC ports (linear storage only).

The MSA 1040 controller supports Fibre Channel Arbitrated Loop (public or private) or point-to-point topologies. Loop protocol can be used in a physical loop or in a direct connection between two devices. Point-to-point protocol is used to connect to a fabric switch, and can also be used for direct connection. See the `set host-parameters` command within the CLI Reference Guide for command syntax and details about connection mode parameter settings relative to supported link speeds.

Fibre Channel ports are used in either of two capacities:

- To connect two storage systems through a Fibre Channel switch for use of Remote Snap replication (linear storage only).
- For attachment to FC hosts directly, or through a switch used for the FC traffic.

The first usage option requires valid licensing for the Remote Snap replication feature, whereas the second option requires that the host computer supports FC and optionally, multipath I/O.

---

 **TIP:** Use the SMU Configuration Wizard to set FC port speed. Within the SMU Reference Guide, see the topic about using the Configuration Wizard and scroll to FC port options. Use the CLI command `set host-parameters` to set FC port options, and use the `show ports` command to view information about host ports.

---

## 10GbE iSCSI protocol

The MSA 1040 controller enclosures support two controller modules using the Internet SCSI interface protocol for host connection. Each controller module provides two host ports designed for use with a 10GbE iSCSI SFP supporting data rates up to 10 Gbit/s, using either one-way or mutual CHAP (Challenge-Handshake Authentication Protocol).

---

 **TIP:** See the topics about Configuring CHAP, and CHAP and replication in the SMU Reference Guide.

---

 **TIP:** Use the SMU Configuration Wizard to set iSCSI port options. Within the SMU Reference Guide, see the topic about using the Configuration Wizard and scroll to iSCSI port options. Use the CLI command `set host-parameters` to set iSCSI port options, and use the `show ports` command to view information about host ports.

---

The 10GbE iSCSI ports are used in either of two capacities:

- To connect two storage systems through a switch for use of Remote Snap replication.
- For attachment to 10GbE iSCSI hosts directly, or through a switch used for the 10GbE iSCSI traffic.

The first usage option requires valid licensing for the Remote Snap replication feature, whereas the second option requires that the host computer supports Ethernet, iSCSI, and optionally, multipath I/O.

## 1 Gb iSCSI protocol

The MSA 1040 controller enclosures support two controller modules using the Internet SCSI interface protocol for host port connection. Each controller module provides two iSCSI host ports configured with an RJ-45 SFP supporting data rates up to 1 Gbit/s, using either one-way or mutual CHAP.

---

 **TIP:** See the topics about Configuring CHAP, and CHAP and replication in the SMU Reference Guide.

---

 **TIP:** Use the SMU Configuration Wizard to set iSCSI port options. Within the SMU Reference Guide, see the topic about using the Configuration Wizard and scroll to iSCSI port options. Use the CLI command `set host-parameters` to set iSCSI port options, and use the `show ports` command to view information about host ports.

---

The 1 Gb iSCSI ports are used in either of two capacities:

- To connect two storage systems through a switch for use of Remote Snap replication.
- For attachment to 1 Gb iSCSI hosts directly, or through a switch used for the 1 Gb iSCSI traffic.

The first usage option requires valid licensing for the Remote Snap replication feature, whereas the second option requires that the host computer supports Ethernet, iSCSI, and optionally, multipath I/O.

## 12 Gb HD mini-SAS protocol

The MSA 1040 controller enclosures support two controller modules using dual SFF-8644 HD mini-SAS host ports supporting data rates up to 12 Gbit/s. HD mini-SAS host interface ports connect to hosts or switches; they are not used for replication. Host ports can be configured via management interfaces to use standard cables or fan-out cables.

## Connecting direct attach configurations

The MSA 1040 controller enclosures support four direct-connect server connections, two per controller module. Connect appropriate cables from the server HBAs to the controller host ports as described below, and shown in the following illustrations.

To connect the MSA 1040 controller to a server or switch—using FC SFPs in controller ports—select Fibre Channel cables supporting 4/8 Gb data rates, that are compatible with the host port SFP connector (see the QuickSpecs). Such cables are also used for connecting a local storage system to a remote storage system via a switch, to facilitate use of the optional Remote Snap replication feature (linear storage only). The maximum speed supported for FC is 8 Gbit/s.

To connect the MSA 1040 controller to a server or switch—using 10GbE iSCSI SFPs in controller ports—select the appropriate qualified cable (see the QuickSpecs). Such cables are also used for connecting a local storage system to a remote storage system via a switch, to facilitate use of the optional Remote Snap replication feature.

To connect the MSA 1040 controller to a server or switch—using the 1 Gb SFPs in controller ports—select the appropriate qualified cable (see the QuickSpecs). Such cables are also used for connecting a local storage system to a remote storage system via a switch, to facilitate use of the optional Remote Snap replication feature.

To connect MSA 1040 controller modules supporting HD mini-SAS host interface ports to a server HBA or switch—using the controller's SFF-8644 dual HD mini-SAS host ports—select a qualified HD mini-SAS cable option (see QuickSpecs). Management interfaces distinguish between *standard* (dual cable with a single connector at each end) and *fan-out* SAS cables. The fan-out SAS cable is comprised of a single SFF-8644 connector that branches into two cable segments, each of which is terminated by a connector. The terminating connectors attach to the host or switch, and are either both of type SFF-8644 or SFF-8088. The storage system must be cabled using either standard cables or fan-out cables: a mixture of cable types is not supported.

---

 **IMPORTANT:** Before attaching a fan-out cable, make sure to update firmware for the SAS HBA for devices that will be attached to the fan-out cable.

---

See the SMU Reference Guide or CLI Reference Guide for more information about the fan-out setting and changing of host-interface settings for MSA 1040 controller modules. See [SAS fan-out cable option](#) for more information about fan-out cable options.

**NOTE:** The MSA 1040 diagrams that follow use a single representation for FC or iSCSI interface protocol. This is due to the fact that the port locations and labeling are identical for each of the three possible SFP options supported by the system.

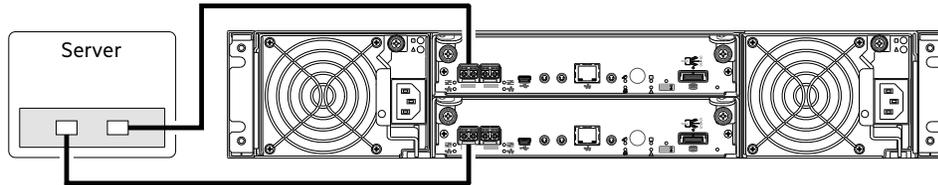
Within each host connection cabling category, the HD mini-SAS model is shown beneath the SFP model.

## Dual-controller configurations

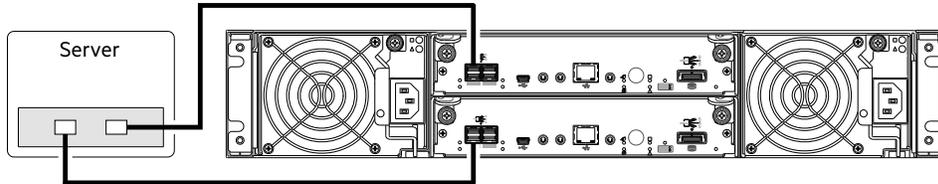
MSA 1040 controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

### One server/one HBA/dual path

MSA 1040 FC or iSCSI



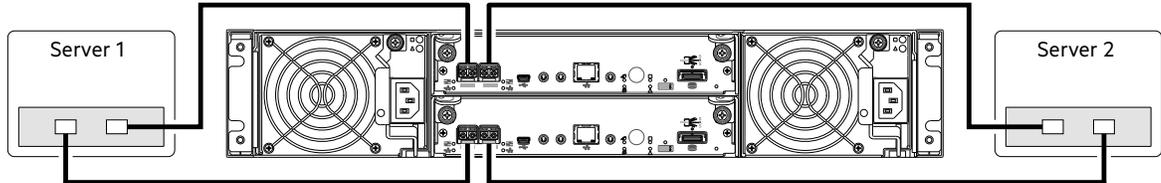
MSA 1040 SAS



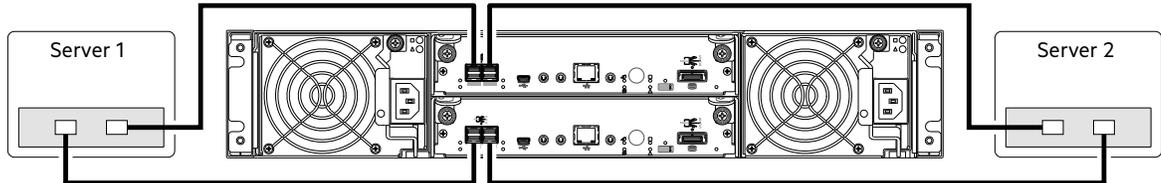
**Figure 15 Connecting hosts: direct attach—one server/one HBA/dual path**

### Two servers/one HBA per server/dual path

MSA 1040 FC or iSCSI



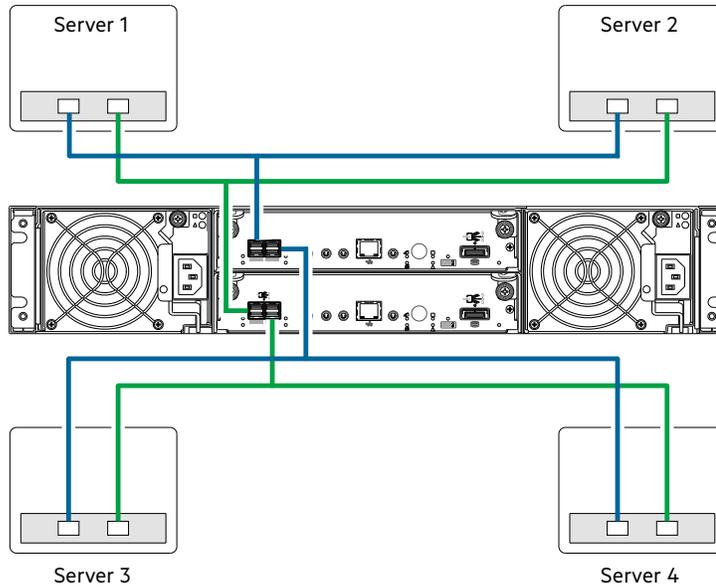
MSA 1040 SAS



**Figure 16 Connecting hosts: direct attach—two servers/one HBA per server/dual path**

Figure 16 includes host connection of an MSA 1040 SAS enclosure using standard SAS cables (bottom diagram); whereas Figure 17 shows MSA 1040 SAS host connection using fan-out cables.

MSA 1040 SAS



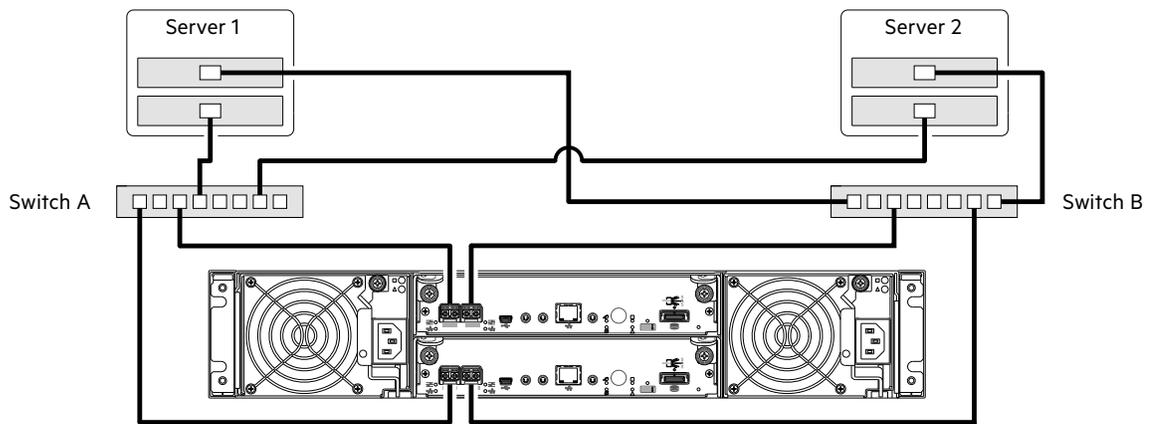
**Figure 17 Connecting hosts: direct attach—four servers/one HBA per server/dual path (fan-out)**

## Connecting switch attach configurations

### Dual controller configuration

Two servers/two switches

MSA 1040 FC or iSCSI



**Figure 18 Connecting hosts: switch attach—two servers/two switches**

## Connecting remote management hosts

The management host directly manages systems out-of-band over an Ethernet network.

1. Connect an RJ-45 Ethernet cable to the network management port on each MSA 1040 controller.
2. Connect the other end of each Ethernet cable to a network that your management host can access (preferably on the same subnet).

---

**NOTE:** Connections to this device must be made with shielded cables—grounded at both ends—with metallic RFI/EMI connector hoods, in order to maintain compliance with FCC Rules and Regulations.

---

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**NOTE:** Access via HTTPS and SSH is enabled by default, and access via HTTP and Telnet is disabled by default.

---

## Connecting two storage systems to replicate volumes

Remote Snap replication is a licensed feature for disaster-recovery. This feature performs asynchronous replication of block-level data from a volume in a primary system to a volume in a secondary system by creating an internal snapshot of the primary volume, and copying the snapshot data to the secondary system via Fibre Channel (linear storage only) or iSCSI links. Replication can be completed using either the SMU v3 for virtual storage or SMU v2 for linear storage.

The two associated volumes form a replication set, and only the primary volume (source of data) can be mapped for access by a server. Both systems must be licensed to use Remote Snap, and must be connected through switches to the same fabric or network (no direct attach). The server accessing the replication set need only be connected to the primary system. If the primary system goes offline, a connected server can access the replicated data from the secondary system.

Replication configuration possibilities are many, and can be cabled—in switch attach fashion—to support MSA 1040 FC or iSCSI systems on the same network, or on different networks (MSA 1040 SAS systems do not support replication). As you consider the physical connections of your system—specifically connections for replication—keep several important points in mind:

- Ensure that controllers have connectivity between systems, whether local or remote.
- Whereas linear storage supports FC and iSCSI host interface ports for replication, virtual storage supports iSCSI host interface ports for replication. Both linear and virtual storage support all qualified host connections.
- If using the SMU v2 user interface, be sure of the desired link type before creating the replication set, because you cannot change the replication link type after creating the replication set.
- Assign specific ports for replication whenever possible. By specifically assigning ports available for replication, you free the controller from scanning and assigning the ports at the time replication is performed.
- For remote replication, ensure that all ports assigned for replication are able to communicate appropriately with the remote replication system (see the CLI Reference Guide for more information).
  - For linear replications, use the `verify remote-link` command.
  - For virtual replications, use the `query peer-connection` command.
- Allow a sufficient number of ports to perform replication. This permits the system to balance the load across those ports as I/O demands rise and fall. If some of the volumes replicated are owned by controller A and others are owned by controller B, then allow one port for replication on each controller module to address replication traffic load.
- For the sake of system security, do not unnecessarily expose the controller module network port to an external network connection.

Conceptual cabling examples are provided addressing cabling on the same network and cabling relative to different networks.

- 
- ① **IMPORTANT:** Remote Snap must be licensed on all systems configured for replication, and the controller module firmware version must be compatible on all systems licensed for replication.

For virtual storage environments, a Virtualization license is also required to enable replication.

---

**NOTE:** Systems must be correctly cabled before performing replication. See the following documents for more information about using Remote Snap to perform replication tasks:

- HPE Remote Snap technical white paper
  - HPE MSA 1040/2040 best practices
  - HPE MSA 1040/2040 SMU Reference Guide
  - HPE MSA 1040/2040 CLI Reference Guide
  - HPE MSA 1040/2040 Event Descriptions Reference Guide
  - HPE MSA 1040 Cable Configuration Guide
- 

To access user documents, see the MSA 1040 manuals site:

<http://www.hpe.com/support/msa1040/manuals>.

To access a technical white paper about Remote Snap replication software, navigate to the link shown:

<http://h20195.www2.hp.com/V2/GetDocument.aspx?docname=4AA1-0977ENW&cc=us&lc=en>.

## Cabling for replication

This section shows example replication configurations for MSA 1040 controller enclosures using FC or iSCSI host interface protocol. The following illustrations provide conceptual examples of cabling to support Remote Snap replication. Blue cables show I/O traffic and green cables show replication traffic.

---

**NOTE:** A simplified version of the MSA 1040 controller enclosure rear panel is used in cabling illustrations to portray either the FC (linear storage only) or iSCSI host interface protocol. The rear panel layouts for the three configurations are identical; only the external connectors used in the host interface ports differ.

---

Once the MSA 1040 systems are physically cabled, see the SMU Reference Guide or online help for information about configuring, provisioning, and using the optional Remote Snap feature.

---

**NOTE:** See the SMU Reference Guide for more information about using Remote Snap to perform replication tasks. See [“Replication setup and verification” \(page 52\)](#).

---

## Host ports and replication

MSA 1040 controller modules use qualified SFP options of the same type (FC or iSCSI). Each host port can perform I/O or replication. MSA 1040 SAS controllers do not support replication.

## Dual-controller configuration

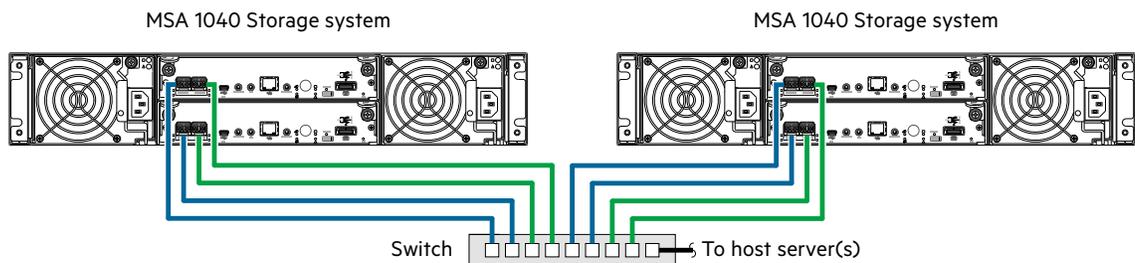
Each of the following diagrams show the rear panel of two MSA 1040 controller enclosures equipped with dual-controller modules using FC or iSCSI host interface protocol. The controller modules use qualified SFP options of the same type, supporting the host interface protocol ordered from your supplier.

❗ **IMPORTANT:** Whereas linear storage supports FC and iSCSI host interface protocols for replication, virtual storage supports iSCSI host interface protocol for replication. Both linear and virtual storage support qualified FC and iSCSI SFP options for host connection.

❗ **IMPORTANT:** MSA 1040 controller enclosures support dual-controller configuration only. Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

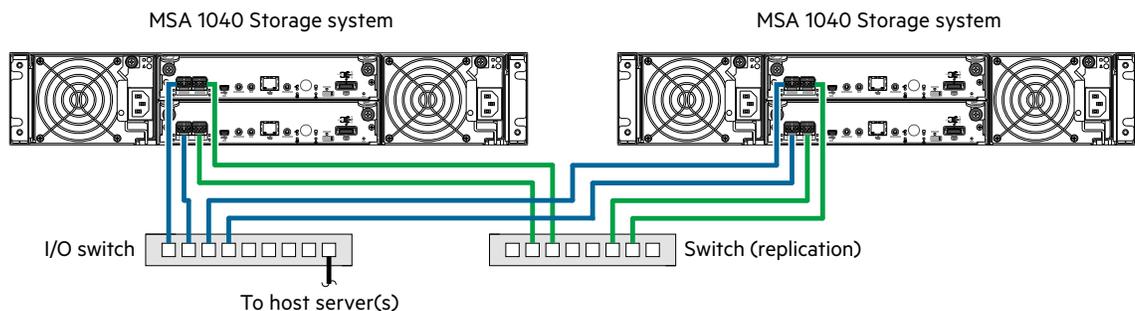
### Multiple servers/single network

The diagram below shows the rear panel of two MSA 1040 controller enclosures with both I/O and replication occurring on the same physical network.



**Figure 19 Connecting two storage systems for Remote Snap: multiple servers/one switch/one location**

The diagram below shows host interface connections and replication, with I/O and replication occurring on different networks. For optimal protection, use two switches. Connect one port from each controller module to the first switch to facilitate I/O traffic, and connect one port from each controller module to the second switch to facilitate replication. Using two switches in tandem avoids the potential single point of failure inherent to using a single switch, however, if one switch fails, either I/O or replication will fail, depending on which of the switches fails.

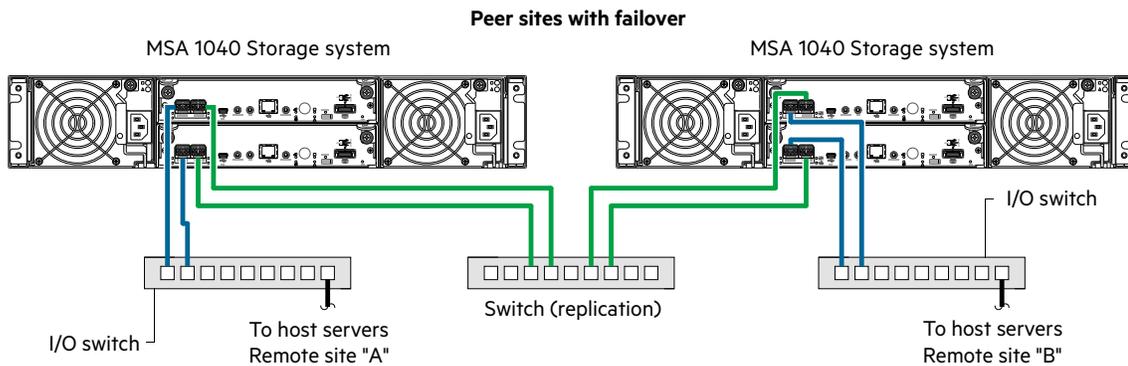


**Figure 20 Connecting two storage systems for Remote Snap: multiple servers/switches/one location**

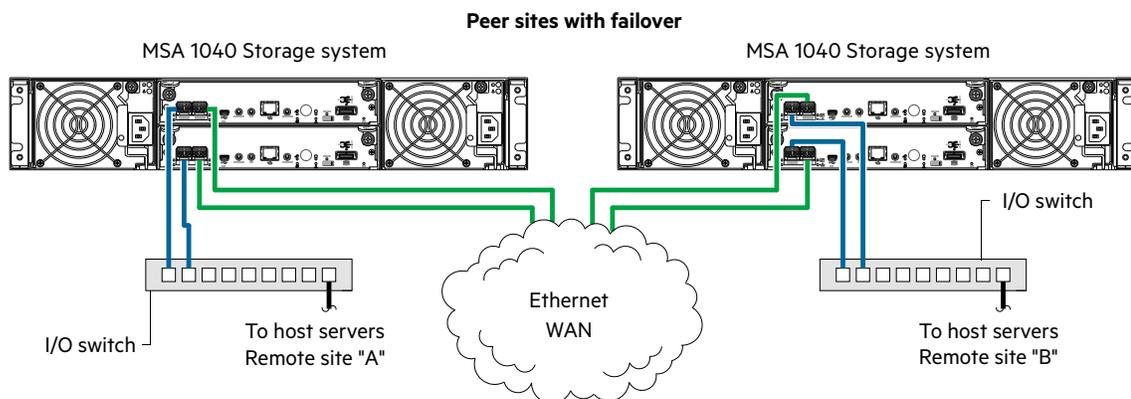
Virtual Local Area Network (VLAN) and zoning can be employed to provide separate networks for iSCSI and FC, respectively. Whether using a single switch or multiple switches for a particular interface, you can create a VLAN or zone for I/O and a VLAN or zone for replication to isolate I/O traffic from replication traffic. Since each switch would include both VLANs or zones, the configuration would function as multiple networks.

## Multiple servers/different networks/multiple switches

The diagrams below shows the rear panel of two MSA 1040 controller enclosures with both I/O and replication occurring on different networks.



**Figure 21 Connecting two storage systems for Remote Snap: multiple servers/switches/two locations**



**Figure 22 Connecting two storage systems for Remote Snap: multiple servers/switches/two locations**

Although not shown in the preceding cabling examples, you can cable replication-enabled MSA 1040 and P2000 G3 systems—via switch attach—for performing replication tasks (linear storage only).

## Updating firmware

After installing the hardware and powering on the storage system components for the first time, verify that the controller modules, expansion modules, and disk drives are using the current firmware release.

---

**NOTE:** Update firmware by installing a firmware file obtained from the HPE web download site at [www.hpe.com/support](http://www.hpe.com/support). To install an HPE ROM Flash Component or firmware Smart Component, follow the instructions on the HPE website.

---

Otherwise, to install a firmware binary file, follow the steps below:

- If using the SMU v3, in the **System** topic, select **Action** > **Update Firmware**.

The Update Firmware panel opens. The Update Controller Modules tab shows versions of firmware components currently installed in each controller.

---

**NOTE:** The SMU v3 does *not* provide a check-box for enabling or disabling Partner Firmware Update for the partner controller. To enable or disable the setting, use the `set advanced-settings` command, and set the `partner-firmware-upgrade` parameter. See the CLI Reference Guide for more information about command parameter syntax.

---

- Using the SMU v2, right-click the system in the Configuration View panel, and select **Tools Update > Firmware**.

The Update Firmware panel displays the currently installed firmware versions, and enables you to update them.

Optionally, you can update firmware using FTP as described in the SMU Reference Guide.

---

ⓘ **IMPORTANT:** See the topics about updating firmware within the SMU Reference Guide before performing a firmware update.

---

**NOTE:** To locate and download the latest software and firmware updates for your product, go to [www.hpe.com/support](http://www.hpe.com/support).

---

# 5 Connecting to the controller CLI port

## Device description

The MSA 1040 controllers feature a command-line interface port used to cable directly to the controller and initially set IP addresses, or perform other configuration tasks. This port employs a mini-USB Type B form factor, requiring a cable that is supplied with the controller, and additional support, so that a server or other computer running a Linux or Windows operating system can recognize the controller enclosure as a connected device. Without this support, the computer might not recognize that a new device is connected, or might not be able to communicate with it. For Linux computers, no new driver files are needed, but a Linux configuration file must be created or modified.

For Windows computers, the Windows USB device driver must be downloaded from a CD or HPE website, and installed on the computer that will be cabled directly to the controller command-line interface port.

---

**NOTE:** Directly cabling to the command-line interface (CLI) port is an out-of-band connection because it communicates outside the data paths used to transfer information from a computer or network to the controller enclosure.

---

## Preparing a Linux computer before cabling to the CLI port

Although Linux operating systems do not require installation of a device driver, certain parameters must be provided during driver loading to enable recognition of the MSA 1040 controller enclosures. To load the Linux device driver with the correct parameters, the following command is required:

```
modprobe usbserial vendor=0x210c product=0xa4a7 use_acm=1
```

Optionally, the information can be incorporated into the `/etc/modules.conf` file.

## Downloading a device driver for Windows computers

A Windows USB device driver download is provided for communicating directly with the controller command-line interface port using a USB cable to connect the controller enclosure and the computer.

---

**NOTE:** Access the download from the HPE MSA support page at <http://www.hpe.com/support>.

---

The USB device driver is also available from the *HPE MSA 1040 Software Support and Documentation CD* that shipped with your product.

## Obtaining IP values

One method of obtaining IP values for your system is to use a network management utility to discover “HP MSA Storage” devices on the local LAN through SNMP. Alternative methods for obtaining IP values for your system are described in the following subsections.

### Setting network port IP addresses using DHCP

In DHCP mode, network port IP address, subnet mask, and gateway values are obtained from a DHCP server if one is available. If a DHCP server is unavailable, current addressing is unchanged.

1. Look in the DHCP server’s pool of leased addresses for two IP addresses assigned to “HP MSA Storage.”
2. Use a ping broadcast to try to identify the device through the ARP table of the host.

If you do not have a DHCP server, you will need to ask your system administrator to allocate two IP addresses, and set them using the command-line interface during initial configuration (described below).

---

**NOTE:** For more information, in the SMU Reference Guide see either the SMU v3 Configuration Wizard topic about network configuration or the SMU v2 Configuration Wizard topic about configuring network ports.

---

## Setting network port IP addresses using the CLI port and cable

You can set network port IP addresses manually using the command-line interface port and cable. If you have not done so already, you need to enable your system for using the command-line interface port [also see [“Using the CLI port and cable—known issues on Windows”](#) (page 40)].

---

**NOTE:** For Linux systems, see [“Preparing a Linux computer before cabling to the CLI port”](#) (page 36). For Windows systems see [“Downloading a device driver for Windows computers”](#) (page 36).

---

Network ports on controller module A and controller module B are configured with the following factory-default IP settings:

- **Management Port IP Address:** 10.0.0.2 (controller A), 10.0.0.3 (controller B)
- **IP Subnet Mask:** 255.255.255.0
- **Gateway IP Address:** 10.0.0.1

If the default IP addresses are not compatible with your network, you must set an IP address for each network port using the command-line interface embedded in each controller module. The command-line interface enables you to access the system using the USB (universal serial bus) communication interface and terminal emulation software. The USB cable and CLI port support USB version 2.0.

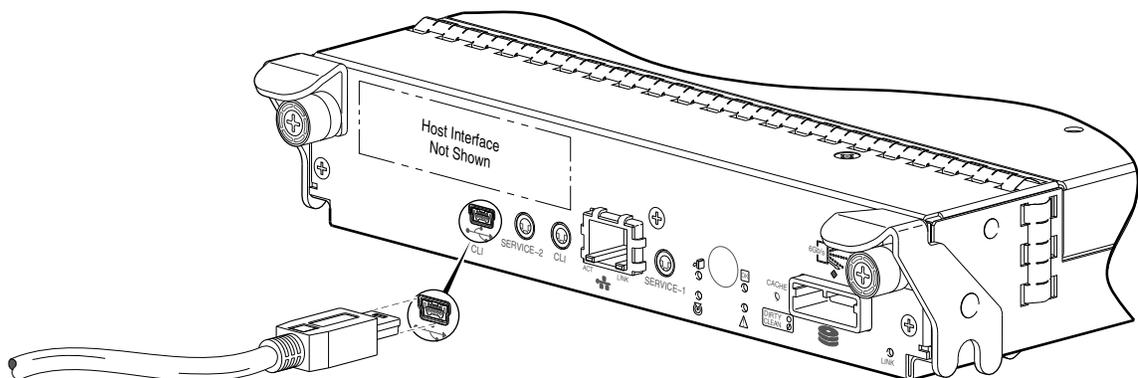
Use the CLI commands described in the steps below to set the IP address for the network port on each controller module. Once new IP addresses are set, you can change them as needed using the SMU. Be sure to change the IP address via the SMU before changing the network configuration.

---

**NOTE:** Changing IP settings can cause management hosts to lose access to the storage system.

---

1. From your network administrator, obtain an IP address, subnet mask, and gateway address for controller A, and another for controller B.  
Record these IP addresses so that you can specify them whenever you manage the controllers using the SMU or the CLI.
2. Use the provided USB cable to connect controller A to a USB port on a host computer. The USB mini 5 male connector plugs into the CLI port as shown in [Figure 23](#) (generic controller module is shown).



Connect USB cable to CLI port on controller faceplate

**Figure 23** Connecting a USB cable to the CLI port

3. Enable the CLI port for subsequent communication:
  - o Linux customers should enter the command syntax provided in “Preparing a Linux computer before cabling to the CLI port” (page 36).
  - o Windows customers should locate the downloaded device driver described in “Downloading a device driver for Windows computers” (page 36), and follow the instructions provided for proper installation.
4. Start and configure a terminal emulator, such as HyperTerminal or VT-100, using the display settings in Table 2 (page 38) and the connection settings in Table 3 (page 38) (also, see the note following this procedure).

**Table 2 Terminal emulator display settings**

Parameter	Value
Terminal emulation mode	VT-100 or ANSI (for color support)
Font	Terminal
Translations	None
Columns	80

**Table 3 Terminal emulator connection settings**

Parameter	Value
Connector	COM3 (for example) <sup>1,2</sup>
Baud rate	115,200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

<sup>1</sup> Your server or laptop configuration determines which COM port is used for Disk Array USB Port.

<sup>2</sup> Verify the appropriate COM port for use with the CLI.

5. In the terminal emulator, connect to controller A.
6. Press **Enter** to display the CLI prompt (#).

The CLI displays the system version, MC version, and login prompt:

- a. At the login prompt, enter the default user `manage`.
- b. Enter the default password `!manage`.

If the default user or password—or both—have been changed for security reasons, enter the secure login credentials instead of the defaults shown above.

---

**NOTE:** The following CLI commands enable you to set the management mode to v3 or v2:

- Use `set protocols` to change the default management mode.
- Use `set cli-parameters` to change the current management mode for the CLI session.

The system defaults to v3 for new customers and v2 for existing users (see the CLI Reference Guide for more information).

---

7. At the prompt, type the following command to set the values you obtained in step 1 for each network port, first for controller A and then for controller B:

```
set network-parameters ip address netmask netmask gateway gateway controller a|b
```

where:

- o *address* is the IP address of the controller
- o *netmask* is the subnet mask
- o *gateway* is the IP address of the subnet router

- o a | b specifies the controller whose network parameters you are setting

For example:

```
# set network-parameters ip 192.168.0.10 netmask 255.255.255.0 gateway 192.168.0.1 controller a
```

```
# set network-parameters ip 192.168.0.11 netmask 255.255.255.0 gateway 192.168.0.1 controller b
```

8. Type the following command to verify the new IP addresses:

```
show network-parameters
```

Network parameters, including the IP address, subnet mask, and gateway address are displayed for each controller.

9. Use the `ping` command to verify network connectivity.

For example:

```
# ping 192.168.0.1 (gateway)
```

```
Info: Pinging 192.168.0.1 with 4 packets.
```

```
Success: Command completed successfully. - The remote computer responded with 4 packets.
```

10. In the host computer's command window, type the following command to verify connectivity, first for controller A and then for controller B:

```
ping controller-IP-address
```

If you cannot access your system for at least three minutes after changing the IP address, your network might require you to restart the Management Controller(s) using the CLI. When you restart a Management Controller, communication with it is temporarily lost until it successfully restarts.

Type the following command to restart the management controller on both controllers:

```
restart mc both
```

11. When you are done using the CLI, exit the emulator.

12. Retain the new IP addresses to access and manage the controllers, using either the SMU or the CLI.

---

**NOTE:** Using HyperTerminal with the CLI on a **Microsoft Windows** host:

On a host computer connected to a controller module's mini-USB CLI port, incorrect command syntax in a HyperTerminal session can cause the CLI to hang. To avoid this problem, use correct syntax, use a different terminal emulator, or connect to the CLI using SSH rather than the mini-USB cable.

Be sure to close the HyperTerminal session before shutting down the controller or restarting its Management Controller. Otherwise, the host's CPU cycles may rise unacceptably.

---

If communication with the CLI is disrupted when using an out-of-band cable connection, communication can sometimes be restored by disconnecting and reattaching the mini-USB cable as described in [step 2](#) on page 37.

The USB device driver is accessible from the *Software Support and Documentation CD* that shipped with your product. The USB device driver is also available as a download.

---

**NOTE:** Access the download from your HPE MSA support website at <http://www.hpe.com/support>.

---

## Using the CLI port and cable—known issues on Windows

When using the CLI port and cable for setting controller IP addresses, be aware of the following known issues on Microsoft Windows platforms.

### Problem

On Windows operating systems, the USB CLI port may encounter issues preventing the terminal emulator from reconnecting to storage after the Management Controller (MC) restarts or the USB cable is unplugged and reconnected.

### Workaround

Follow these steps when using the mini-USB cable and USB Type B CLI port to communicate out-of-band between the host and controller module for setting network port IP addresses.

To create a new connection or open an existing connection (HyperTerminal):

1. From the Windows Control Panel, select Device Manager.
2. Connect using the USB COM port and Detect Carrier Loss option.
  - a. Select **Connect To > Connect using:** > pick a COM port from the list.
  - b. Select the **Detect Carrier Loss** check box.

The Device Manager page should show “Ports (COM & LPT)” with an entry entitled “Disk Array USB Port (COM $n$ )”—where  $n$  is your system’s COM port number.

3. Set network port IP addresses using the CLI (see procedure on [page 37](#)).

To restore a hung connection when the MC is restarted (any supported terminal emulator):

1. If the connection hangs, disconnect and quit the terminal emulator program.
  - a. Using Device Manager, locate the COM $n$  port assigned to the Disk Array Port.
  - b. Right-click on the hung **Disk Array USB Port (COM $n$ )**, and select **Disable**.
  - c. Wait for the port to disable.
2. Right-click on the previously hung—now disabled—**Disk Array USB Port (COM $n$ )**, and select **Enable**.
3. Start the terminal emulator and connect to the COM port.
4. Set network port IP addresses using the CLI (see procedure on [page 37](#)).

## 6 Basic operation

Verify that you have completed the sequential “Installation Checklist” instructions in [Table 1 \(page 17\)](#). Once you have successfully completed steps 1 through 8 therein, you can access the management interface using your web browser to complete the system setup.

### Accessing the SMU

Upon completing the hardware installation, you can access the web-based management interface—SMU (Storage Management Utility)—from the controller module to monitor and manage the storage system. Invoke your web browser, and enter the `https://IP-address` of the controller module’s network port in the address field (obtained during completion of “Installation Checklist” step 8), then press **Enter**. To Sign In to the SMU, use the default user name **manage** and password **!manage**. If the default user or password—or both—have been changed for security reasons, enter the secure login credentials instead of the defaults. This brief Sign In discussion assumes proper web browser setup.

---

**!** **IMPORTANT:** For detailed information about accessing and using the SMU, see the section about getting started in the web-posted SMU Reference Guide.

---

The Getting Started section provides instructions for signing-in to the SMU, introduces key concepts, addresses browser setup, and provides tips for using the main window and the help window.

---

**💡 TIP:** After signing in to the SMU, you can use online help as an alternative to consulting the reference guide.

---

### Configuring and provisioning the storage system

Once you have familiarized yourself with the SMU, use it to configure and provision the storage system. If you are licensed to use the optional Remote Snap feature, you may also need to set up storage systems for replication. Refer to the following topics within the SMU Reference Guide or online help:

- Configuring the system
  - Provisioning the system
  - Using Remote Snap to replicate volumes
- 

**NOTE:** See the topic about installing a license within the SMU Reference Guide for instructions about creating a temporary license or installing a permanent license.

---

**!** **IMPORTANT:** If the system is used in a VMware environment, set the system Missing LUN Response option to use its Illegal Request setting. To do so, see either the topic about changing the missing LUN response in the SMU Reference Guide or the command topic about the set-advanced-settings command in the CLI Reference Guide.

---

# 7 Troubleshooting

These procedures are intended to be used only during initial configuration, for the purpose of verifying that hardware setup is successful. They are not intended to be used as troubleshooting procedures for configured systems using production data and I/O.

## USB CLI port connection

MSA 1040 controllers feature a CLI port employing a mini-USB Type B form factor. If you encounter problems communicating with the port after cabling your computer to the USB device, you may need to either download a device driver (Windows), or set appropriate parameters via an operating system command (Linux). See [“Connecting to the controller CLI port” \(page 36\)](#) for more information.

## Fault isolation methodology

MSA 1040 controllers provide many ways to isolate faults. This section presents the basic methodology used to locate faults within a storage system, and to identify the associated Field-replaceable Units (FRUs) affected.

As noted in [“Basic operation” \(page 41\)](#), use the SMU to configure and provision the system upon completing the hardware installation. As part of this process, configure and enable event notification so the system will notify you when a problem occurs that is at or above the configured severity (see the topics about using the Configuration Wizard and configuring event notification within the SMU Reference Guide). With event notification configured and enabled, you can follow the recommended actions in the notification message to resolve the problem, as further discussed in the options presented below.

### Basic steps

The basic fault isolation steps are listed below:

- Gather fault information, including using system LEDs [see [“Gather fault information” \(page 43\)](#)].
- Determine where in the system the fault is occurring [see [“Determine where the fault is occurring” \(page 43\)](#)].
- Review event logs [see [“Review the event logs” \(page 43\)](#)].
- If required, isolate the fault to a data path component or configuration [see [“Isolate the fault” \(page 44\)](#)].

Cabling systems to enable use of the licensed Remote Snap feature—to replicate volumes—is another important fault isolation consideration pertaining to initial system installation. See [“Isolating Remote Snap replication faults” \(page 52\)](#) for more information about troubleshooting during initial setup.

### Options available for performing basic steps

When performing fault isolation and troubleshooting steps, select the option or options that best suit your site environment. Use of any option (four options are described below) is not mutually-exclusive to the use of another option. You can use the SMU to check the health icons/values for the system and its components to ensure that everything is okay, or to drill down to a problem component. If you discover a problem, both the SMU and the CLI provide recommended-action text online. Options for performing basic steps are listed according to frequency of use:

- Use the SMU.
- Use the CLI.
- Monitor event notification.
- View the enclosure LEDs.

### Use the SMU

The SMU uses health icons to show OK, Degraded, Fault, or Unknown status for the system and its components. The SMU enables you to monitor the health of the system and its components. If any component has a problem, the system health will be Degraded, Fault, or Unknown. Use the SMU GUI to drill down to find each component that has a problem, and follow actions in the Health Recommendations field for the component to resolve the problem.

## Use the CLI

As an alternative to using the SMU, you can run the `show system` command in the CLI to view the health of the system and its components. If any component has a problem, the system health will be Degraded, Fault, or Unknown, and those components will be listed as Unhealthy Components. Follow the recommended actions in the component Health Recommendations field to resolve the problem.

## Monitor event notification

With event notification configured and enabled, you can view event logs to monitor the health of the system and its components. If a message tells you to check whether an event has been logged, or to view information about an event in the log, you can do so using either the SMU or the CLI. Using the SMU, you would view the event log and then click on the event message to see detail about that event. Using the CLI, you would run the `show events detail` command (with additional parameters to filter the output) to see the detail for an event.

## View the enclosure LEDs

You can view the LEDs on the hardware (while referring to [LED descriptions](#) for your enclosure model) to identify component status. If a problem prevents access to either the SMU or the CLI, this is the only option available. However, monitoring/management is often done at a management console using storage management interfaces, rather than relying on line-of-sight to LEDs of racked hardware components.

## Performing basic steps

You can use any of the available options in performing the basic steps comprising the fault isolation methodology.

### Gather fault information

When a fault occurs, it is important to gather as much information as possible. Doing so will help you determine the correct action needed to remedy the fault.

Begin by reviewing the reported fault:

- Is the fault related to an internal data path or an external data path?
- Is the fault related to a hardware component such as a disk drive module, controller module, or power supply?

By isolating the fault to *one* of the components within the storage system, you will be able to determine the necessary action more quickly.

### Determine where the fault is occurring

Once you have an understanding of the reported fault, review the enclosure LEDs. The enclosure LEDs are designed to alert users of any system faults, and might be what alerted the user to a fault in the first place.

When a fault occurs, the Fault ID status LED on the enclosure right ear (see [“Front panel components” \(page 11\)](#)) illuminates. Check the LEDs on the back of the enclosure to narrow the fault to a FRU, connection, or both. The LEDs also help you identify the location of a FRU reporting a fault.

Use the SMU to verify any faults found while viewing the LEDs. The SMU is also a good tool to use in determining where the fault is occurring if the LEDs cannot be viewed due to the location of the system. The SMU provides you with a visual representation of the system and where the fault is occurring. It can also provide more detailed information about FRUs, data, and faults.

### Review the event logs

The event logs record all system events. Each event has a numeric code that identifies the type of event that occurred, and has one of the following severities:

- Critical. A failure occurred that may cause a controller to shut down. Correct the problem *immediately*.
- Error. A failure occurred that may affect data integrity or system stability. Correct the problem as soon as possible.
- Warning. A problem occurred that may affect system stability, but not data integrity. Evaluate the problem and correct it if necessary.

- Informational. A configuration or state change occurred, or a problem occurred that the system corrected. No immediate action is required.

See the Event Descriptions Reference Guide for information about specific events, located at your MSA 1040 manuals page: <http://www.hpe.com/support/msa1040/manuals>.

The event logs record all system events. It is very important to review the logs, not only to identify the fault, but also to search for events that might have caused the fault to occur. For example, a host could lose connectivity to a disk group if a user changes channel settings without taking the storage resources assigned to it into consideration. In addition, the type of fault can help you isolate the problem to either hardware or software.

## Isolate the fault

Occasionally it might become necessary to isolate a fault. This is particularly true with data paths, due to the number of components comprising the data path. For example, if a host-side data error occurs, it could be caused by any of the components in the data path: controller module, cable, connectors, switch, or data host.

## If the enclosure does not initialize

It may take up to two minutes for the enclosures to initialize. If the enclosure does not initialize:

- Perform a rescan.
- Power cycle the system.
- Make sure the power cord is properly connected, and check the power source that it is connected to.
- Check the event log for errors.

## Correcting enclosure IDs

When installing a system with drive enclosures attached, the enclosure IDs might not agree with the physical cabling order. This is because the controller might have been previously attached to some of the same enclosures during factory testing, and it attempts to preserve the previous enclosure IDs if possible. To correct this condition, make sure that both controllers are up, and perform a rescan using the SMU or the CLI. This will reorder the enclosures, but can take up to two minutes for the enclosure IDs to be corrected.

To perform a rescan using the CLI, type the following command:

```
rescan
```

To rescan using the SMU v3:

1. Verify that both controllers are operating normally.
2. Do one of the following:
  - o Point to the **System** tab and select **Rescan Disk Channels**.
  - o In the **System** topic, select **Action > Rescan Disk Channels**.
3. Click **Rescan**.

To rescan using the SMU v2:

1. Verify that both controllers are operating normally.
2. In the Configuration View panel, right-click the system and select **Tools > Rescan Disk Channels**.
3. Click **Rescan**.

## Stopping I/O

When troubleshooting disk drive and connectivity faults, stop I/O to the affected disk groups from all hosts and remote systems as a data protection precaution. As an additional data protection precaution, it is helpful to conduct regularly scheduled backups of your data.

---

❗ **IMPORTANT:** Stopping I/O to a disk group is a host-side task, and falls outside the scope of this document.

---

When on-site, you can verify there is no I/O activity by briefly monitoring the system LEDs. When accessing the storage system remotely, this is not possible. Remotely, you can use the `show disk-group-statistics` command to determine if input and output has stopped. Perform these steps:

1. Using the CLI, run the `show disk-group-statistics` command.  
The `Reads` and `Writes` outputs show the number of these operations that have occurred since the statistic was last reset, or since the controller was restarted. Record the numbers displayed.
2. Run the `show disk-group-statistics` command a second time.  
This provides you a specific window of time (the interval between requesting the statistics) to determine if data is being written to or read from the disk group. Record the numbers displayed.
3. To determine if any reads or writes occur during this interval, subtract the set of numbers you recorded in [step 1](#) from the numbers you recorded in [step 2](#).
  - o If the resulting difference is zero, then I/O has stopped.
  - o If the resulting difference is not zero, a host is still reading from or writing to this disk group. Continue to stop I/O from hosts, and repeat [step 1](#) and [step 2](#) until the difference in [step 3](#) is zero.

See the CLI Reference Guide for additional information, at your HPE MSA 1040 manuals page:  
<http://www.hpe.com/support/msa1040/manuals>.

## Diagnostic steps

This section describes possible reasons and actions to take when an LED indicates a fault condition during initial system setup. See “[LED descriptions](#)” ([page 64](#)) for descriptions of all LED statuses.

---

**NOTE:** Once event notification is configured and enabled using the SMU, you can view event logs to monitor the health of the system and its components using the GUI.

---

In addition to monitoring LEDs via line-of-sight observation of racked hardware components when performing diagnostic steps, you can also monitor the health of the system and its components using the management interfaces. Be mindful of this when reviewing the **Actions** column in the diagnostics tables, and when reviewing the step procedures provided in this chapter.

## Is the enclosure front panel Fault/Service Required LED amber?

**Table 4 Diagnostics LED status: Front panel “Fault/Service Required”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	A fault condition exists/occurred. If installing an I/O module FRU, the module has not gone online and likely failed its self-test.	<ul style="list-style-type: none"> <li>Check the LEDs on the back of the controller enclosure to narrow the fault to a FRU, connection, or both.</li> <li>Check the event log for specific information regarding the fault. Follow any Recommended Actions.</li> <li>If installing an IOM FRU, try removing and reinstalling the new IOM, and check the event log for errors.</li> <li>If the above actions do not resolve the fault, isolate the fault, and contact an authorized service provider for assistance. Replacement may be necessary.</li> </ul>

## Is the enclosure rear panel FRU OK LED off?

**Table 5 Diagnostics LED status: Rear panel “FRU OK”**

Answer	Possible reasons	Actions
No (blinking)	System functioning properly. System is booting.	No action required. Wait for system to boot.
Yes	The controller module is not powered on. The controller module has failed.	<ul style="list-style-type: none"> <li>Check that the controller module is fully inserted and latched in place, and that the enclosure is powered on.</li> <li>Check the event log for specific information regarding the failure.</li> </ul>

## Is the enclosure rear panel Fault/Service Required LED amber?

**Table 6 Diagnostics LED status: Rear panel “Fault/Service Required”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes (blinking)	One of the following errors occurred: <ul style="list-style-type: none"> <li>Hardware-controlled power-up error</li> <li>Cache flush error</li> <li>Cache self-refresh error</li> </ul>	<ul style="list-style-type: none"> <li>Restart this controller from the other controller using the SMU or the CLI.</li> <li>If the above action does not resolve the fault, remove the controller and reinsert it.</li> <li>If the above action does not resolve the fault, contact an authorized service provider for assistance. It may be necessary to replace the controller.</li> </ul>

## Are both disk drive module LEDs off (Online/Activity and Fault/UID)?

**Table 7 Diagnostics LED status: Front panel disks “Online/Activity” and “Fault/UID”**

Answer	Possible reasons	Actions
Yes	<ul style="list-style-type: none"> <li>There is no power.</li> <li>The disk is offline.</li> <li>The disk is not configured.</li> </ul>	Check that the disk drive is fully inserted and latched in place, and that the enclosure is powered on.

**NOTE:** See [“Disk drives used in MSA 1040 enclosures” \(page 12\)](#).

## Is the disk drive module Fault/UID LED blinking amber?

**Table 8 Diagnostics LED status: Front panel disks “Fault/UID”**

Answer	Possible reasons	Actions
No, but the <b>Online/Activity LED</b> is <b>blinking</b> .	The disk drive is rebuilding.	No action required.  <b>⚠ CAUTION:</b> Do not remove a disk drive that is reconstructing. Removing a reconstructing disk drive might terminate the current operation and cause data loss.
Yes, and the <b>Online/Activity LED</b> is <b>off</b> .	The disk drive is offline. A predictive failure alert may have been received for this device.	<ul style="list-style-type: none"> <li>• Check the event log for specific information regarding the fault.</li> <li>• Isolate the fault.</li> <li>• Contact an authorized service provider for assistance.</li> </ul>
Yes, and the <b>Online/Activity LED</b> is <b>blinking</b> .	The disk drive is active, but a predictive failure alert may have been received for this device.	<ul style="list-style-type: none"> <li>• Check the event log for specific information regarding the fault.</li> <li>• Isolate the fault.</li> <li>• Contact an authorized service provider for assistance.</li> </ul>

## Is a connected host port Host Link Status LED off?

**Table 9 Diagnostics LED status: Rear panel “Host Link Status”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required. (see <a href="#">Link LED note: page 70</a> )
Yes	The link is down.	<ul style="list-style-type: none"> <li>• Check cable connections and reseal if necessary.</li> <li>• Inspect cables for damage. Replace cable if necessary.</li> <li>• Swap cables to determine if fault is caused by a defective cable. Replace cable if necessary.</li> <li>• Verify that the switch, if any, is operating properly. If possible, test with another port.</li> <li>• Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.</li> <li>• In the SMU, review event logs for indicators of a specific fault in a host data path component. Follow any Recommended Actions.</li> <li>• Contact an authorized service provider for assistance.</li> <li>• See <a href="#">“Isolating a host-side connection fault” (page 49)</a>.</li> </ul>

## Is a connected port Expansion Port Status LED off?

**Table 10 Diagnostics LED status: Rear panel “Expansion Port Status”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The link is down.	<ul style="list-style-type: none"> <li>• Check cable connections and reseal if necessary.</li> <li>• Inspect cable for damage. Replace cable if necessary.</li> <li>• Swap cables to determine if fault is caused by a defective cable. Replace cable if necessary.</li> <li>• In the SMU, review event logs for indicators of a specific fault in a host data path component. Follow any Recommended Actions.</li> <li>• Contact an authorized service provider for assistance.</li> <li>• See <a href="#">“Isolating a controller module expansion port connection fault” (page 51)</a>.</li> </ul>

## Is a connected port Network Port Link Status LED off?

**Table 11 Diagnostics LED status: Rear panel “Network Port Link Status”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The link is down.	Use standard networking troubleshooting procedures to isolate faults on the network.

## Is the power supply Input Power Source LED off?

**Table 12 Diagnostics LED status: Rear panel power supply “Input Power Source”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply is not receiving adequate power.	<ul style="list-style-type: none"><li>• Verify that the power cord is properly connected and check the power source to which it connects.</li><li>• Check that the power supply FRU is firmly locked into position.</li><li>• In the SMU, check the event log for specific information regarding the fault. Follow any Recommended Actions.</li><li>• If the above action does not resolve the fault, isolate the fault, and contact an authorized service provider for assistance.</li></ul>

## Is the power supply Voltage/Fan Fault/Service Required LED amber?

**Table 13 Diagnostics LED status: Rear panel power supply: “Voltage/Fan Fault/Service Required”**

Answer	Possible reasons	Actions
No	System functioning properly.	No action required.
Yes	The power supply unit or a fan is operating at an unacceptable voltage/RPM level, or has failed.	<p>When isolating faults in the power supply, remember that the fans in both modules receive power through a common bus on the midplane, so if a power supply unit fails, the fans continue to operate normally.</p> <ul style="list-style-type: none"><li>• Check that the power supply FRU is firmly locked into position.</li><li>• Check that the power cable is connected to a power source.</li><li>• Check that the power cable is connected to the power supply module.</li></ul>

## Controller failure in a single-controller configuration

Cache memory is flushed to CompactFlash in the case of a controller failure or power loss. During the write to CompactFlash process, only the components needed to write the cache to the CompactFlash are powered by the supercapacitor. This process typically takes 60 seconds per 1 Gbyte of cache. After the cache is copied to CompactFlash, the remaining power left in the supercapacitor is used to refresh the cache memory. While the cache is being maintained by the supercapacitor, the Cache Status LED flashes at a rate of 1/10 second on and 9/10 second off.

- 
- ① **IMPORTANT:** Transportable cache only applies to single-controller configurations. In dual controller configurations, there is no need to transport cache from a failed controller to a replacement controller because the cache is duplicated between the peer controllers (subject to volume write optimization setting).
-

## If the controller has failed or does not start, is the Cache Status LED on/blinking?

**Table 14** Diagnostics LED status: Rear panel “Cache Status”

Answer	Actions
No, the Cache LED status is off, and the controller does not boot.	If valid data is thought to be in Flash, see <a href="#">Transporting cache</a> ; otherwise, replace the controller module.
No, the Cache Status LED is off, and the controller boots.	The system has flushed data to disks. If the problem persists, replace the controller module.
Yes, at a strobe 1:10 rate - 1 Hz, and the controller does not boot.	See <a href="#">Transporting cache</a> .
Yes, at a strobe 1:10 rate - 1 Hz, and the controller boots.	The system is flushing data to CompactFlash. If the problem persists, replace the controller module.
Yes, at a blink 1:1 rate - 1 Hz, and the controller does not boot.	See <a href="#">Transporting cache</a> .
Yes, at a blink 1:1 rate - 1 Hz, and the controller boots.	The system is in self-refresh mode. If the problem persists, replace the controller module.

---

**NOTE:** See also “[Cache Status LED details](#)” (page 71).

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### Transporting cache

To preserve the existing data stored in the CompactFlash, you must transport the CompactFlash from the failed controller to a replacement controller using the procedure outlined in *HPE MSA Controller Module Replacement Instructions* shipped with the replacement controller module. Failure to use this procedure will result in the loss of data stored in the cache module.

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⚠ **CAUTION:** Remove the controller module only after the copy process is complete, which is indicated by the Cache Status LED being off, or blinking at 1:10 rate.

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### Isolating a host-side connection fault

During normal operation, when a controller module host port is connected to a data host, the port’s host link status/link activity LED is green. If there is I/O activity, the LED blinks green. If data hosts are having trouble accessing the storage system, and you cannot locate a specific fault or cannot access the event logs, use the following procedure. This procedure requires scheduled downtime.

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ⓘ **IMPORTANT:** Do not perform more than one step at a time. Changing more than one variable at a time can complicate the troubleshooting process.

---

### Host-side connection troubleshooting featuring host ports with SFPs

The procedure below applies to MSA 1040 controller enclosures employing small form factor pluggable (SFP) transceiver connectors (4/8 Gb FC, 10GbE iSCSI, or 1 Gb iSCSI) in host interface ports. In the following procedure, “SFP and host cable” is used to refer to any of the qualified SFP options supporting host ports used for I/O or replication.

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**NOTE:** When experiencing difficulty diagnosing performance problems, consider swapping out one SFP at a time to see if performance improves.

---

1. Halt all I/O to the storage system as described in [“Stopping I/O” \(page 45\)](#).
2. Check the host link status/link activity LED.  
If there is activity, halt all applications that access the storage system.
3. Check the Cache Status LED to verify that the controller cached data is flushed to the disk drives.
  - o Solid – Cache contains data yet to be written to the disk.
  - o Blinking – Cache data is being written to CompactFlash.
  - o Flashing at 1/10 second on and 9/10 second off – Cache is being refreshed by the supercapacitor.
  - o Off – Cache is clean (no unwritten data).
4. Remove the SFP and host cable and inspect for damage.
5. Reseat the SFP and host cable.  
Is the host link status/link activity LED on?
  - o Yes – Monitor the status to ensure that there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
  - o No – Proceed to the next step.
6. Move the SFP and host cable to a port with a known good link status.  
This step isolates the problem to the external data path (SFP, host cable, and host-side devices) or to the controller module port.  
Is the host link status/link activity LED on?
  - o Yes – You now know that the SFP, host cable, and host-side devices are functioning properly. Return the SFP and cable to the original port. If the link status/link activity LED remains off, you have isolated the fault to the controller module port. Replace the controller module.
  - o No – Proceed to the next step.
7. Swap the SFP with the known good one.  
Is the host link status/link activity LED on?
  - o Yes – You have isolated the fault to the SFP. Replace the SFP.
  - o No – Proceed to the next step.
8. Re-insert the original SFP and swap the cable with a known good one.  
Is the host link status/link activity LED on?
  - o Yes – You have isolated the fault to the cable. Replace the cable.
  - o No – Proceed to the next step.
9. Verify that the switch, if any, is operating properly. If possible, test with another port.
10. Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.
11. Replace the HBA with a known good HBA, or move the host side cable and SFP to a known good HBA.  
Is the host link status/link activity LED on?
  - o Yes – You have isolated the fault to the HBA. Replace the HBA.
  - o No – It is likely that the controller module needs to be replaced.
12. Move the cable and SFP back to its original port.  
Is the host link status/link activity LED on?
  - o No – The controller module port has failed. Replace the controller module.
  - o Yes – Monitor the connection for a period of time. It may be an intermittent problem, which can occur with damaged SFPs, cables, and HBAs.

## Host-side connection troubleshooting featuring SAS host ports

The procedure below applies to MSA 1040 controller enclosures employing 12 Gb SFF-8644 connectors in the HD mini-SAS host ports used for I/O.

1. Halt all I/O to the storage system as described in [“Stopping I/O” \(page 45\)](#).

2. Check the host activity LED.  
If there is activity, halt all applications that access the storage system.
3. Check the Cache Status LED to verify that the controller cached data is flushed to the disk drives.
  - o Solid – Cache contains data yet to be written to the disk.
  - o Blinking – Cache data is being written to CompactFlash.
  - o Flashing at 1/10 second on and 9/10 second off – Cache is being refreshed by the supercapacitor.
  - o Off – Cache is clean (no unwritten data).
4. Reseat the host cable and inspect for damage.  
Is the host link status LED on?
  - o Yes – Monitor the status to ensure that there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
  - o No – Proceed to the next step.
5. Move the host cable to a port with a known good link status.  
This step isolates the problem to the external data path (host cable and host-side devices) or to the controller module port.  
Is the host link status LED on?
  - o Yes – You now know that the host cable and host-side devices are functioning properly. Return the cable to the original port. If the link status LED remains off, you have isolated the fault to the controller module port. Replace the controller module.
  - o No – Proceed to the next step.
6. Verify that the switch, if any, is operating properly. If possible, test with another port.
7. Verify that the HBA is fully seated, and that the PCI slot is powered on and operational.
8. Replace the HBA with a known good HBA, or move the host side cable to a known good HBA.  
Is the host link status LED on?
  - o Yes – You have isolated the fault to the HBA. Replace the HBA.
  - o No – It is likely that the controller module needs to be replaced.
9. Move the host cable back to its original port.  
Is the host link status LED on?
  - o No – The controller module port has failed. Replace the controller module.
  - o Yes – Monitor the connection for a period of time. It may be an intermittent problem, which can occur with damaged cables and HBAs.

## Isolating a controller module expansion port connection fault

During normal operation, when a controller module expansion port is connected to a drive enclosure, the expansion port status LED is green. If the connected port's expansion port LED is off, the link is down. Use the following procedure to isolate the fault.

This procedure requires scheduled downtime.

---

**NOTE:** Do not perform more than one step at a time. Changing more than one variable at a time can complicate the troubleshooting process.

---

1. Halt all I/O to the storage system as described in [“Stopping I/O” \(page 45\)](#).
2. Check the host activity LED.  
If there is activity, halt all applications that access the storage system.
3. Check the Cache Status LED to verify that the controller cached data is flushed to the disk drives.

- Solid – Cache contains data yet to be written to the disk.
  - Blinking – Cache data is being written to CompactFlash.
  - Flashing at 1/10 second on and 9/10 second off – Cache is being refreshed by the supercapacitor.
  - Off – Cache is clean (no unwritten data).
4. Reseat the expansion cable, and inspect it for damage.
- Is the expansion port status LED on?
- Yes – Monitor the status to ensure there is no intermittent error present. If the fault occurs again, clean the connections to ensure that a dirty connector is not interfering with the data path.
  - No – Proceed to the next step.
5. Move the expansion cable to a port on the controller enclosure with a known good link status.
- This step isolates the problem to the expansion cable or to the controller module expansion port.
- Is the expansion port status LED on?
- Yes – You now know that the expansion cable is good. Return the cable to the original port. If the expansion port status LED remains off, you have isolated the fault to the controller module expansion port. Replace the controller module.
  - No – Proceed to the next step.
6. Move the expansion cable back to the original port on the controller enclosure.
7. Move the expansion cable on the drive enclosure to a known good expansion port on the drive enclosure.
- Is the expansion port status LED on?
- Yes – You have isolated the problem to the drive enclosure port. Replace the expansion module.
  - No – Proceed to the next step.
8. Replace the cable with a known good cable, ensuring the cable is attached to the original ports used by the previous cable.
- Is the host link status LED on?
- Yes – Replace the original cable. The fault has been isolated.
  - No – It is likely that the controller module must be replaced.

## Isolating Remote Snap replication faults

### Cabling for replication

Remote Snap replication is a licensed feature for disaster-recovery. This feature performs asynchronous replication of block-level data from a volume in a primary system to a volume in a secondary system by creating an internal snapshot of the primary volume, and copying the snapshot data to the secondary system via Fibre Channel (linear storage only) or iSCSI links. The primary volume exists in a primary disk group (linear storage) or pool (virtual storage) in the primary storage system. See [“Connecting two storage systems to replicate volumes” \(page 31\)](#) for host connection information concerning Remote Snap.

### Replication setup and verification

After storage systems and hosts are cabled for replication, you can use the SMU (v3 for virtual replications or v2 for linear replications) to prepare to use the Remote Snap feature. Optionally, you can use SSH to access the IP address of the controller module and access the Remote Snap feature using the CLI.

---

**NOTE:** You can use the CLI to perform replication in linear and virtual storage environments.

- Set Management mode to v2 to replicate in linear storage environments (use Manage role).
  - Set Management mode to v3 to replicate in virtual storage environments (use Manage role).
-

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**NOTE:** Refer to the following manuals for more information on replication setup:

- See *HPE Remote Snap* technical white paper for replication best practices
  - See *HPE MSA 1040/2040 SMU Reference Guide* for procedures to setup and manage replications
  - See *HPE MSA 1040/2040 CLI Reference Guide* for replication commands and syntax
  - See *HPE MSA 1040/2040 Event Descriptions Reference Guide* for replication event reporting
- 

Basic information for enabling the MSA 1040 controller enclosures for replication supplements the troubleshooting procedures that follow:

- Familiarize yourself with Remote Snap by reviewing the chapters about getting started, working in the Replications topic, and using Remote Snap to replicate volumes in the SMU Reference Guide.
  - For best practices concerning replication-related tasks, see the technical white paper.
  - In order to replicate an existing volume to a pool on the peer (v3) in the primary system or secondary system, follow these steps:
    - Find the port address.  
Using the CLI, run the `query peer-connection` command.
    - Create a peer connection.  
To create a peer connection, use the CLI command `create peer-connection` or in the SMU v3 **Replications** topic, select **Action > Create Peer Connection**.
    - Create a replication set.  
To create a replication set, use the CLI command `create replication-set` or in the SMU v3 **Replications** topic, select **Action > Create Replication Set**.
    - Replicate.  
To initiate replication, use the CLI command `replicate` or in the SMU v3 **Replications** topic, select **Action > Initiate Replication**.
  - In order to replicate an existing volume to another disk group (v2) in the primary system or secondary system, follow these steps:
    - Use **Wizards > Replication Setup Wizard** to prepare to replicate an existing volume to another vdisk in the secondary system.  
Follow the wizard to select the primary volume, replication mode, and secondary volume, and to confirm your replication settings. The wizard verifies the communication links between the primary and secondary systems. Once setup is successfully completed, you can initiate replication from the SMU v2 or the CLI.
  - For descriptions of replication-related events, see the Event Descriptions Reference Guide.
- 

ⓘ **IMPORTANT:** Remote Snap must be licensed on all systems configured for replication, and the controller module firmware must be compatible on all systems licensed for replication.

For virtual storage environments, a Virtualization license is also required to enable replication.

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ⓘ **IMPORTANT:** Linear replication sets, and virtual peer connections and replication cannot exist concurrently on a system.

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## Diagnostic steps for replication setup

Tables in the following subsections show menu navigation using the SMU v3 (virtual storage), and the SMU v2 (linear storage). Shorthand v3 and v2 terms distinguish between supported web browser GUIs.

### SMU v3

Can you successfully use the Remote Snap feature?

**Table 15 Diagnostics for replication setup: Using Remote Snap feature (v3)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Remote Snap is not licensed on each controller enclosure used for replication.	<p>Verify licensing of the optional feature per system:</p> <ul style="list-style-type: none"> <li>In the <b>Home</b> topic in the SMU v3, select <b>Action &gt; Install License</b>. The License Settings panel opens and displays information about each licensed feature.</li> <li>If the Replication feature is not enabled, obtain and install a valid license for Remote Snap.</li> <li>For more information on licensing, see the chapter about installing a license in the SMU Reference Guide.</li> </ul> <hr/> <p><b>NOTE:</b> Remote Snap is only supported by MSA 1040 SAN controller enclosures (configured for iSCSI).</p> <hr/>
No	Compatible firmware revision supporting Remote Snap is not running on each system used for replication.	<p>Perform the following actions on each system used for replication:</p> <ul style="list-style-type: none"> <li>In the <b>System</b> topic, select <b>Action &gt; Update Firmware</b>. The Update Firmware panel opens. The Update Controller Modules tab shows firmware versions installed in each controller.</li> <li>If necessary, update the controller module firmware to ensure compatibility with the other systems.</li> <li>For more information on compatible firmware, see the chapter about updating firmware in the SMU Reference Guide.</li> </ul>
No	Invalid cabling connection. (If multiple controller enclosures are used, check the cabling for each system.)	<p>Verify controller enclosure cabling:</p> <ul style="list-style-type: none"> <li>Verify use of proper cables.</li> <li>Verify proper cabling paths for host connections.</li> <li>Verify cabling paths between replication ports and switches have visibility to each other.</li> <li>Verify that cable connections are securely fastened.</li> <li>Inspect cables for damage and replace if necessary.</li> </ul>

Can you view information about remote links?

**Table 16 Diagnostics for replication setup: Viewing information about remote links (v3)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Communication link is down	<ul style="list-style-type: none"> <li>Verify controller enclosure cabling (see <a href="#">Table 15</a>).</li> <li>Review event logs for indicators of a specific fault in a host or replication data path component. In the footer, click the events panel and select <b>Show Event List</b>. This will open the <b>Event Log Viewer</b> panel.</li> <li>Verify valid IP address of the network port on the remote system.</li> <li>Click in the <b>Volumes</b> topic, then click on a volume name in the volumes list. Click the <b>Replication Sets</b> tab to display replications and associated metadata.</li> <li>Alternatively, click in the <b>Replications</b> topic to display replications and associated metadata.</li> </ul>

Can you create a replication set?

- ❗ **IMPORTANT:** Remote Snap must be licensed on all systems configured for replication, and the controller module firmware must be compatible on all systems licensed for replication.

For virtual storage environments, a Virtualization license is also required to enable replication.

**Table 17 Diagnostics for replication setup: Creating a replication set (v3)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	On controller enclosures with iSCSI host interface ports, replication set creation fails due to use of CHAP.	If using CHAP (Challenge-Handshake Authentication Protocol), configure it as described in the SMU Reference Guide section about working in the Replications topic.
No	Unable to create the secondary volume (the destination volume in the virtual disk group to which you will replicate data from the primary volume)? <sup>1</sup>	<ul style="list-style-type: none"> <li>Review event logs (in the footer, click the events panel and select <b>Show Event List</b>) for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>Verify valid specification of the secondary volume according to either of the following criteria: <ul style="list-style-type: none"> <li>A conflicting volume does not already exist</li> <li>Creation of the new volume on the disk group</li> </ul> </li> </ul>
No	Communication link is down.	<ul style="list-style-type: none"> <li>See actions described in <a href="#">“Can you view information about remote links?”</a> (page 55).</li> </ul>

<sup>1</sup> After ensuring valid licensing, valid cabling connections, and network availability, create the replication set using the **Replications** topic, select **Action > Create Replication Set**.

## Can you replicate a volume?

- ① **IMPORTANT:** Remote Snap must be licensed on all systems configured for replication, and the controller module firmware must be compatible on all systems licensed for replication.

For virtual storage environments, a Virtualization license is also required to enable replication.

**Table 18 Diagnostics for replication setup: Replicating a volume (v3)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Remote Snap is not licensed on each controller enclosure used for replication.	See actions described in <a href="#">“Can you successfully use the Remote Snap feature?” (page 54).</a>
No	Nonexistent replication set.	<ul style="list-style-type: none"> <li>• Determine existence of primary or secondary volumes.</li> <li>• If a replication set has not been successfully created, use the <b>Replications</b> topic, select <b>Action &gt; Create Replication Set</b> to create one.</li> <li>• Review event logs (in the footer, click the events panel and select <b>Show Event List</b>) for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> </ul>
No	Network error occurred during in-progress replication.	<ul style="list-style-type: none"> <li>• Review event logs for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>• Click in the <b>Volumes</b> topic, then click on a volume name in the volumes list. Click the <b>Replication Sets</b> tab to display replications and associated metadata.</li> <li>• Replications that enter the suspended state can be resumed manually. See the SMU Reference Guide for additional details.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">“Can you view information about remote links?” (page 55).</a>

## Has a replication run successfully?

**Table 19 Diagnostics for replication setup: Checking for a successful replication (v3)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Last Successful Run shows N/A.	<ul style="list-style-type: none"> <li>• In the <b>Volumes</b> topic, click on the volume that is a member of the replication set. <ul style="list-style-type: none"> <li>○ Select the Replications Sets table</li> <li>○ Check the Last Successful Run information</li> </ul> </li> <li>• If a replication has not run successfully, use the SMU v3 to replicate as described in the section about working in the Replications topic within the SMU Reference Guide.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">“Can you view information about remote links?” (page 55).</a>

Can you successfully use the Remote Snap feature?

**Table 20 Diagnostics for replication setup: Using Remote Snap feature (v2)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Remote Snap is not licensed on each controller enclosure used for replication.	<p>Verify licensing of the optional feature per system:</p> <ul style="list-style-type: none"> <li>In the Configuration View panel in the SMU v2, right-click the system, and select <b>View &gt; Overview</b>. Within the System Overview table, select the <b>Licensed Features</b> component to display the status of licensed features.</li> <li>If the Replication feature is not enabled, obtain and install a valid license for Remote Snap.</li> </ul> <hr/> <p><b>NOTE:</b> Remote Snap is not supported by MSA 1040 SAS controller enclosures.</p> <hr/>
No	Compatible firmware revision supporting Remote Snap is not running on each system used for replication.	<p>Perform the following actions on each system used for replication:</p> <ul style="list-style-type: none"> <li>In the Configuration View panel in the SMU v2, right-click the system, and select <b>Tools &gt; Update Firmware</b>. The Update Firmware panel displays currently installed firmware versions.</li> <li>If necessary, update the controller module firmware to ensure compatibility with other systems.</li> </ul>
No	Invalid cabling connection. (Check cabling for each system)	<p>Verify controller enclosure cabling.</p> <ul style="list-style-type: none"> <li>Verify use of proper cables.</li> <li>Verify proper cabling paths for host connections.</li> <li>Verify cabling paths between replication ports and switches on the same fabric or network.</li> <li>Verify that cable connections are securely fastened.</li> <li>Inspect cables for damage and replace if necessary.</li> </ul>

Can you view information about remote links?

**Table 21 Diagnostics for replication setup: Viewing information about remote links (v2)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Invalid login credentials	<ul style="list-style-type: none"> <li>Verify user name with Manage role on remote system.</li> <li>Verify user's password on remote system.</li> </ul>
No	Communication link is down.	<ul style="list-style-type: none"> <li>Verify controller enclosure cabling (see <a href="#">Table 20</a>).</li> <li>Review event logs (in the Configuration View panel, right-click the system, and select <b>View &gt; Event Log</b>) for indicators of a specific fault in a host or replication data path component.</li> <li>Verify valid IP address of the network port on the remote system.</li> <li>In the Configuration View panel, right-click the remote system, and select <b>Tools &gt; Check Remote System Link</b>. Click <b>Check Links</b>.</li> </ul>

## Can you create a replication set?

**Table 22 Diagnostics for replication setup: Creating a replication set (v2)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Selected link type or port-to-link connections are incorrect.	<ul style="list-style-type: none"> <li>Remote Replication mode: In the Configuration View panel in the, right-click the remote system, and select <b>Tools &gt; Check Remote System Link</b>. Click <b>Check Links</b> to verify correct link type and remote host port connections.</li> <li>Local Replication mode: In the Configuration View panel in the, right-click the local system, and select <b>Tools &gt; Check Local System Link</b>. Click <b>Check Links</b> to verify correct link type and local host port connections.</li> </ul>
No	On controller enclosures with iSCSI host interface ports, replication set creation fails due to use of CHAP.	If using CHAP (Challenge-Handshake Authentication Protocol), configure it as described in the SMU topics “Using the Replication Setup Wizard” or “Replicating a volume.”
No	Unable to select the replication mode (Local or Remote)?	<ul style="list-style-type: none"> <li>Review event logs (in the Configuration View panel, right-click the system, and select <b>View &gt; Event Log</b>) for indicators of a specific fault in a host or replication data path component. Follow any Recommended Actions.</li> <li>Local Replication mode replicates to a secondary volume residing in the local storage system. <ul style="list-style-type: none"> <li>Verify valid links. <p>On dual-controller systems, verify that A ports can access B ports on the partner controller, and vice versa.</p> </li> <li>Verify existence of either a replication-prepared volume of the same size as the master volume, or a disk group with sufficient unused capacity.</li> </ul> </li> <li>Remote Replication mode replicates to a secondary volume residing in an independent storage system: <ul style="list-style-type: none"> <li>Verify selection of valid remote disk group.</li> <li>Verify selection of valid remote volume on the disk group.</li> <li>Verify valid IP address of remote system network port.</li> <li>Verify user name with Manage role on remote system.</li> <li>Verify user password on remote system.</li> </ul> </li> </ul> <hr/> <p><b>NOTE:</b> If the remote system has not been added, it cannot be selected.</p> <hr/>
No	Unable to select the secondary volume (the destination volume on the disk group to which you will replicate data from the primary volume)?	<ul style="list-style-type: none"> <li>Review event logs for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>Verify valid specification of the secondary volume according to either of the following criteria: <ul style="list-style-type: none"> <li>Creation of new volume on the disk group.</li> <li>Selection of replication-prepared volume</li> </ul> </li> </ul>
No	Communication link is down.	See actions described in <a href="#">“Can you view information about remote links?” (page 57)</a> .

## Can you replicate a volume?

**Table 23 Diagnostics for replication setup: Replicating a volume (v2)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Remote Snap is not licensed on each controller enclosure used for replication.	See actions described in <a href="#">“Can you successfully use the Remote Snap feature?” (page 57)</a> .

**Table 23 Diagnostics for replication setup: Replicating a volume (v2) (continued)**

Answer	Possible reasons	Actions
No	Nonexistent replication set.	<ul style="list-style-type: none"> <li>• Determine existence of primary or secondary volumes.</li> <li>• If a replication set has not been successfully created, use the SMU Replication Setup Wizard to create one.</li> <li>• Review event logs (in the Configuration View panel, right-click the system, and select <b>View &gt; Event Log</b>) for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> </ul>
No	Network error occurred during in-progress replication.	<ul style="list-style-type: none"> <li>• Review event logs for indicators of a specific fault in a replication data path component. Follow any Recommended Actions.</li> <li>• In the Configuration View panel, right-click the secondary volume, and select <b>View &gt; Overview</b> to display the Replication Volume Overview table: <ul style="list-style-type: none"> <li>○ Check for replication interruption (suspended) status.</li> <li>○ Check for inconsistent status.</li> <li>○ Check for offline status.</li> </ul> </li> <li>• Replications that enter the suspended state must be resumed manually.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">“Can you view information about remote links?” (page 57)</a> .

**Can you view a replication image?****Table 24 Diagnostics for replication setup: Viewing a replication image (v2)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Nonexistent replication image.	<ul style="list-style-type: none"> <li>• In the Configuration View panel, expand disk groups and their subordinate volumes to reveal the existence of a replication image or images.</li> <li>• If a replication image has not been successfully created, use the SMU to create one as described in the “Using Remote Snap to replicate volumes” topic within the SMU Guide.</li> </ul>
No	Communication link is down.	See actions described in <a href="#">“Can you view information about remote links?” (page 57)</a> .

**Can you view remote systems?****Table 25 Diagnostics for replication setup: Viewing a remote system (v2)**

Answer	Possible reasons	Actions
Yes	System functioning properly.	No action required.
No	Communication link is down.	See actions described in <a href="#">“Can you view information about remote links?” (page 57)</a> .

## Resolving voltage and temperature warnings

1. Check that all of the fans are working by making sure the Voltage/Fan Fault/Service Required LED on each power supply is off, or by using the SMU to check enclosure health status.

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**NOTE:** The shorthand v3 and v2 prefixes are used to distinguish between the product versions supported by MSA 1040 enclosures. General references to the SMU—that do not require version distinction—use the generic term.

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- v3: In the lower corner of the footer, overall health status of the enclosure is indicated by a health status icon. For more information, point to the **System** tab and select **View System** to see the System panel. You can select from

**Front, Rear, and Table** views on the System panel. If you hover over a component, its associated metadata and health status displays onscreen.

- o v2: In the Configuration View panel, right-click the enclosure and select **View > Overview** to view the health status of the enclosure and its components. The Enclosure Overview page enables you to see information about each enclosure and its physical components in front, rear, and tabular views—using graphical or tabular presentation—allowing you to view the health status of the enclosure and its components.

See [“Options available for performing basic steps” \(page 42\)](#) for a description of health status icons and alternatives for monitoring enclosure health.

2. Make sure that all modules are fully seated in their slots with latches locked.
3. Make sure that no slots are left open for more than two minutes.

If you need to replace a module, leave the old module in place until you have the replacement or use a blank module to fill the slot. Leaving a slot open negatively affects the airflow and can cause the enclosure to overheat.

4. Try replacing each power supply module one at a time.
5. Replace the controller modules one at a time.
6. Replace SFPs one at a time (FC or iSCSI systems).

## Sensor locations

The storage system monitors conditions at different points within each enclosure to alert you to problems. Power, cooling fan, temperature, and voltage sensors are located at key points in the enclosure. In each controller module and expansion module, the enclosure management processor (EMP) monitors the status of these sensors to perform SCSI enclosure services (SES) functions.

The following sections describe each element and its sensors.

## Power supply sensors

Each enclosure has two fully redundant power supplies with load-sharing capabilities. The power supply sensors described in the following table monitor the voltage, current, temperature, and fans in each power supply. If the power supply sensors report a voltage that is under or over the threshold, check the input voltage.

**Table 26 Power supply sensor descriptions**

Description	Event/Fault ID LED condition
Power supply 1	Voltage, current, temperature, or fan fault
Power supply 2	Voltage, current, temperature, or fan fault

## Cooling fan sensors

Each power supply includes two fans. The normal range for fan speed is 4,000 to 6,000 RPM. When a fan speed drops below 4,000 RPM, the EMP considers it a failure and posts an alarm in the storage system event log. The following table lists the description, location, and alarm condition for each fan. If the fan speed remains under the 4,000 RPM threshold, the internal enclosure temperature may continue to rise. Replace the power supply reporting the fault.

**Table 27 Cooling fan sensor descriptions**

Description	Location	Event/Fault ID LED condition
Fan 1	Power supply 1	< 4,000 RPM
Fan 2	Power supply 1	< 4,000 RPM
Fan 3	Power supply 2	< 4,000 RPM
Fan 4	Power supply 2	< 4,000 RPM

During a shutdown, the cooling fans do not shut off. This allows the enclosure to continue cooling.

## Temperature sensors

Extreme high and low temperatures can cause significant damage if they go unnoticed. Each controller module has six temperature sensors. Of these, if the CPU or FPGA (Field Programmable Gate Array) temperature reaches a shutdown value, the controller module is automatically shut down. Each power supply has one temperature sensor.

When a temperature fault is reported, it must be remedied as quickly as possible to avoid system damage. This can be done by warming or cooling the installation location.

**Table 28 Controller module temperature sensor descriptions**

Description	Normal operating range	Warning operating range	Critical operating range	Shutdown values
CPU temperature	3°C–88°C	0°C–3°C, 88°C–90°C	> 90°C	0°C 100°C
FPGA temperature	3°C–97°C	0°C–3°C, 97°C–100°C	None	0°C 105°C
Onboard temperature 1	0°C–70°C	None	None	None
Onboard temperature 2	0°C–70°C	None	None	None
Onboard temperature 3 (Capacitor temperature)	0°C–70°C	None	None	None
CM temperature	5°C–50°C	≤ 5°C, ≥ 50°C	≤ 0°C, ≥ 55°C	None

When a power supply sensor goes out of range, the Fault/ID LED illuminates amber and an event is logged to the event log.

**Table 29 Power supply temperature sensor descriptions**

Description	Normal operating range
Power Supply 1 temperature	–10°C–80°C
Power Supply 2 temperature	–10°C–80°C

## Power supply module voltage sensors

Power supply voltage sensors ensure that the enclosure power supply voltage is within normal ranges. There are three voltage sensors per power supply.

**Table 30 Voltage sensor descriptions**

Sensor	Event/Fault LED condition
Power supply 1 voltage, 12V	< 11.00V > 13.00V
Power supply 1 voltage, 5V	< 4.00V > 6.00V
Power supply 1 voltage, 3.3V	< 3.00V > 3.80V

# 8 Support and other resources

## Accessing Hewlett Packard Enterprise Support

- For live assistance, go to the Contact Hewlett Packard Enterprise Worldwide website:  
[www.hpe.com/assistance](http://www.hpe.com/assistance)
- To access documentation and support services, go to the HP Support Center – Hewlett Packard Enterprise website:  
[www.hpe.com/support/hpesc](http://www.hpe.com/support/hpesc)

### Information to collect

- Technical support registration number (if applicable)
- Product name, model or version, and serial number
- Operating system name and version
- Firmware version
- Error messages
- Product-specific reports and logs
- Add-on products or components
- Third-party products or components

### Accessing updates

- Some software products provide a mechanism for accessing software updates through the product interface. Review your product documentation to identify the recommended software update method.
- To download product updates, go to either of the following:
  - HP Support Center – Hewlett Packard Enterprise **Get connected with updates from HP** page:  
[www.hpe.com/support/e-updates](http://www.hpe.com/support/e-updates)
  - Software Depot website:  
[www.hpe.com/support/softwaredepot](http://www.hpe.com/support/softwaredepot)
- To view and update your entitlements, and to link your contracts, Care Packs, and warranties with your profile, go to the HP Support Center – Hewlett Packard Enterprise **More Information on Access to HP Support Materials** page:  
[www.hpe.com/support/AccessToSupportMaterials](http://www.hpe.com/support/AccessToSupportMaterials)

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❗ **IMPORTANT:** Access to some updates might require product entitlement when accessed through the HP Support Center – Hewlett Packard Enterprise. You must have a Hewlett Packard Enterprise Passport set up with relevant entitlements.

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### Websites

Website	Link
Hewlett Packard Enterprise Information Library	<a href="http://www.hpe.com/info/enterprise/docs">www.hpe.com/info/enterprise/docs</a>
HP Support Center – Hewlett Packard Enterprise	<a href="http://www.hpe.com/support/hpesc">www.hpe.com/support/hpesc</a>
Contact Hewlett Packard Enterprise Worldwide	<a href="http://www.hpe.com/assistance">www.hpe.com/assistance</a>
Subscription Service/Support Alerts	<a href="http://www.hpe.com/support/e-updates">www.hpe.com/support/e-updates</a>
Software Depot	<a href="http://www.hpe.com/support/softwaredepot">www.hpe.com/support/softwaredepot</a>
Customer Self Repair	<a href="http://www.hpe.com/support/selfrepair">www.hpe.com/support/selfrepair</a>
Insight Remote Support	<a href="http://www.hpe.com/info/insightremotesupport/docs">www.hpe.com/info/insightremotesupport/docs</a>

Website	Link
Serviceguard Solutions for HP-UX	<a href="http://www.hpe.com/info/hpux-serviceguard-docs">www.hpe.com/info/hpux-serviceguard-docs</a>
Single Point of Connectivity Knowledge (SPOCK) Storage compatibility matrix	<a href="http://www.hpe.com/storage/spock">www.hpe.com/storage/spock</a>
Storage white papers and analyst reports	<a href="http://www.hpe.com/storage/whitepapers">www.hpe.com/storage/whitepapers</a>

## Customer self repair

Hewlett Packard Enterprise customer self repair (CSR) programs allow you to repair your product. If a CSR part needs to be replaced, it will be shipped directly to you so that you can install it at your convenience. Some parts do not qualify for CSR. Your Hewlett Packard Enterprise authorized service provider will determine whether a repair can be accomplished by CSR.

For more information about CSR, contact your local service provider or go to the CSR website:

[www.hpe.com/support/selfrepair](http://www.hpe.com/support/selfrepair)

## Remote support

Remote support is available with supported devices as part of your warranty, Care Pack Service, or contractual support agreement. It provides intelligent event diagnosis, and automatic, secure submission of hardware event notifications to Hewlett Packard Enterprise, which will initiate a fast and accurate resolution based on your product's service level. Hewlett Packard Enterprise strongly recommends that you register your device for remote support.

For more information and device support details, go to the following website:

[www.hpe.com/info/insightremotesupport/docs](http://www.hpe.com/info/insightremotesupport/docs)

## Documentation feedback

Hewlett Packard Enterprise is committed to providing documentation that meets your needs. To help us improve the documentation, send any errors, suggestions, or comments to Documentation Feedback ([docsfeedback@hpe.com](mailto:docsfeedback@hpe.com)). When submitting your feedback, include the document title, part number, edition, and publication date located on the front cover of the document. For online help content, include the product name, product version, help edition, and publication date located on the legal notices page.

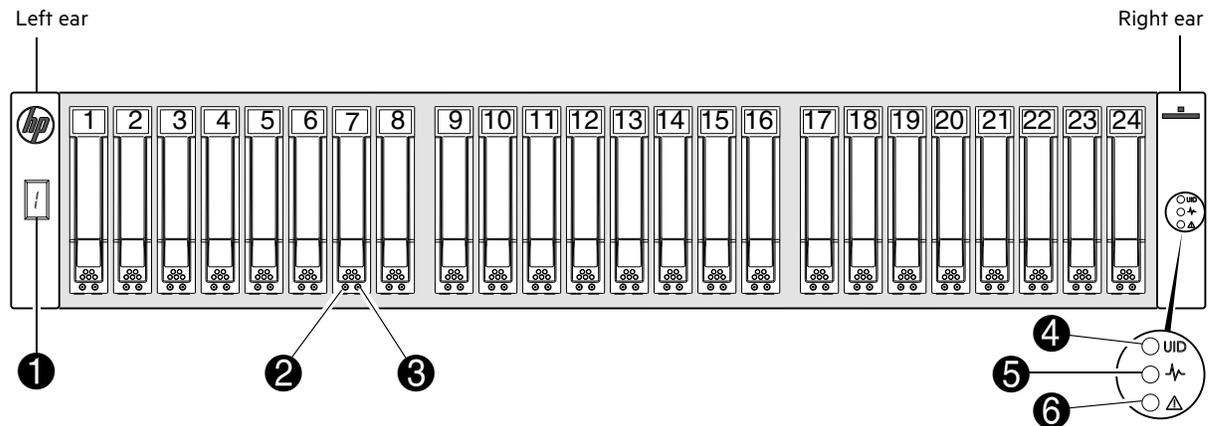
# A LED descriptions

## Front panel LEDs

HPE MSA 1040 models support small form factor (SFF) and large form factor (LFF) enclosures. The SFF chassis, configured with 24 2.5" SFF disks, is used as a controller enclosure. The LFF chassis, configured with 12 3.5" LFF disks, is used as either a controller enclosure or drive enclosure.

Supported drive enclosures, used for adding storage, are available in LFF or SFF chassis. The MSA 2040 6 Gb 3.5" 12-drive enclosure is the large form factor drive enclosure used for storage expansion. The HPE D2700 6 Gb enclosure, configured with 25 2.5" SFF disks, is the small form factor drive enclosure used for storage expansion. See [“SFF drive enclosure” \(page 15\)](#) for a description of the D2700.

## MSA 1040 Array SFF enclosure

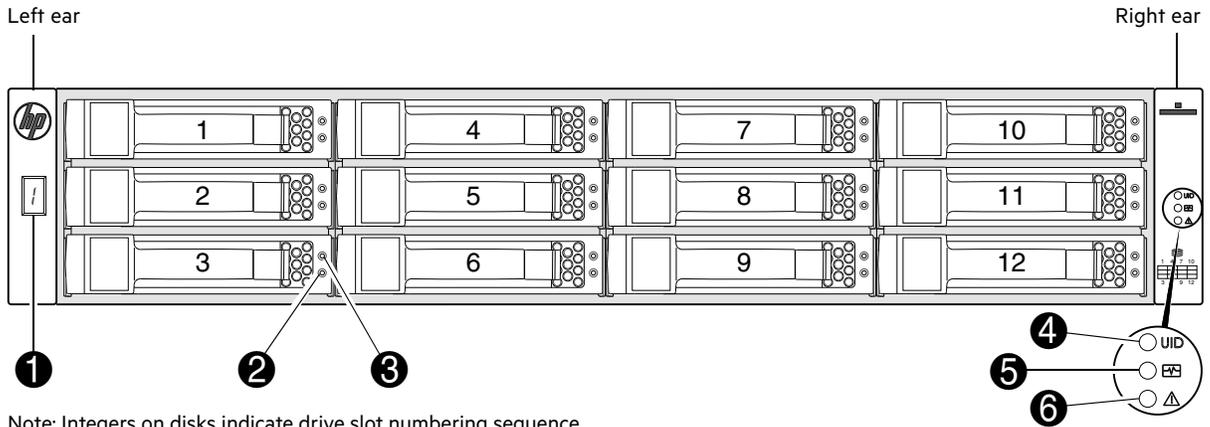


Note: Integers on disks indicate drive slot numbering sequence.

LED	Description	Definition
1	Enclosure ID	Green — On Enables you to correlate the enclosure with logical views presented by management software. Sequential enclosure ID numbering of controller enclosures begins with the integer 1. The enclosure ID for an attached drive enclosure is nonzero.
2	Disk drive Online/Activity	See <a href="#">“Disk drive LEDs” (page 66)</a> .
3	Disk drive Fault/UID	See <a href="#">“Disk drive LEDs” (page 66)</a> .
4	Unit Identification (UID)	Blue — Identified. Off — Identity LED off.
5	Heartbeat	Green — The enclosure is powered on with at least one power supply operating normally. Off — Both power supplies are off; the system is powered off.
6	Fault ID	Amber — Fault condition exists. The event has been identified, but the problem needs attention. Off — No fault condition exists.

**Figure 24 LEDs: MSA 1040 Array SFF enclosure front panel**

# MSA 1040 Array LFF or supported 12-drive expansion enclosure

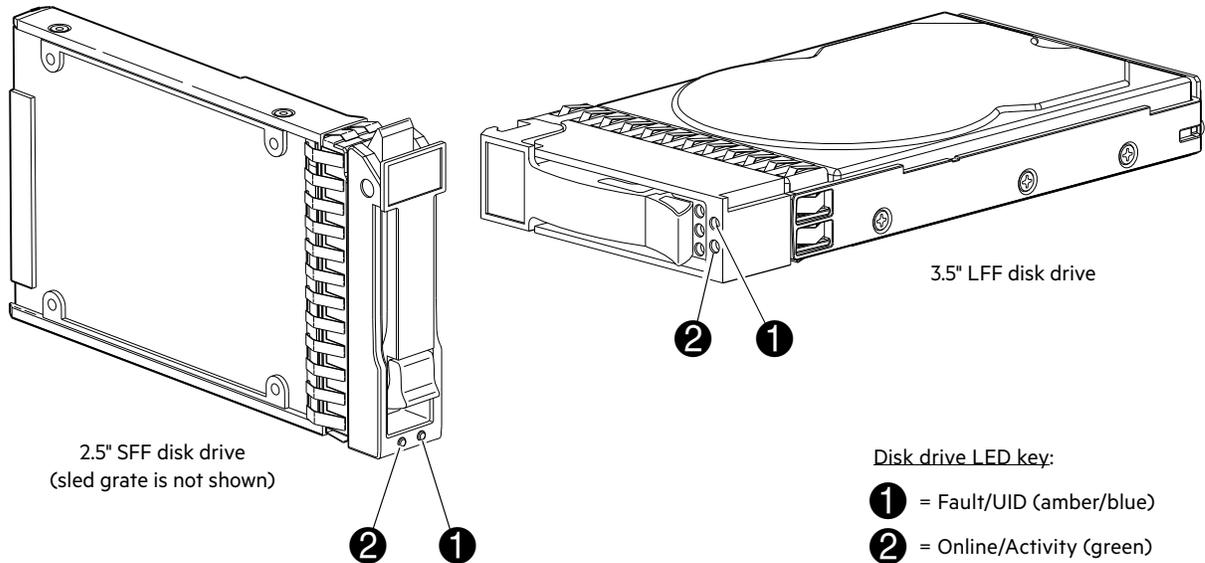


Note: Integers on disks indicate drive slot numbering sequence.

LED	Description	Definition
1	Enclosure ID	Green — On Enables you to correlate the enclosure with logical views presented by management software. Sequential enclosure ID numbering of controller enclosures begins with the integer 1. The enclosure ID for an attached drive enclosure is nonzero.
2	Disk drive Online/Activity	See “Disk drive LEDs” (page 66).
3	Disk drive Fault/UID	See “Disk drive LEDs” (page 66).
4	Unit Identification (UID)	Blue — Identified. Off — Identity LED off.
5	Heartbeat	Green — The enclosure is powered on with at least one power supply operating normally. Off — Both power supplies are off; the system is powered off.
6	Fault ID	Amber — Fault condition exists. The event has been identified, but the problem needs attention. Off — No fault condition exists.

Figure 25 LEDs: MSA 1040 Array LFF enclosure front panel

## Disk drive LEDs



Online/Activity (green)	Fault/UID (amber/blue)	Description
On	Off	Normal operation. The disk drive is online, but it is not currently active.
Blinking irregularly	Off	The disk drive is active and operating normally.
Off	Amber; blinking regularly (1 Hz)	Offline: the disk is not being accessed. A predictive failure alert may have been received for this device. Further investigation is required.
On	Amber; blinking regularly (1 Hz)	Online: possible I/O activity. A predictive failure alert may have been received for this device. Further investigation is required.
Blinking irregularly	Amber; blinking regularly (1 Hz)	The disk drive is active, but a predictive failure alert may have been received for this disk. Further investigation is required.
Off	Amber; solid <sup>1</sup>	Offline: no activity. A failure or critical fault condition has been identified for this disk.
Off	Blue; solid	Offline: the disk drive has been selected by a management application such as the SMU.
On or blinking	Blue; solid	The controller is driving I/O to the disk, and it has been selected by a management application such as the SMU.
Blinking regularly (1 Hz)	Off	<p><b>CAUTION:</b> Do not remove the disk drive. Removing a disk may terminate the current operation and cause data loss. The disk is reconstructing.</p>
Off	Off	Either there is no power, the drive is offline, or the drive is not configured.

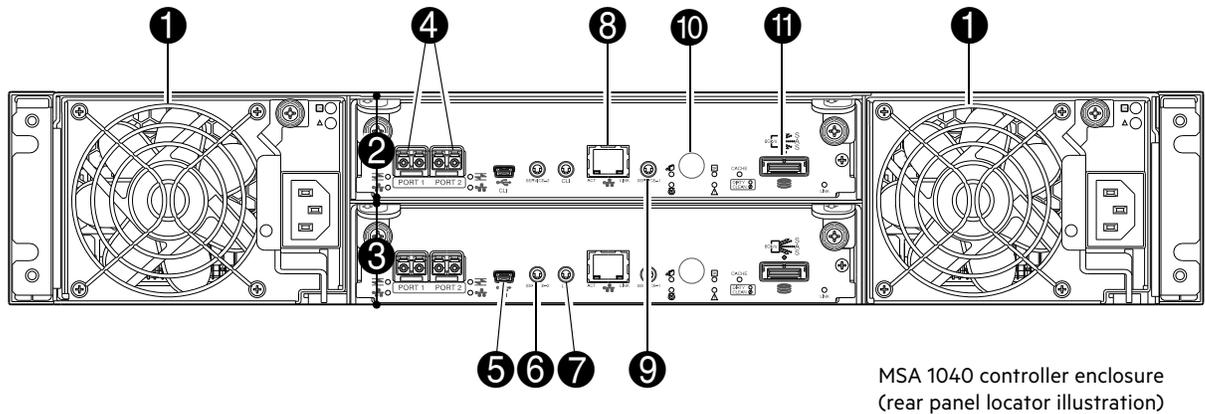
<sup>1</sup> This Fault/UID state can indicate that the disk is a leftover. The fault may involve metadata on the disk rather than the disk itself. See the Clearing disk metadata topic in the SMU Reference Guide or online help.

**Figure 26 LEDs: Disk drive combinations — enclosure front panel**

# Rear panel LEDs

## Controller enclosure—rear panel layout

The diagram and table below display and identify important component items comprising the rear panel layout of the MSA 1040 controller enclosure. The example configuration shown in [Figure 27](#) uses FC SFPs. Diagrams and tables on the following pages further describe rear panel LED behavior for component field-replaceable units.



- |  |   |
|--|---|
| 1 AC Power supplies [see <a href="#">Figure 31 (page 71)</a> ]   | 7 Reserved for future use   |
| 2 Controller module A [see <a href="#">Figure 28 (page 68)</a> ] | 8 Network port  |
| 3 Controller module B [see <a href="#">Figure 28 (page 68)</a> ] | 9 Service port 1 (used by service personnel only)                                       |
| 4 Host ports: used for host connection or replication            | 10 Disabled button (used by engineering only)<br>(Stickers shown covering the openings) |
| 5 CLI port (USB - Type B)  | 11 SAS expansion port   |
| 6 Service port 2 (used by service personnel only)                |   |

**Figure 27 MSA 1040 Array: rear panel**

A controller enclosure accommodates two power supply FRUs within the two power supply slots (see two instances of callout 1 above). The controller enclosure accommodates two controller module FRUs of the same type within the I/O module slots (see callouts 2 and 3 above).

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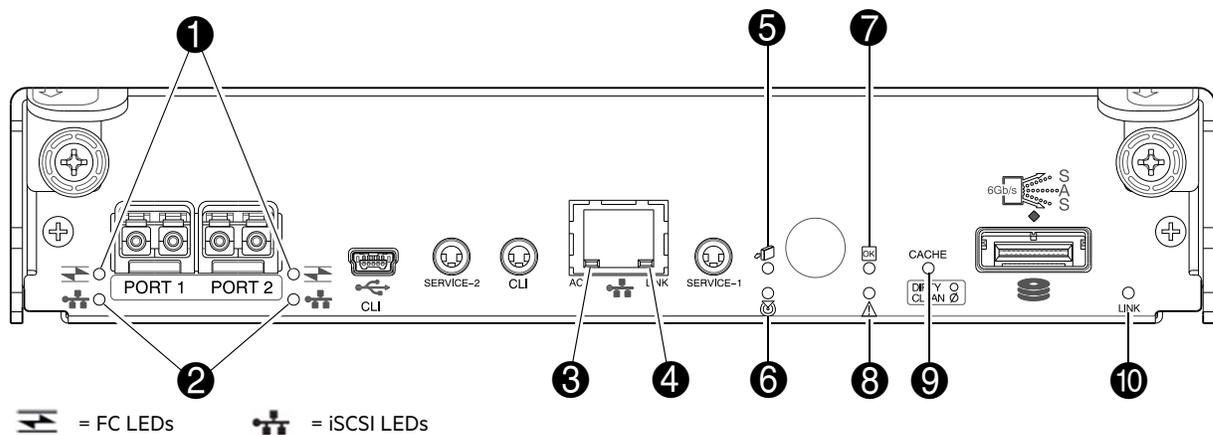
**! IMPORTANT:** MSA 1040 controller enclosures are configured with dual-controller modules (see callout 2 and callout 3 above). Single-controller support is provided only when a controller fails over to its partner controller. A controller module must be installed in each IOM slot to ensure sufficient airflow through the enclosure during operation.

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The diagrams with tables that immediately follow provide descriptions of the different controller modules and the power supply module that can be installed into the rear panel of an MSA 1040 controller enclosure. The controller module for your product is pre-configured with the appropriate external connector for the selected host interface protocol. Showing controller modules and power supply modules separately from the enclosure provides improved clarity in identifying the component items called out in the diagrams and described in the tables.

Descriptions are also provided for optional drive enclosures supported by MSA 1040 controller enclosures for expanding storage capacity.

## MSA 1040 controller module—rear panel LEDs



LED	Description	Definition
1	Host 4/8 Gb FC <sup>1</sup> Link Status/ Link Activity	Off — No link detected. Green — The port is connected and the link is up. Blinking green — The link has I/O or replication activity.
2	Host 10GbE iSCSI <sup>2,3</sup> Link Status/ Link Activity	Off — No link detected. Green — The port is connected and the link is up. Blinking green — The link has I/O or replication activity.
3	Network Port Link Active Status <sup>4</sup>	Off — The Ethernet link is not established, or the link is down. Green — The Ethernet link is up (applies to all negotiated link speeds).
4	Network Port Link Speed <sup>4</sup>	Off — Link is up at 10/100base-T negotiated speeds. Amber — Link is up and negotiated at 1000base-T.
5	OK to Remove	Off — The controller module is not prepared for removal. Blue — The controller module is prepared for removal.
6	Unit Locator	Off — Normal operation. Blinking white — Physically identifies the controller module.
7	FRU OK	Off — Controller module is not OK. Blinking green — System is booting. Green — Controller module is operating normally.
8	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled power-up or a cache flush or restore error.
9	Cache Status	Green — Cache contains unwritten data and operation is normal. The unwritten information can be log or debug data that remains in the cache, so a Green cache status LED does not, by itself, indicate that any user data is at risk or that any action is necessary. Off — In a working controller, cache is clean (contains no unwritten data). This is an occasional condition that occurs while the system is booting. Blinking green — A CompactFlash flush or cache self-refresh is in progress, indicating cache activity. See also <a href="#">Cache Status LED details</a> .
10	Expansion Port Status	Off — The port is empty or the link is down. On — The port is connected and the link is up.

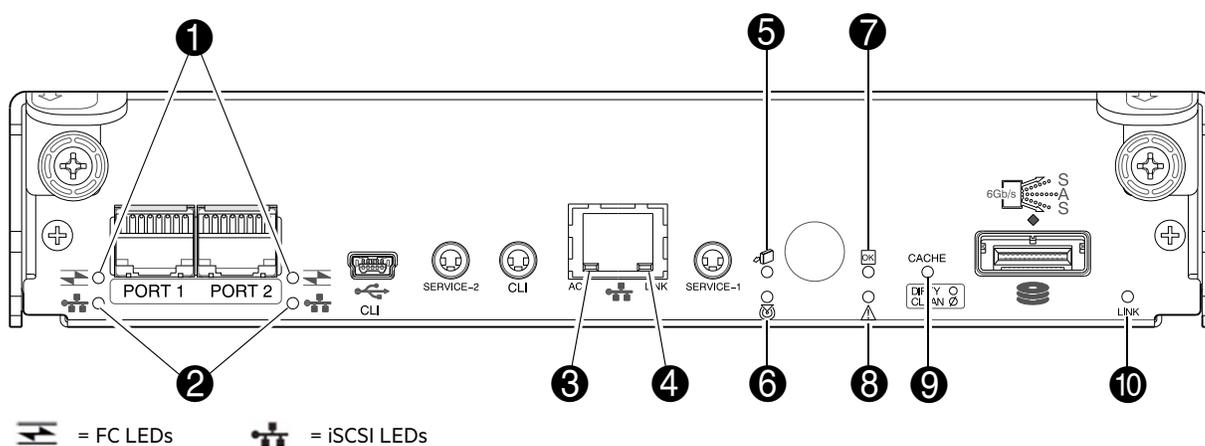
<sup>1</sup> When in FC mode, the SFPs must be a qualified 8 Gb fibre optic option described in the QuickSpecs. An 8 Gbit/s SFP can run at 8 Gbit/s, 4 Gbit/s, or auto-negotiate its link speed.

<sup>2</sup> When in 10GbE iSCSI mode, the SFPs must be a qualified 10GbE iSCSI optic option as described in the QuickSpecs.

<sup>3</sup> When powering up and booting, iSCSI LEDs will be on/blinking momentarily, then they will switch to the mode of operation.

<sup>4</sup> When port is down, both LEDs are off.

**Figure 28 LEDs: MSA 1040 controller module (equipped with either FC or 10GbE iSCSI SFPs)**



LED	Description	Definition
1	Not used in example <sup>1</sup>	The FC SFP is not show in this example [see <a href="#">Figure 28 (page 68)</a> ].
2	Host 1 Gb iSCSI <sup>2,3</sup> Link Status/ Link Activity	Off — No link detected. Green — The port is connected and the link is up; or the link has I/O or replication activity.
3	Network Port Link Active Status <sup>4</sup>	Off — The Ethernet link is not established, or the link is down. Green — The Ethernet link is up (applies to all negotiated link speeds).
4	Network Port Link Speed <sup>4</sup>	Off — Link is up at 10/100base-T negotiated speeds. Amber — Link is up and negotiated at 1000base-T.
5	OK to Remove	Off — The controller module is not prepared for removal. Blue — The controller module is prepared for removal.
6	Unit Locator	Off — Normal operation. Blinking white — Physically identifies the controller module.
7	FRU OK	Off — Controller module is not OK. Blinking green — System is booting. Green — Controller module is operating normally.
8	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled power-up or a cache flush or restore error.
9	Cache Status	Green — Cache contains unwritten data and operation is normal. The unwritten information can be log or debug data that remains in the cache, so a Green cache status LED does not, by itself, indicate that any user data is at risk or that any action is necessary. Off — In a working controller, cache is clean (contains no unwritten data). This is an occasional condition that occurs while the system is booting. Blinking green — A CompactFlash flush or cache self-refresh is in progress, indicating cache activity. See also <a href="#">Cache Status LED details</a> .
10	Expansion Port Status	Off — The port is empty or the link is down. On — The port is connected and the link is up.

<sup>1</sup> When in FC mode, the SFPs must be a qualified 8 Gb fibre optic option described in the QuickSpecs.

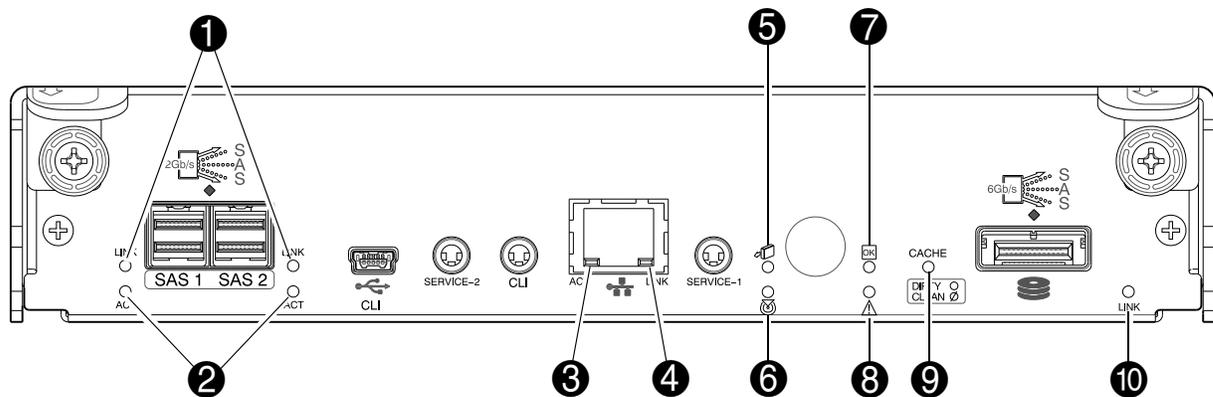
<sup>2</sup> When in 1 Gb iSCSI mode, the SFPs must be a qualified RJ-45 iSCSI option as described in the QuickSpecs. The 1 Gb iSCSI mode does not support an iSCSI optic option.

<sup>3</sup> When powering up and booting, iSCSI LEDs will be on/blinking momentarily, then they will switch to the mode of operation.

<sup>4</sup> When port is down, both LEDs are off.

**Figure 29 LEDs: MSA 1040 controller module (equipped with 1 Gb RJ-45 SFPs)**

## MSA 1040 SAS controller module—rear panel LEDs



LED	Description	Definition
1	Host 6/12 Gb SAS <sup>1</sup> Link Status	Off — No link detected. Green — The port is connected and the link is up.
2	Host 6/12 Gb SAS <sup>1</sup> Link Activity	Off — The link is idle. Blinking green — The link has I/O activity.
3	Network Port Link Active Status <sup>2</sup>	Off — The Ethernet link is not established, or the link is down. Green — The Ethernet link is up (applies to all negotiated link speeds).
4	Network Port Link Speed <sup>2</sup>	Off — Link is up at 10/100base-T negotiated speeds. Amber — Link is up and negotiated at 1000base-T.
5	OK to Remove	Off — The controller module is not prepared for removal. Blue — The controller module is prepared for removal.
6	Unit Locator	Off — Normal operation. Blinking white — Physically identifies the controller module.
7	FRU OK	Off — Controller module is not OK. Blinking green — System is booting. Green — Controller module is operating normally.
8	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled power-up or a cache flush or restore error.
9	Cache Status	Green — Cache contains unwritten data and operation is normal. The unwritten information can be log or debug data that remains in the cache, so a Green cache status LED does not, by itself, indicate that any user data is at risk or that any action is necessary. Off — In a working controller, cache is clean (contains no unwritten data). This is an occasional condition that occurs while the system is booting. Blinking green — A CompactFlash flush or cache self-refresh is in progress, indicating cache activity. See also <a href="#">Cache Status LED details</a> .
10	Expansion Port Status	Off — The port is empty or the link is down. On — The port is connected and the link is up.

<sup>1</sup> See the qualified HD mini-SAS host cable options described in the QuickSpecs.

<sup>2</sup> When port is down, both LEDs are off.

**Figure 30 LEDs: MSA 1040 controller module (equipped with SFF-8644 12 Gb SAS connectors)**

**NOTE:** Once a Link Status LED is lit, it remains so, even if the controller is shutdown via the SMU or CLI.

When a controller is shutdown or otherwise rendered inactive—its Link Status LED remains illuminated—falsely indicating that the controller can communicate with the host. Though a link exists between the host and the chip on the

controller, the controller is not communicating with the chip. To reset the LED, the controller must be properly power-cycled [see “Powering on/powering off” (page 23)].

### Cache Status LED details

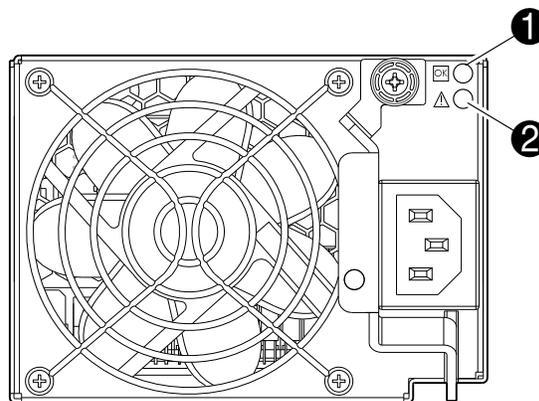
If the LED is blinking evenly, a cache flush is in progress. When a controller module loses power and write cache contains data that has not been written to disk, the supercapacitor pack provides backup power to flush (copy) data from write cache to CompactFlash memory. When cache flush is complete, the cache transitions into self-refresh mode.

If the LED is blinking momentarily slowly, the cache is in a self-refresh mode. In self-refresh mode, if primary power is restored before the backup power is depleted (3–30 minutes, depending on various factors), the system boots, finds data preserved in cache, and writes it to disk. This means the system can be operational within 30 seconds, and before the typical host I/O time-out of 60 seconds, at which point system failure would cause host-application failure. If primary power is restored after the backup power is depleted, the system boots and restores data to cache from CompactFlash, which can take about 90 seconds. The cache flush and self-refresh mechanism is an important data protection feature; essentially four copies of user data are preserved: one in controller cache and one in CompactFlash of each controller. The Cache Status LED illuminates solid green during the boot-up process. This behavior indicates the cache is logging all POSTs, which will be flushed to the CompactFlash the next time the controller shuts down.

**△ CAUTION:** If the Cache Status LED illuminates solid green—and you wish to shut-down the controller—do so from the user interface, so unwritten data can be flushed to CompactFlash.

### Power supply LEDs

Power redundancy is achieved through two independent load-sharing power supplies. In the event of a power supply failure, or the failure of the power source, the storage system can operate continuously on a single power supply. Greater redundancy can be achieved by connecting the power supplies to separate circuits. AC power supplies may or may not have a power switch (model shown below has no power switch). Whether a power supply has a power switch is significant to powering on/off. Power supplies are used by controller and drive enclosures.



AC model

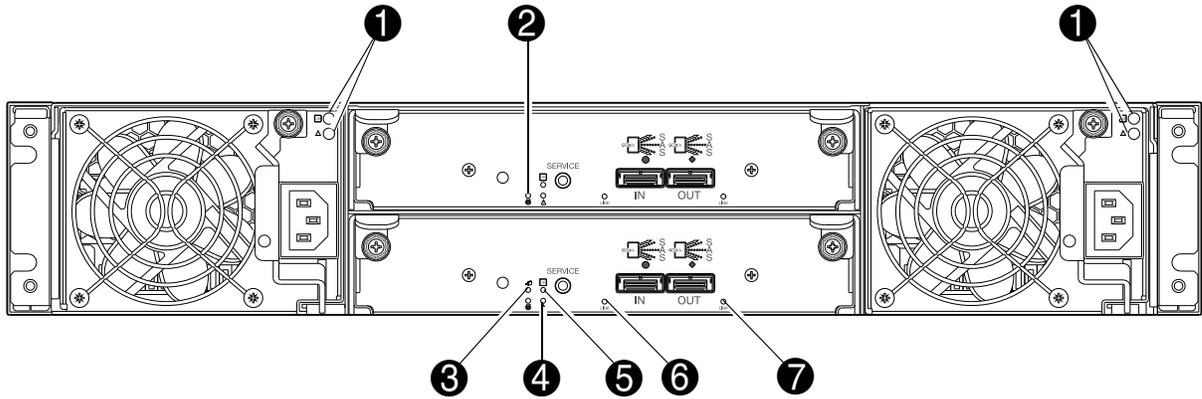
LED	Description	Definition
1	Input Source Power Good	Green — Power is on and input voltage is normal. Off — Power is off or input voltage is below the minimum threshold.
2	Voltage/Fan Fault/Service Required	Amber — Output voltage is out of range or a fan is operating below the minimum required RPM. Off — Output voltage is normal.

**Figure 31 LEDs: MSA 1040 Storage system enclosure power supply module**

**NOTE:** See “Powering on/powering off” (page 23) for information on power-cycling enclosures.

## MSA 2040 6 Gb 3.5" 12-drive enclosure—rear panel layout

MSA 1040 controllers support the MSA 2040 6 Gb 3.5" 12-drive enclosure. The front panel of the drive enclosure looks identical to that of an MSA 1040 Array LFF. The rear panel of the drive enclosure is shown below.



LED	Description	Definition
1	Power supply LEDs	See “Power supply LEDs” (page 71).
2	Unit Locator	Off — Normal operation. Blinking white— Physically identifies the expansion module.
3	OK to Remove	Not implemented.
4	Fault/Service Required	Amber — A fault has been detected or a service action is required. Blinking amber — Hardware-controlled powerup or a cache flush or restore error.
5	FRU OK	Green — Expansion module is operating normally. Blinking green — System is booting. Off — Expansion module is not OK.
6	SAS In Port Status	Green — Port link is up and connected. Off — Port is empty or link is down.
7	SAS Out Port Status	Green — Port link is up and connected. Off — Port is empty or link is down.

**Figure 32 LEDs: MSA 2040 6 Gb 3.5" 12-drive enclosure rear panel**

The MSA 2040 6 Gb 3.5" 12-drive enclosure is identical in outward physical appearance to the legacy P2000 G3 6 Gb 3.5" 12-drive enclosure. For information about upgrading P2000 G3 components for use with MSA 1040 controllers, see “Upgrading to MSA 2040” (page 16).

## D2700 6Gb drive enclosure

MSA 1040 controllers support the D2700 6 Gb drive enclosure for adding storage. For information about D2700 components and LEDs, see the user guide for the D2700 disk enclosure at [www.hpe.com](http://www.hpe.com). Pictorial representations of this drive enclosure are also provided in the *MSA 1040 Quick Start Instructions* and *MSA 1040 Cable Configuration Guide*.

# B Specifications and requirements

## Safety requirements

Install the system in accordance with the local safety codes and regulations at the facility site. Follow all cautions and instructions marked on the equipment. Also, refer to the documentation included with your product ship kit.

## Site requirements and guidelines

The following sections provide requirements and guidelines that you must address when preparing your site for the installation.

When selecting an installation site for the system, choose a location not subject to excessive heat, direct sunlight, dust, or chemical exposure. These conditions greatly reduce the system's longevity and might void your warranty.

## Site wiring and AC power requirements

The following are required for all installations using AC power supplies:

- All AC mains and supply conductors to power distribution boxes for the rack-mounted system must be enclosed in a metal conduit or raceway when specified by local, national, or other applicable government codes and regulations.
- Ensure that the voltage and frequency of your power source match the voltage and frequency inscribed on the equipment's electrical rating label.
- To ensure redundancy, provide two separate power sources for the enclosures. These power sources must be independent of each other, and each must be controlled by a separate circuit breaker at the power distribution point.
- The system requires voltages within minimum fluctuation. The customer-supplied facilities' voltage must maintain a voltage with not more than  $\pm 5$  percent fluctuation. The customer facilities must also provide suitable surge protection.
- Site wiring must include an earth ground connection to the AC power source. The supply conductors and power distribution boxes (or equivalent metal enclosure) must be grounded at both ends.
- Power circuits and associated circuit breakers must provide sufficient power and overload protection. To prevent possible damage to the AC power distribution boxes and other components in the rack, use an external, independent power source that is isolated from large switching loads (such as air conditioning motors, elevator motors, and factory loads).

---

**NOTE:** For power requirements, see the QuickSpecs: <http://www.hpe.com/support/msa1040/QuickSpecs>. If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.

---

## Weight and placement guidelines

Refer to “Physical requirements” (page 74) for detailed size and weight specifications.

- The weight of an enclosure depends on the number and type of modules installed.
- Ideally, use two people to lift an enclosure. However, one person can safely lift an enclosure if its weight is reduced by removing the power supply modules and disk drive modules.
- Do not place enclosures in a vertical position. Always install and operate the enclosures in a horizontal/level orientation.
- When installing enclosures in a rack, make sure that any surfaces over which you might move the rack can support the weight. To prevent accidents when moving equipment, especially on sloped loading docks and up ramps to raised floors, ensure you have a sufficient number of helpers. Remove obstacles such as cables and other objects from the floor.
- To prevent the rack from tipping, and to minimize personnel injury in the event of a seismic occurrence, securely anchor the rack to a wall or other rigid structure that is attached to both the floor and to the ceiling of the room.

## Electrical guidelines

- These enclosures work with single-phase power systems having an earth ground connection. To reduce the risk of electric shock, do not plug an enclosure into any other type of power system. Contact your facilities manager or a qualified electrician if you are not sure what type of power is supplied to your building.
- Enclosures are shipped with a grounding-type (three-wire) power cord. To reduce the risk of electric shock, always plug the cord into a grounded power outlet.
- Do not use household extension cords with the enclosures. Not all power cords have the same current ratings. Household extension cords do not have overload protection and are not meant for use with computer systems.

## Ventilation requirements

Refer to “[Environmental requirements](#)” (page 75) for detailed environmental requirements.

- Do not block or cover ventilation openings at the front and rear of an enclosure. Never place an enclosure near a radiator or heating vent. Failure to follow these guidelines can cause overheating and affect the reliability and warranty of your enclosure.
- Leave a minimum of 15 cm (6 inches) at the front and back of each enclosure to ensure adequate airflow for cooling. No cooling clearance is required on the sides, top, or bottom of enclosures.
- Leave enough space in front and in back of an enclosure to allow access to enclosure components for servicing. Removing a component requires a clearance of at least 37 cm (15 inches) in front of and behind the enclosure.

## Cabling requirements

- Keep power and interface cables clear of foot traffic. Route cables in locations that protect the cables from damage.
- Route interface cables away from motors and other sources of magnetic or radio frequency interference.
- Stay within the cable length limitations.

## Management host requirements

A local management host with at least one USB Type B port connection is recommended for the initial installation and configuration of a controller enclosure. After you configure one or both of the controller modules with an Internet Protocol (IP) address, you then use a remote management host on an Ethernet network to configure, manage, and monitor.

---

**NOTE:** Connections to this device must be made with shielded cables—grounded at both ends—with metallic RFI/EMI connector hoods, in order to maintain compliance with FCC Rules and Regulations.

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## Physical requirements

The floor space at the installation site must be strong enough to support the combined weight of the rack, controller enclosures, drive enclosures (expansion), and any additional equipment. The site also requires sufficient space for installation, operation, and servicing of the enclosures, together with sufficient ventilation to allow a free flow of air to all enclosures.

[Table 31](#) and [Table 32](#) list enclosure dimensions and weights. Weights are based on an enclosure having a full complement of disk drives, two controller or expansion modules, and two power supplies installed. “2U12” denotes the LFF enclosure (12 disks) and “2U24” denotes the SFF enclosure (24 disks).

Table 32 provides weight data for MSA 1040 controller enclosures and select drive enclosures. For information about other HPE MSA drive enclosures that may be cabled to these systems (i.e., D2700), check the QuickSpecs: <http://www.hpe.com/support/msa1040/QuickSpecs>. If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.

**Table 31 Rackmount enclosure dimensions**

Specifications	Rackmount
2U Height (y-axis)	8.9 cm (3.5 inches)
Width (x-axis):	
<ul style="list-style-type: none"> <li>Chassis only</li> </ul>	44.7 cm (17.6 inches)
<ul style="list-style-type: none"> <li>Chassis with bezel ear caps</li> </ul>	47.9 cm (18.9 inches)
Depth (z-axis):	
SFF drive enclosure (2U24)	
<ul style="list-style-type: none"> <li>Back of chassis ear to controller latch</li> </ul>	50.5 cm (19.9 inches)
<ul style="list-style-type: none"> <li>Front of chassis ear to back of cable bend</li> </ul>	57.9 cm (22.8 inches)
LFF drive enclosure (2U12)	
<ul style="list-style-type: none"> <li>Back of chassis ear to controller latch</li> </ul>	60.2 cm (23.7 inches)
<ul style="list-style-type: none"> <li>Front of chassis ear to back of cable bend</li> </ul>	67.1 cm (26.4 inches)

**Table 32 Rackmount enclosure weights**

Specifications	Rackmount
MSA 1040 Array SFF enclosure	8.6 kg (19.0 lb) [chassis]
<ul style="list-style-type: none"> <li>Chassis with FRUs (no disks)<sup>1,2</sup></li> </ul>	19.9 kg (44.0 lb)
<ul style="list-style-type: none"> <li>Chassis with FRUs (including disk)<sup>1,3</sup></li> </ul>	25.4 kg (56.0 lb)
MSA 1040 Array LFF enclosure	9.9 kg (22.0 lb) [chassis]
<ul style="list-style-type: none"> <li>Chassis with FRUs (no disks)<sup>1,2</sup></li> </ul>	21.3 kg (47.0 lb)
<ul style="list-style-type: none"> <li>Chassis with FRUs (including disks)<sup>1,3</sup></li> </ul>	30.8 kg (68.0 lb)
MSA 2040 or P2000 6 Gb 3.5" drive enclosure	9.9 kg (22.0 lb) [chassis]
<ul style="list-style-type: none"> <li>Chassis with FRUs (no disks)<sup>1,2</sup></li> </ul>	21.3 kg (47.0 lb)
<ul style="list-style-type: none"> <li>Chassis with FRUs (including disks)<sup>1,3</sup></li> </ul>	30.8 kg (68.0 lb)

<sup>1</sup> Weights shown are nominal, and subject to variances.

<sup>2</sup> Weights may vary due to different power supplies, IOMs, and differing calibrations between scales.

<sup>3</sup> Weights may vary due to actual number and type of disk drives (SAS or SSD) installed.

## Environmental requirements

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**NOTE:** For operating and non-operating environmental technical specifications, see the QuickSpecs: <http://www.hpe.com/support/msa1040/QuickSpecs>.

---

If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.

## Electrical requirements

### Site wiring and power requirements

Each enclosure has two power supply modules for redundancy. If full redundancy is required, use a separate power source for each module. The AC power supply unit in each power supply module is auto-ranging and is automatically configured to an input voltage range from 100–240 VAC with an input frequency of 50–60 Hz. The power supply modules meet standard voltage requirements for both U.S. and international operation. The power supply modules use standard industrial wiring with line-to-neutral or line-to-line power connections.

### Power cord requirements

Each enclosure is equipped with two power supplies. For enclosures equipped with AC power supply modules, use two power cords that are appropriate for use in a typical outlet in the destination country. Each power cable connects one of the power supplies to an independent, external power source. To ensure power redundancy, connect the two suitable power cords to two separate circuits: for example, to one commercial circuit and one uninterruptible power source (UPS).

---

① **IMPORTANT:** See the QuickSpecs for information about power cables provided with your MSA 1040 Storage product.

---

If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.

# C Electrostatic discharge

## Preventing electrostatic discharge

To prevent damaging the system, be aware of the precautions you need to follow when setting up the system or handling parts. A discharge of static electricity from a finger or other conductor may damage system boards or other static-sensitive devices. This type of damage may reduce the life expectancy of the device.

To prevent electrostatic damage:

- Avoid hand contact by transporting and storing products in static-safe containers.
- Keep electrostatic-sensitive parts in their containers until they arrive at static-protected workstations.
- Place parts in a static-protected area before removing them from their containers.
- Avoid touching pins, leads, or circuitry.
- Always be properly grounded when touching a static-sensitive component or assembly.

## Grounding methods to prevent electrostatic discharge

Several methods are used for grounding. Use one or more of the following methods when handling or installing electrostatic-sensitive parts:

- Use a wrist strap connected by a ground cord to a grounded workstation or computer chassis. Wrist straps are flexible straps with a minimum of 1 megohm ( $\pm 10$  percent) resistance in the ground cords. To provide proper ground, wear the strap snug against the skin.
- Use heel straps, toe straps, or boot straps at standing workstations. Wear the straps on both feet when standing on conductive floors or dissipating floor mats.
- Use conductive field service tools.
- Use a portable field service kit with a folding static-dissipating work mat.

If you do not have any of the suggested equipment for proper grounding, have an authorized reseller install the part. For more information on static electricity or assistance with product installation, contact an authorized reseller.

## D SAS fan-out cable option

### Locate the SAS fan-out cable

Locate the appropriate qualified SAS fan-out cable option for your 2-port SAS controller module. Qualified fan-out cable options are briefly described in “[Cable requirements for MSA 1040 enclosures](#)” (page 18) within this document.

---

**NOTE:** Qualified SAS fan-out cable options are labeled on the host connection end of each bifurcated cable. Hosts should be connected to the same ports on both controller modules to align with the usage shown in the SMU.

---

Refer to the QuickSpecs for additional information such as supported cable lengths.

<http://www.hpe.com/support/msa1040/QuickSpecs>

(If a website location has changed, a Google search for HPE 1040 quickspecs will provide a link.)

A cabling example showing use of SAS fan-out cables is provided in [Connecting direct attach configurations](#) [see [Figure 17 \(page 30\)](#)].

# E Warranty and regulatory information

For important safety, environmental, and regulatory information, see *Safety and Compliance Information for Server, Storage, Power, Networking, and Rack Products*, available at [www.hpe.com/support/Safety-Compliance-EnterpriseProducts](http://www.hpe.com/support/Safety-Compliance-EnterpriseProducts).

## Warranty information

### HPE ProLiant and x86 Servers and Options

[www.hpe.com/support/ProLiantServers-Warranties](http://www.hpe.com/support/ProLiantServers-Warranties)

### HPE Enterprise Servers

[www.hpe.com/support/EnterpriseServers-Warranties](http://www.hpe.com/support/EnterpriseServers-Warranties)

### HPE Storage Products

[www.hpe.com/support/Storage-Warranties](http://www.hpe.com/support/Storage-Warranties)

### HPE Networking Products

[www.hpe.com/support/Networking-Warranties](http://www.hpe.com/support/Networking-Warranties)

## Regulatory information

### Belarus Kazakhstan Russia marking



#### Manufacturer and Local Representative Information

##### Manufacturer information:

- Hewlett Packard Enterprise, 3000 Hanover Street, Palo Alto, CA 94304, U.S.

##### Local representative information Russian:

- Russia:

ЗАО «Хьюлетт-Паккард А.О.», 125171, Россия, г. Москва, Ленинградское шоссе, 16А, стр.3, тел./факс: +7 (495) 797 35 00, +7 (495) 287 89 05

- Belarus:

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- Kazakhstan:

ТОО «Хьюлетт-Паккард (К)», 050040, Казахстан, г. Алматы, Бостандыкский район, ул. Тимирязева, 28В, 1 этаж, тел./факс: +7 (727) 355 35 50, +7 (727) 355 35 51

##### Local representative information Kazakh:

- Kazakhstan:

ЖШС «Хьюлетт-Паккард (К)», Қазақстан, Алматы қ., Бостандық ауданы, Тимирязев к-сі, 28В, тел./факс: +7 (727) 355 35 50, +7 (727) 355 35 51

**Manufacturing date:**

The manufacturing date is defined by the serial number.

CCSYWWZZZZ (serial number format for this product)

Valid date formats include:

- YWW, where Y indicates the year counting from within each new decade, with 2000 as the starting point; for example, 238: 2 for 2002 and 38 for the week of September 9. In addition, 2010 is indicated by 0, 2011 by 1, 2012 by 2, 2013 by 3, and so forth.
- YYWW, where YY indicates the year, using a base year of 2000; for example, 0238: 02 for 2002 and 38 for the week of September 9.

**Turkey RoHS material content declaration**

Türkiye Cumhuriyeti: EEE Yönetmeliğine Uygundur

**Ukraine RoHS material content declaration**

Обладнання відповідає вимогам Технічного регламенту щодо обмеження використання деяких небезпечних речовин в електричному та електронному обладнанні, затвердженого постановою Кабінету Міністрів України від 3 грудня 2008 № 1057

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