

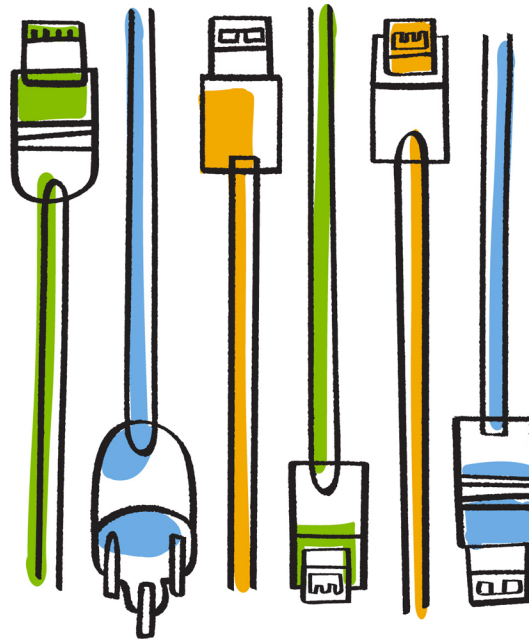


NetApp®

SAS Disk Shelves

Installation and Service Guide

For DS4243, DS2246, DS4486, and DS4246



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SAS disk shelf safety information

Before you install the shelf, you need to be aware of safety information about the physical installation, power and electrical, and management of your disk shelf.



Danger: Failure to follow these directions could result in bodily harm or death.



Caution: If this equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment might be impaired.

Physical installation safety rules

Before installing the disk shelf, make sure that you have read and understand these physical installation safety rules.

- The rack construction must be capable of supporting the total weight of the installed enclosures and the design should incorporate stabilizing features to prevent the rack from tipping or being pushed over during installation or in normal use.
- When installing disk shelves and a storage system into a movable cabinet or rack, install from the bottom up for best stability.
- A fully loaded disk shelf is heavy. Do not try to lift it by yourself.
Before moving the enclosure, you can remove all Power Supply Units (PSUs) and I/O Modules (IOMs) to minimize weight.
 - A fully loaded DS4243 or DS4246 disk shelf can weigh approximately 110 lbs. (50 kg).
 - A fully loaded DS2246 disk shelf can weigh approximately 49 lbs (22 kg).
 - A fully loaded DS4486 disk shelf can weigh approximately 150 lbs (68 kg). With only the two IOMs, four PSUs, and four disk carriers installed, the disk shelf can weigh approximately 82 lbs (37 kg).
- A safe lifting height is 20U.
- Do not lift the enclosure by the handles on the PSUs.
They are not designed to take the weight.
- Ensure that the socket outlets are located near the equipment and are easily accessible since the plug on the power supply cord is used as the main disconnect device.
- The rack, when configured with the units, must meet the safety requirements of UL 60950-1 and IEC 60950-1.



Caution: The optional RJ45 socket on the I/O module is for Ethernet connection only and must not be connected to a telecommunications network.

Power and electrical safety rules

Before installing the disk shelf, make sure that you have read and understand these power and electrical safety rules.

- The enclosure must only be operated from a power supply input voltage range of 100-240 VAC.
- The rack design should take into consideration the maximum operating ambient temperature for the unit, which is 40 degrees C.
- The rack should have a safe electrical distribution system.
It must provide over-current protection for the unit and must not be overloaded by the local number of units installed in the rack.
When addressing these concerns consideration should be given to the electrical power consumption rating shown on the name plate.
- A safe electrical earth connection must be provided to the power supply cords.
- This equipment is designed for connection to a grounded outlet.
The grounding type plug is an important safety feature.
To avoid the risk of electrical shock or damage to the equipment, do not disable this feature.
- The electrical distribution system must provide a reliable earth connection for each unit in the rack.
- DC-based systems must be installed in a restricted access location and the two input power terminals for the DC power supply must be connected to separate isolated branch circuits.
- Provide a suitable power source with electrical overload protection to meet the requirements laid down in the technical specification.

Management safety rules

Before operating, replacing, or removing the disk shelf or disk shelf components, make sure that you have read and understand these management safety rules.

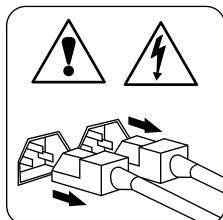
- In order to comply with applicable safety, emission, and thermal requirements, no covers should be removed and all bays must be populated with plug-in modules.
- Since all plug-in modules and blank plates are part of the fire enclosure, they must only be removed when a replacement can be immediately added.
The system must not be run without all modules or blanks in place.
- To reduce the risk of personal injury or equipment damage, allow internal components time to cool before touching them.
- When removing a disk shelf from a movable cabinet or a rack, empty from the top down.
- To avoid danger of the rack toppling over, do not slide more than one enclosure out of the rack at a time.
- Permanently unplug the unit before you move it or if you think it has become damaged in any way.
- The power connection should always be disconnected prior to removal of a PSU from the enclosure.



Danger: Do not remove a faulty PSU unless you have a replacement PSU of the correct type ready for insertion. The system must not be run without all units or module blanks in place.



Danger: Do not remove covers from the PSU. Danger of electrical shock inside. Return the PSU to you supplier for repair.



Caution: This unit has more than one power supply cord. To reduce the risk of electrical shock, disconnect all power supply cords for complete isolation before servicing.

Installing SAS disk shelves in a new HA pair or single-controller configuration

Installing the SAS disk shelves as part of your new a new HA pair or single-controller configuration includes installing a rack mount kit for each disk shelf and installing the disk shelves in the rack.

Before you begin

- Your HA pair or single-controller configuration must have met the supported configuration requirements including supported disk shelves, SAS cables, number of stacks, and number of disk shelves in a stack.

[NetApp Hardware Universe](#)

- If you are installing DS4486 disk shelves, you must have read and understood the *Rules for handling disk carriers for DS4486 disk shelves* section to prevent damage to the disk drives in the disk carriers.

About this task

- Disk shelves do not need to be grounded; grounding is done through the power cords.
- If you are installing the disk shelf in an equipment rack or NetApp cabinet, you must install the two-post telco tray kit or four-post rail kit that came with your disk shelf.
- At the end of this procedure you are directed to the *Cabling disk shelves in a new HA pair or single-controller configuration* procedure in the [SAS Disk Shelves Universal SAS and ACP Cabling Guide](#), which includes connecting the disk shelf power cords, powering on the disk shelves, verifying shelf IDs, and cabling SAS and ACP connections.
- If you are installing a new MetroCluster system with SAS disk shelves, you should be using the appropriate MetroCluster document, which might have referred you to this procedure for specific installation instructions.

[Configuring a stretch MetroCluster system with SAS disk shelves and SAS optical cables in 7-mode](#)

[Configuring a MetroCluster system with SAS disk shelves and FibreBridge 6500N bridges in 7-Mode](#)

[Clustered Data ONTAP 8.3 MetroCluster Installation and Configuration Guide](#)

Steps

1. Ground yourself to the platform chassis using the grounding leash.
2. Install the two-post telco tray kit or four-post rail kit for your disk shelf model using the installation flyer that came with the kit.

Attention: If you are installing multiple disk shelves, you should install them from the bottom to the top of the rack for the best stability.

Do not ear-mount the disk shelf into a telco-type rack; the disk shelf will collapse from the rack under its own weight.

If you have a...	Then, using the installation flyer that came with the kit...
DS4243, DS2246, or DS4246 disk shelf	Install the two-post telco tray kit or four-post rail kit to support the disk shelf. Attention: For two-post mid-mount installations, you must use the mid-mount brackets in addition to the two-post telco tray kit.
DS4486 disk shelf	Install the four-post rail kit to support the disk shelf. Note: If you are installing a DS4486 disk shelf and you are installing it in a NetApp cabinet, you should have received the X8783 rail kit. If you are installing the disk shelf in a third-party cabinet, you should have received the X5529 or X5526 rail kit.

3. Install and secure the disk shelf onto the support brackets and rack.

To make the disk shelf lighter and easier to maneuver, remove the power supplies and I/O Modules (IOMs). Avoid removing disk drives or carriers if possible, because excessive handling can lead to internal damage.

It is recommended that you use a mechanical hoist or lift if you are moving a fully loaded DS4243 or DS4486 disk shelf.

Attention: A fully populated DS4243 or DS4246 disk shelf can weigh approximately 110 lbs (49.9 kg).

A fully populated DS2246 disk shelf can weigh approximately 49 lbs (22 kg).

A DS4486 disk shelf with the two IOMs, four power supplies, and four disk carriers can weigh approximately 82 lbs (37 kg). A fully populated disk shelf can weigh approximately 150 lbs (68 kg).

4. Reinstall any power supplies and IOMs you removed to install your disk shelf into the rack.

If you installed a DS4486 disk shelf, carefully unpack and insert the remaining disk carriers using two hands.

Note: Do not place your hands on the two disk drive boards exposed on the underside of the disk carrier.

5. If you are adding multiple disk shelves, repeat Steps 2 through 4 for each disk shelf you are installing.

After you finish

Use the *Cabling disk shelves in a new HA pair or single-controller configuration* procedure in the [SAS Disk Shelves Universal SAS and ACP Cabling Guide](#) to connect the disk shelf power cords, power on the disk shelves, verify shelf IDs, and cable the SAS and ACP connections.

Changing the disk shelf ID

You must have a unique shelf ID for each SAS disk shelf (internal and attached) within your storage system.

About this task

- A valid shelf ID is 00 through 98.

Note: Although Data ONTAP 8.3 made 99 available as a valid shelf ID, because of Bug ID 898866, 99 cannot be used.

NetApp Bugs Online Bug ID 898866: Setting Shelf ID to 99 is not supported

Note: FAS2xxx systems have the internal disk shelf ID preset to 00. You can change the internal shelf ID on the FAS22xx and FAS25xx.

- If your storage system has SAS stacks and FC loops, shelf IDs do not need to be unique between the SAS and FC disk shelves.
FC shelf IDs continue to be unique within each FC loop and SAS shelf IDs continue to be unique within the HA pair or single-controller configuration.
- If two or more SAS disk shelves have the same ID, the EMS message `sas.shelf.conflict` appears on the system console and the system assigns an ID to the duplicate disk shelf. You must reassign the duplicate shelf ID.
Note: For systems running Data ONTAP 8.2.x or earlier, the system assigns a soft ID number equal to or greater than 100, or assigns the disk shelf serial number to the duplicate disk shelf. For systems running Data ONTAP 8.3 or later, the system assigns the disk shelf serial number to the duplicate disk shelf.
- Depending on your disk shelf model, the device you use to change the shelf ID is a U-shaped tab or button.
- If you are changing the shelf ID in a storage system that is running Data ONTAP, you must wait at least 70 seconds before turning the power back on to complete the power cycle (in Step 8).

Steps

1. Turn on the power to the disk shelf if it is not already on.
2. Remove the left ear cover to locate the U-shaped tab or button near the shelf LEDs.
3. Change the first number of the shelf ID by pressing and holding the U-shaped tab or button until the first number on the digital display blinks, which can take two to three seconds.
Note: If the ID takes longer than two to three seconds to blink, press the U-shaped tab or button again, making sure to press it in all the way.

This activates the disk shelf ID programming mode.
4. Press the U-shaped tab or button to advance the number until you reach the desired number from 0 to 9.

The first number continues to blink.
5. Change the second number of the shelf ID by pressing and holding the U-shaped tab or button until the second number on the digital display blinks, which can take two to three seconds.

The first number on the digital display stops blinking.

6. Press the U-shaped tab or button to advance the number until you reach the desired number from 0 to 9.

The second number continues to blink.

7. Lock in the desired number and exit the programming mode by pressing and holding the U-shaped tab or button until the second number stops blinking, which can take two to three seconds.

Both numbers on the digital display start blinking and the fault LED on the operator display panel illuminates after about five seconds, alerting you that the pending disk shelf ID has not yet taken effect.

8. Power-cycle the disk shelf to make the shelf ID take effect.

Note: If you are changing the shelf ID in a storage system that is running Data ONTAP, you must wait at least 70 seconds before turning the power back on to complete the power cycle. This ensures that Data ONTAP can properly delete the old disk shelf address and update the copy of the new disk shelf address.

If your storage system is up and serving data, changing a shelf ID is a disruptive action.

9. Repeat Steps 1 through 8 for each additional disk shelf.

Hot-adding a SAS disk shelf

You can hot-add a SAS disk shelf to an existing stack of supported SAS disk shelves; you can also hot-add a SAS disk shelf to a SAS HBA or an onboard SAS port on the controller (as a new stack). Hot-adding a disk shelf involves installing, cabling, and verifying the disk drive and disk shelf firmware versions.

Before you begin

- Your system cannot be a MetroCluster system, which requires a different procedure depending on the type of MetroCluster system you have.

Configuring a stretch MetroCluster system with SAS disk shelves and SAS optical cables in 7-mode

Configuring a MetroCluster system with SAS disk shelves and FibreBridge 6500N bridges in 7-Mode

MetroCluster Service Guide for Clustered Data ONTAP

- Your storage system must meet the requirements for the disk shelf you are hot-adding including supported disk shelves, SAS cables, number of stacks, and number of disk shelves in a stack.
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- If you are hot-adding a single disk shelf or a stack of disk shelves directly to a system controller, you must have met the following requirements:

- Each controller in your storage system must have enough available PCI SAS HBA or onboard SAS ports.
- You must have identified the correct controller port pairs that you can use to cable the disk shelf.

The *Universal SAS and ACP Cabling Guide* has completed port pair worksheets for common configurations that you can use. If there is no completed worksheet for your configuration, fill out a worksheet template.

SAS Disk Shelves Universal SAS and ACP Cabling Guide

Note: You must define controller port pairs and cable the SAS connections according to the cabling rules (and worksheets) defined in the *Universal SAS and ACP Cabling Guide*.

- Disk shelf (IOM), disk drive, and if applicable, ACP firmware should be current on all disk shelves in your system before adding new disk shelves, shelf FRU components, or SAS cables. Best practice is to always have the most current versions of firmware on your system.

NetApp Downloads: Disk Shelf Firmware

NetApp Downloads: Disk Drive and Firmware

Note: Do not revert firmware to a version that does not support the disk shelves, disk shelf FRU components, or SAS cables in your system.

- If you are hot-adding a disk shelf with SAS optical cables to a stack of disk shelves that is connected with SAS copper cables, you can temporarily have both cable types present in the stack.

After hot-adding the disk shelf, you must replace the SAS copper cables for the rest of the shelf-to-shelf connections in the stack and the shelf-to-controller connections from the first and last disk shelf in the stack so that the stack meets the cabling rules for using SAS optical and SAS copper cables. This means that you must have ordered the appropriate number of SAS optical cables.

Note: If you have a multipath HA or single-controller-dual-path (multipath) system, you can replace cables nondisruptively. If you have a single-controller-single-path or FAS2xxx mixed-

path system, you must halt your system. The “Replacing SAS cables” section of this document has more information.

- If you are installing DS4486 disk shelves, you must have read and understood the *Rules for handling disk carriers for DS4486 disk shelves* section to prevent damage to the disk drives in the disk carriers.

About this task

- You can use longer cables to connect the hot-added shelf, if needed.
This is a cable replacement and can be done as the first step when performing the “Cabling the hot-added disk shelf” procedure.
- Alternate Control Path (ACP) is supported up to 100 meters (per Ethernet standard).
You use CAT6 Ethernet cables, which can be non-NetApp cables.
- If you are hot-adding a disk shelf to an existing stack, this procedure is written for hot-adding the disk shelf to the logical last disk shelf of the stack.
- If you are hot-adding more than one disk shelf, you hot-add one at a time.
- If you are installing the disk shelf in an equipment rack or NetApp cabinet, you must install the two-post telco tray kit or four-post rail kit that came with your disk shelf.
- Do not force a connector into a port. The SAS cable QSFP connectors are keyed; when oriented correctly into a SAS port, the QSFP connector clicks into place and the disk shelf SAS port LNK LED illuminates green.
For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector).
- Disk shelves do not need to be grounded; grounding is done through the power cords.
- To prevent degraded performance, do not twist, fold, pinch, or step on the cables.
Cables have a minimum bend radius. Cable manufacturer specifications define the minimum bend radius; however, a general guideline for minimum bend radius is 10 times the cable diameter.
- Using Velcro wraps instead of tie-wraps to bundle and secure system cables allows for easier cable adjustments.
- The SAS cables can be SAS copper, SAS optical, or a mix depending on whether or not your system meets the requirements for using the type of cable.
If you are using a mix of SAS copper cables and SAS optical cables, the following rules apply:
 - Shelf-to-shelf connections in a stack must be all SAS copper cables or all SAS optical cables.
 - If the shelf-to-shelf connections are SAS optical cables, the shelf-to-controller connections to that stack must also be SAS optical cables.
 - If the shelf-to-shelf connections are SAS copper cables, the shelf-to-controller connections to that stack can be SAS optical cables or SAS copper cables.
- SAS optical multimode QSFP-to-QSFP cables can be used for controller-to-shelf and shelf-to-shelf connections, and are available in lengths up to 50 meters.
- If you are using SAS optical multimode MPO cables with MPO QSFP modules, the following rules apply:
 - You can use these cables for controller-to-shelf and shelf-to-shelf connections.
 - The length of a single cable cannot exceed 150 meters for OM4 and 100 meters for OM3.

- The total end-to-end path (sum of point-to-point paths from the controller to the last shelf) cannot exceed 510 meters.
The total path includes the set of breakout cables, patch panels, and inter-panel cables.
- If you are using SAS optical multimode breakout cables, the following rules apply:
 - You can use these cables for controller-to-shelf and shelf-to-shelf connections.
If you use multimode breakout cables for a shelf-to-shelf connection, you can only use it once within a stack of disk shelves. You must use SAS optical multimode QSFP-to-QSFP or MPO cables with MPO QSFP modules to connect the remaining shelf-to-shelf connections.
 - The point-to-point (QSFP-to-QSFP) path of any multimode cable cannot exceed 150 meters for OM4 and 100 meters for OM3.
The path includes the set of breakout cables, patch panels, and inter-panel cables.
 - The total end-to-end path (sum of point-to-point paths from the controller to the last shelf) cannot exceed 510 meters.
The total path includes the set of breakout cables, patch panels, and inter-panel cables.
 - Up to one pair of patch panels can be used in a path.
 - You need to supply the patch panels and inter-panel cables.
The inter-panel cables must be the same mode as the SAS optical breakout cable: multimode.
 - You received a set of QSFP-to-MPO cable modules with each set of SAS optical breakout cables, which you must attach to the MPO end of each SAS optical breakout cable.
The breakout cables have SC, LC, or MTRJ connectors on the opposite end, which connect to a patch panel.
 - You must connect all eight (four pairs) of the SC, LC, or MTRJ breakout connectors to the patch panel.

Installing a disk shelf for a hot-add

Installing the new disk shelf involves installing the disk shelf in a rack using the applicable two-post telco tray kit or the four-post rail kit, setting the disk shelf ID, and enabling ACP if you will be using ACP capability on your storage system for the first time.

Steps

1. Properly ground yourself.
2. Install the two-post telco tray kit or the four-post rail kit for your disk shelf model using the installation flyer that came with the kit.

Attention: If you are installing multiple disk shelves, you should install them from the bottom to the top of the rack for the best stability.

Do not ear-mount the disk shelf into a telco-type rack; the disk shelf's weight will cause it to collapse in the rack under its own weight.

If you have a...	Then, using the installation flyer that came with the kit...
DS4243, DS2246, or DS4246 disk shelf	Install the two-post telco tray kit or four-post rail kit to support the disk shelf. Attention: For two-post mid-mount installations, you must use the mid-mount brackets in addition to the two-post telco tray kit.

If you have a...	Then, using the installation flyer that came with the kit...
DS4486 disk shelf	Install the four-post rail kit to support the disk shelf. Note: If you are installing a DS4486 disk shelf and you are installing it in a NetApp cabinet, you should have received the X8783 rail kit. If you are installing the disk shelf in a third-party cabinet, you should have received the X5529 or X5526 rail kit.

3. Install and secure the disk shelf onto the support brackets and rack.

To make the disk shelf lighter and easier to maneuver, remove the power supplies and I/O modules (IOMs). Avoid removing the disk drives or carriers if possible, because excessive handling can lead to internal damage.

It is recommended that you use a mechanical hoist or lift if you are moving a fully loaded DS4243 or DS4486 disk shelf.

Attention: A fully populated DS4243 or DS4246 disk shelf can weigh approximately 110 lbs (49.9 kg).

A fully populated DS2246 disk shelf can weigh approximately 49 lbs (22 kg).

A DS4486 disk shelf with the two IOMs, four power supplies, and four disk carriers can weigh approximately 82 lbs (37 kg). A fully populated disk shelf can weigh approximately 150 lbs (68 kg).

4. Reinstall any power supplies and IOMs you removed to install your disk shelf into the rack.

If you installed a DS4486 disk shelf, carefully unpack and insert the remaining disk carriers.

Note: Do not place hands on the two disk drive boards exposed on the underside of the disk carrier.

5. If you are adding multiple disk shelves, repeat Steps 3 through 4 for each disk shelf you are installing.

6. Connect the power supplies for each disk shelf:

- a. Connect the power cords first to the disk shelves, securing them in place with the power cord retainer, and then connect the power cords to different power sources for resiliency.

Note: If you have a disk shelf with four power supplies, connect power supplies in slots 1 and 3 to one power source and power supplies in slots 2 and 4 to a different power source.

- b. Turn on the power supplies for each disk shelf and wait for the disk drives to spin up.

When the disk shelf has the maximum number of supported power supplies, all disk drives or carriers spin up at the same time. However, if one or two power supplies have faulted in a disk shelf with four power supplies, or if one power supply has faulted in a disk shelf with two power supplies, disk drives spin up in sets of six at 12-second intervals.

7. Change the shelf ID for each disk shelf you hot-added by completing the following substeps:

You can verify IDs already in use by entering the `sasadmin shelf` command at the system console.

For 7-Mode HA pairs, you can enter this command from either node.

For clustered systems, you must run this command from the nodeshell of the target node.

- a. Change the shelf ID to a valid ID.
- b. Power-cycle the disk shelf to make the shelf ID take effect.

The *Changing the disk shelf ID* section has detailed information and instructions.

8. If you are not currently using the ACP capability but want to, enable ACP on your storage system by completing the following steps; otherwise, go to *Cabling the hot-added disk shelf*.

Note: It is recommended that you use ACP.

- a. Enable ACP on the storage system by entering the applicable command at the system console:

- If your system is running Data ONTAP 8.2 or earlier, enter `options acp.enabled on`
- If your system is running Data ONTAP 8.2.1 or later, enter `acpadmin configure`

For 7-Mode HA pairs, you can run this command from either node.

For clustered systems, you must run this command from the nodeshell of the target node.

- b. Dedicate a network interface and specify other parameters, such as network domain and netmask, as prompted.

For 7-Mode HA pairs, you must dedicate a network interface for each node.

Note: Some storage systems have a dedicated Ethernet port for ACP that you should use. For example, FAS2040 systems would use the dedicated e0P port.

Cabling the hot-added disk shelf

Cabling the hot-added disk shelf involves cabling the SAS connections and if applicable, assigning disk drive ownership and cabling the ACP connections.

Before you begin

You must have met all of the *Before you begin* requirements of the *Hot-adding a SAS disk shelf* section and installed your disk shelf according to the *Installing a disk shelf for a hot-add* procedure.

Steps

1. Cable the SAS connections.

If you are cabling a disk shelf...	Then...
To an existing stack of disk shelves	<p>a. Disconnect the SAS cable from the I/O Module (IOM) A circle port on the last shelf in the stack. You can leave the other end of the cable connected to the controller to minimize confusion, or replace the cable with a longer cable if needed.</p> <p>Note: If you have a single-controller-single-path or single-controller-mixed-path configuration, you must halt your system to replace cables. The “Replacing SAS cables” section of this document has more information.</p> <p>b. Connect (daisy-chain) the IOM A circle port of the last disk shelf in the stack to the IOM A square port of the new disk shelf using the SAS cables that came with the new disk shelf.</p> <p>c. Connect the cable you removed in Substep 1a to the IOM A circle port of the new disk shelf.</p> <p>d. Verify that all cables are securely fastened.</p> <p>e. Repeat Substeps 1a through 1d for IOM B. The storage system recognizes the new disk shelf as soon as all the disk drives have spun up.</p>
To an existing SAS HBA or onboard SAS port	<p>a. Use the port pairs worksheet you acquired in the <i>Before you begin</i> section. Detailed cabling instructions are in the <i>How to read the port pairs worksheet to cable stacks</i> section of the SAS Disk Shelves Universal SAS and ACP Cabling Guide.</p> <p>b. Verify that all cables are securely fastened.</p>

If a disk shelf error message appears on the console after you complete SAS cabling, you need to use the information in *SAS cabling error messages* to determine the corrective actions you should take.

2. Verify SAS connectivity by completing the following substeps:

For 7-Mode HA pairs, you can run these commands from the system console of either node.

For clustered systems, you must run these commands from the nodeshell of the target node.

- a. Enter the following command to find out what the adapter name is:

```
sasadmin expander_map
```

- b. Enter the following command to verify that all disk drives can be seen by the system:

```
sasadmin shelf adapter_name
```

The system displays a representation of your disk shelf populated with all the disk drives that it detects.

- c. Enter the following command to verify that all IOMs (expanders) can be detected by the system (SAS channels and controller ports):

```
sasadmin expander_map adapter_name
```

The following example of output from this command shows that a single expander, IOM B (slot B), in shelf 3 (ID 3) is attached to port 4a (channel 4a) on the controller:

```
Expanders on channel 4a:
```

Level 1: WWN 500a098000049c3f, ID 3, Serial Number 1006SZ00196, Product 'DS224IOM6 ', Rev '0134', Slot B

3. Check whether your system has disk autoassignment enabled by entering the applicable command:

If you have an HA pair, you can enter the applicable command at the console of either controller.

If your system is operating in....	Then...
7-Mode	Enter the following command: options disk.auto_assign
Clustered ONTAP	Enter the following command: storage disk option modify -autoassign

If disk autoassignment is enabled, the output shows `disk.auto_assign on`.

4. If your system does not have disk autoassignment enabled or disk drives in the same stack are owned by both controllers, assign disk drive ownership.

The following substeps enable you to complete basic disk ownership assignment for 7-Mode. To specify the disk drives to be assigned or the system to own the disk drives, see the *Data ONTAP Storage Management Guide for 7-Mode*. For 7-Mode HA pairs, you can run these commands from the system console of either node.

For clustered systems, see the *Clustered Data ONTAP Physical Storage Management Guide* for disk drive ownership information on the NetApp Support Site at mysupport.netapp.com.

- a. Enter the following command to see all the unassigned disk drives:

```
disk show -n
```

The disk drives in the hot-added shelf have the ownership state of **Not Owned**.

- b. Enter the following command to assign ownership of the disk drives:

```
disk assign all
```

If you need to assign the disk drives to a non-local storage system, you can specify that storage system by using the `-o owner_name` option. To determine the `owner_name`, you can run the `hostname` command at the console of either controller.

- c. Enter the following command to verify the assignments that you made:

```
disk show -v
```

5. If you are currently using the ACP capability or want to start using it, complete the following substeps; otherwise, go to the next step.

If you are cabling a disk shelf...	Then...
To an existing stack of disk shelves	<ol style="list-style-type: none"> a. Disconnect any intrastack, stack-to-stack, and controller-to-shelf ACP connections from the last disk shelf and reconnect them to the same ACP ports in the new disk shelf. b. Daisy-chain the ACP ports from the last disk shelf to the new disk shelf.
To an existing SAS HBA or onboard SAS port	Cable the ACP connections for the new disk shelf by using the ACP cabling procedure in the <i>Universal SAS and ACP Cabling Guide</i> on the NetApp Support Site at mysupport.netapp.com .

If you are cabling a disk shelf...	Then...
Not currently using ACP, but want to start using it	Cable the ACP connections for your storage system by using the ACP cabling procedure in the <i>Universal SAS and ACP Cabling Guide</i> on the NetApp Support Site at mysupport.netapp.com .

6. Verify that all cables are securely fastened.
7. If you hot-added a disk shelf with SAS optical cables to a stack of disk shelves connected with SAS copper cables, replace the SAS copper cables for the rest of the shelf-to-shelf connections and the shelf-to-controller connections so that the stack meets the cabling rules stated in the “Hot-adding a SAS disk shelf” section of this document; otherwise, go to the next step.

Use the appropriate cable replacement procedure for your configuration in the “Replacing SAS Cables” section of this document.
8. If running a version of Data ONTAP prior to 8.2.1, go to *Verifying the disk drive, disk shelf, and ACP firmware versions*.

SAS cabling error messages

After you have cabled the SAS connections for your hot-added disk shelf, one of two error messages can appear on the console if there is a problem with the disk shelf IDs.

Some of the corrective actions in these error messages are disruptive.

ses.shelf.invalNum

Description

This message occurs when Data ONTAP detects that a Serial Attached SCSI (SAS) disk shelf connected to the system has an invalid disk shelf number.

Corrective action

1. Power-cycle the disk shelf.
2. If the problem persists, replace the disk shelf modules.
3. If the problem persists, replace the disk shelf.

ses.shelf.sameNumReassign

Description

This message occurs when Data ONTAP detects more than one Serial Attached SCSI (SAS) disk shelf connected to the same adapter with the same disk shelf number.

Corrective action

1. Change the disk shelf number on the disk shelf to one that does not conflict with other shelves attached to the same adapter.
2. Halt the system and reboot the disk shelf.
3. If the problem persists, contact technical support.

Verifying the disk drive, disk shelf, and ACP firmware versions

Because versions of Data ONTAP prior to 8.2.1 do not always automatically update the disk drive, disk shelf, and ACP firmware on hot-added SAS disk shelves, you should verify that the disk drive, disk shelf, and if applicable, ACP firmware are the most current versions. If they are not, you must manually update the firmware.

About this task

- This procedure is for 7-Mode configurations.
For clustered systems, see the *Clustered Data ONTAP Upgrade and Revert/Downgrade Guide* at mysupport.netapp.com/documentation/productsatoz/index.html.
- Disk shelf (IOM), disk drive, and if applicable, ACP firmware should be current on all disk shelves in your system before adding new disk shelves, shelf FRU components, or SAS cables. Best practice is to always have the most current versions of firmware on your system.
[NetApp Downloads: Disk Shelf Firmware](#)
[NetApp Downloads: Disk Drive and Firmware](#)

Note: Do not revert firmware to a version that does not support the disk shelves, disk shelf FRU components, or SAS cables in your system.

Steps

1. Check the console for a message containing `dbfu.selected:info` and text stating `selected for background disk firmware update` to determine whether or not you need to manually update the disk drive firmware.

For example, actual output could look similar to `Fri Jul 19 13:05:23 PDT [svt-8040-02: bdfu.selected:info]: Disk svt-16g-sw4:4.126L64 [NETAPP X420_SFIRF300A10 NQ03] S/N [3SE0W95500009017R4SV] selected for background disk firmware.`

After assigning disk drives on the hot-added disk shelf, the disk drive firmware updates should have begun automatically on each disk drive with downrev firmware. A repeated message similar to what is shown above appears on the console every three to five minutes—the time it takes to update downrev firmware on a disk drive—showing the firmware update progress.

If...	Then...
There is similar output	Go to the next step. Disk drives with downrev firmware have been detected and the firmware is being updated automatically.

If...	Then...
There is no similar output	<p>Wait for an hourly message on the console and take the applicable action:</p> <ul style="list-style-type: none"> • If there is no message on the console about disk drive firmware, this means that the disk drive firmware is current and no action is needed. • If there is a message containing <code>disk.fw.downrevWarning</code> and text stating disks have downrev firmware that you need to update, update the disk drive firmware by completing the following substeps: For example, actual output could look similar to Sun May 5 04:00:01 PDT [svt-6040-01: disk.fw.downrevWarning:warning]: 1 disks have downrev firmware that you need to update. <ol style="list-style-type: none"> a. Download the disk drive firmware using the procedure at NetApp Downloads: Disk Drive and Firmware. b. Enter the following command at the storage system console to update the disk drive firmware: disk_fw_update You must run this command on both controllers. Attention: Running this command will delay I/O on the disk drives on which you are updating the firmware.

2. Verify that the disk shelf firmware is the most current version:

- a. Enter the following command at the system console:

```
sasadmin expander_map
```

For HA pairs, you can run this command on either node.

- b. Locate the disk shelf firmware information for the hot-added disk shelf in the output.

Example

0151 is the disk shelf firmware version for shelf number one (Slot A/IOM A) in the storage system:

```
Expanders on channel 4a:
```

```
Level 3: WWN 500a0980000840ff, ID 1, Serial Number ' SHU0954292G114C',  
Product 'DS424IOM6 ', Rev '0151', Slot A
```

- c. Compare the firmware information in the command output with the disk shelf firmware information at [NetApp Downloads: Disk Shelf Firmware](#) to determine the most current disk shelf firmware version.

3. The next step depends on how current the disk shelf firmware is.

If the firmware version in the command output is...	Then...
The same as or later than the most current version on the NetApp Support Site	No disk shelf firmware update is needed. If you are using ACP, go to Step 4; otherwise, the procedure is complete.

If the firmware version in the command output is...	Then...
An earlier version than the most current version on the NetApp Support Site	<ol style="list-style-type: none"> a. Download the disk shelf firmware file by using the procedure at NetApp Downloads: Disk Shelf Firmware. For HA pairs, you can run the commands from either controller. b. If you are using ACP, go to Step 4; otherwise, the procedure is complete.

4. If you are using ACP, verify that the ACP firmware is the most current version:

- a. Enter the following command at the system console:

```
storage show acp
```

- b. Locate the ACP firmware information for the hot-added shelf in the output.

You should see command output similar to the following:

```

Alternate Control Path: Enabled
Ethernet Interface:     e0b
ACP Status:            Active
ACP IP address:        192.168.0.67
ACP domain:           192.168.0.1
ACP netmask:           255.255.252.0
ACP Connectivity Status: Full Connectivity

Shelf Module  Reset Cnt  IP address      FW Version  Module Type
Status
-----
7a.001.A      001        198.15.1.145   1.01        IOM6
inactive (upgrading firmware)
7a.001.B      000        198.15.1.146   1.1         IOM6
active
7c.002.A      000        198.15.1.206   1.1         IOM6
active
7c.002.B      000        198.15.1.204   1.1         IOM6
active

```

- c. Compare the firmware information in the output with the most current ACP firmware information at [NetApp Downloads: Disk Shelf Firmware](#).

5. The next step depends on how current the ACP firmware is in the `storage show ACP` output.

If the ACP firmware version in the <code>storage show ACP</code> output is...	Then...
The same as the most current version on the NetApp Support Site	No ACP firmware update is needed.

If the ACP firmware version in the storage show ACP output is...	Then...
An earlier version than the most current version on the NetApp Support Site	<ol style="list-style-type: none"><li data-bbox="665 321 1383 384">a. Download the most recent ACP firmware from NetApp Downloads: Disk Shelf Firmware.<li data-bbox="665 405 1383 489">b. Follow the instructions on the NetApp Support Site to extract your firmware files to the <code>etc/acpp_fw/</code> directory in the root volume of your storage system.<li data-bbox="665 510 1383 657">c. Enter the following command to update the ACP firmware: storage download acp For more information about the command, see the <code>storage (1)</code> man page.<li data-bbox="665 678 1383 741">d. Enter the following command to verify the new ACP firmware: storage show acp<li data-bbox="665 762 1383 825">e. Reissue the <code>storage show acp</code> command after the update is complete to see the new ACP firmware version listed in the output.

Hot-removing disk shelves or stacks in systems running Data ONTAP 8.2.1 or later

If your system is running Data ONTAP 8.2.1 or later, you can hot-remove disk shelves—physically remove SAS disk shelves that have had the aggregates removed from the disk drives—in a multipath HA or single-controller-dual-path (multipath) configuration that is up and serving data. Your system can be a 7-Mode or clustered Data ONTAP system. You can hot-remove one or more disk shelves from anywhere within a stack of disk shelves or remove a stack of disk shelves.

Before you begin

- Your system must not be a MetroCluster configuration.
See the appropriate document for your MetroCluster system.
[Configuring a MetroCluster system with SAS disk shelves and FibreBridge 6500N bridges in 7-Mode](#)
[Configuring a stretch MetroCluster system with SAS disk shelves and SAS optical cables in 7-mode](#)
[MetroCluster Service Guide](#) for clustered Data ONTAP
- Your storage system must be running Data ONTAP 8.2.1 or later.
- Your storage system must be a multipath HA or single-controller-dual-path (multipath) configuration.
- For FAS22xx and FAS25xx systems:
 - For FAS22xx and FAS25xx HA pairs with external storage, the external storage must be cabled as multipath HA.
 - For FAS22xx and FAS25xx single-controller configurations with external storage, the external storage must be cabled as dual path (multipath).
- You must have already removed all aggregates from the disk drives in the disk shelves you are removing.

Attention: If you attempt this procedure with aggregates on the disk shelf you are removing, you could fail the system with a multi-disk panic.

For information about taking an aggregate offline for 7-Mode systems, see “Taking an aggregate offline” in the *Storage Management Guide for 7-Mode*. For information about taking an aggregate offline for clustered Data ONTAP systems, see “Commands for managing aggregates” in the *Clustered Data ONTAP Physical Storage Management Guide*. These documents are available on the NetApp Support Site at mysupport.netapp.com.

- As a best practice, if you have a clustered Data ONTAP system that is greater than two-nodes, you should have reassigned epsilon to an HA pair other than the one that is undergoing planned maintenance.
Reassigning epsilon minimizes the risk of unforeseen errors impacting all nodes in a clustered Data ONTAP system. Information about the role of quorum and epsilon, and the procedure for reassigning epsilon to another node in a cluster can be found in the *Clustered Data ONTAP System Administration Guide for Cluster Administrators*.
[Find a System Administration Guide for your version of Data ONTAP 8](#)
- As a best practice, you should remove disk drive ownership after you remove the aggregates from the disk drives in the disk shelves you are removing.

Note: This procedure follows the best practice of removing disk drive ownership; therefore, steps are written with the assumption that you have removed disk drive ownership.

For information about removing disk drive ownership in a 7-Mode system, see the “Removing ownership from a disk” procedure in the *Storage Management Guide for 7-Mode*. For information about removing disk drive ownership in a clustered Data ONTAP system, see the “Removing ownership from a disk” procedure in the *Clustered Data ONTAP Physical Storage Management Guide*. These documents are available on the NetApp Support Site at mysupport.netapp.com.

Note: The procedure for removing ownership from disk drives requires you to disable disk autoassignment. You reenable disk autoassignment when prompted at the end of this shelf hot-remove procedure.

- Multipath HA configurations cannot be in a takeover state.
- If you are removing one or more disk shelves from within a stack, you must have factored the distance to bypass the disk shelves you are removing. Therefore, if the current cables are not long enough—including Ethernet cables for the ACP connections—you need to have longer cables available.
The *Hardware Universe* at hwu.netapp.com contains information about supported SAS cables.

About this task

- This procedure follows the cabling rules in the *Universal SAS and ACP Cabling Guide*; therefore, references to IOMs and IOM SAS and ACP square and circle ports align with the cabling rules. If your multipath HA or single-controller-dual-path (multipath) configuration is cabled differently from what is prescribed in the cabling guide, the IOM and/or IOM ports might be different.
- *Path A* refers to the A-side disk shelf I/O module (IOM A) located in the top or left of the disk shelf depending on your disk shelf model.
- *Path B* refers to the B-side disk shelf I/O module (IOM B) located in the bottom or right of the disk shelf depending on your disk shelf model.
- The *first* disk shelf in the stack is the disk shelf with the SAS square ports directly connected to the controllers.
- The *interim* disk shelf in the stack is the disk shelf directly connected to other disk shelves in the stack.
- The *last* disk shelf in the stack is the disk shelf with SAS circle ports directly connected to the controllers.
- The *next* disk shelf is the disk shelf downstream of the disk shelf being removed, in depth order.
- The *previous* disk shelf is the disk shelf upstream of the disk shelf being removed, in depth order.
- To prevent degraded performance, do not twist, fold, pinch, or step on the cables. Cables have a minimum bend radius. Cable manufacturer specifications define the minimum bend radius; however, a general guideline for minimum bend radius is 10 times the cable diameter.
- Using Velcro wraps instead of tie-wraps to bundle and secure system cables allows for easier cable adjustments.
- If your system uses ACP, ACP connections can be recabled at any time because they are independent of the data path; however, in this procedure, for simplicity, you recable ACP connections after you recable the SAS connections.
- For clustered Data ONTAP configurations, you use clustered Data ONTAP commands and 7-Mode commands; therefore, you will be entering commands from the clustershell and from the nodeshell.

Steps

1. Verify that your system configuration is `Multi-Path HA` or `Multi-Path` (single-controller-dual-path):

sysconfig

For multipath HA configurations operating in 7-Mode, you can run the command from either controller. For clustered systems, you run this command from the nodeshell.

It might take up to a minute for the system to complete discovery.

The configuration is listed in the `System Storage Configuration` field.

Note: For FAS22xx and FAS25xx systems with external storage, the output is displayed as `Mixed-Path HA` for an HA pair, and `Mixed-Path` for a single-controller configuration. This is because the internal storage is cabled differently than the external storage. For an HA pair, the internal storage is cabled as `single-path HA` and the external storage is cabled as `multipath HA`. For a single-controller configuration, the internal storage is cabled as `single-path` and the external storage is cabled as `dual-path` (multipath).

Attention: If your non FAS22xx or FAS25xx system is shown as something other than `Multi-Path HA` or `Multi-Path`, you cannot continue with this procedure. Your system must meet the prerequisites stated in the “Before you begin” section of this procedure.

2. Verify that no aggregates are on the disk drives in the disk shelves you are removing, by completing the applicable substeps:

If your system is operating in...	Then...
7-Mode	<ol style="list-style-type: none"> a. Enter the following command: <pre>aggr status -r</pre> If you have traditional volumes, you enter the <code>vol status -r</code> command. For multipath HA configurations, you can enter the command from the console of either controller. b. Check the output <code>SHELF</code> column to verify that the disk shelves from which you have removed aggregates do not appear.
Clustered Data ONTAP	<ol style="list-style-type: none"> a. Enter the following command from the clustershell: <pre>storage disk show -shelf shelf_number -container-type !spare</pre> For multipath HA configurations, you can enter the command from the console of either controller. b. Check the output to verify that all the disk drives in the disk shelves you are removing are spares or failed. If all disk drives are spares, the output message is <code>There are no entries matching your query</code>. If any disk drives are failed, output contains a line item for each failed disk drive and shows the disk drive as <code>broken</code>.

Attention: If any disk drives in the disk shelves you are removing are anything other than spares or failed, you cannot continue with this procedure. Your system must meet the prerequisites stated in the “Before you begin” section of this procedure.

Example

The following `aggr status -r` output is for a 7-Mode system with disk shelf 3 being removed. Because aggregates have been removed from disk shelf 3, only disk shelves in the stack with aggregates (disk shelves 2 and 4) appear in the `SHELF` column:

```
fas6200> aggr status -r

RAID Disk Device          HA  SHELF BAY CHAN Pool Type  RPM  Used (MB/
blks)   Phys (MB/blks)
-----
...
dparity 1a.02.16             1a   2  16 SA:A  -   SAS 15000
560000/1146880000 560208/1147307688
parity 1a.04.6              1a   4   6 SA:A  -   SAS 15000
560000/1146880000 560208/1147307687
data 1c.04.13             1c   4  13 SA:B  -   SAS 15000
560000/1146880000 560208/1147307687
...
```

3. Verify that ownership is removed from the disk drives on the disk shelves you are removing:
 - a. Enter the applicable command at the console of either controller:

If your system is operating in...	Then...
7-Mode	<code>disk show -v</code>
Clustered Data ONTAP	<code>storage disk show -shelf shelf_number</code>

- b. Check the output and take the appropriate action:

If the output shows...	Then...
<ul style="list-style-type: none"> • For 7-Mode, Not Owned or FAILED • For clustered Data ONTAP, unassigned or broken 	<p>Go to the next step.</p> <p>The disk drives in the disk shelves you are removing are in the correct state.</p>
Any disk drives in the disk shelves you are removing have ownership	You can use the “Removing ownership from a disk” procedure referenced in the “Before you begin” section of this procedure.

Example

The following output for the `disk show -v` command shows disk drives on the disk shelf being removed (disk shelf 3). Two disk drives have the ownership removed; therefore, `Not Owned` appears in the `OWNER` column. Two disk drives are failed; therefore, `FAILED` appears in the `POOL` column:

```
fas6200> disk show -v
```

DISK HOME	OWNER CHKSUM	POOL	SERIAL NUMBER	DR
...				
4b.03.5	Not Owned	NONE	YHGLB6PA	Block
4b.03.11	Not Owned	NONE	YHGL37ZA	Block
4b.03.15		FAILED		Block
4b.03.13		FAILED		Block
...				

Example

The following output for the `storage disk show -shelf3` command shows that disk drives on the disk shelf being removed (disk shelf 3) have the ownership removed; therefore, `unassigned` appears in the `Container Type` column. Two disk drives are failed; therefore, `broken` appears in the `Container Type` column:

```
cluster::> storage disk show -shelf 3
```

Disk	Usable Size	Shelf	Bay	Disk Type	Container Type	Container Name	Owner
...							
1.3.4	-	3	4	SAS	unassigned	-	-
1.3.5	-	3	5	SAS	unassigned	-	-
1.3.6	-	3	6	SAS	broken	-	-
1.3.7	-	3	7	SAS	broken	-	-
...							

4. Turn on the LEDs for each disk shelf you are removing so that the disk shelves are physically identifiable, by entering the following command for each disk shelf you are removing:

```
storage shelf identify adapter_name.shelfshelf_ID on
```

You must be in advanced privilege level to enter this command. You can enter the command from the console of either controller. For clustered systems, enter the command from the nodeshell.

All LEDs on the front and back of the specified disk shelves flash. LEDs continue to flash for up to five minutes.

Note: You need to be certain of which disk shelves you are removing so that you can correctly recable path A and path B later in this procedure. Even if you are removing an entire stack of disk shelves, it is recommended that you use this command.

Example

To physically identify disk shelf 3, you enter `storage shelf identify 0b.shelf3 on`.

5. If you are removing an entire stack of disk shelves, complete the following substeps; otherwise, go to the next step:
 - a. Remove all SAS cables on path A and path B.

This includes controller-to-shelf cables and shelf-to-shelf cables for all disk shelves in the stack you are removing.

- b. If you are using ACP, recable the applicable ACP stack connections to bypass the stack you are removing:

To reference illustrations of ACP cabling for multipath HA systems, see the *Universal SAS and ACP Cabling Guide* on the NetApp Support Site at mysupport.netapp.com.

If you are removing...	Then...
The first stack	<ul style="list-style-type: none"> <li data-bbox="591 296 1383 359">i. Uncable the ACP shelf-to-shelf connections and put the cables aside. <li data-bbox="591 380 1383 474">ii. Uncable the ACP intrastack connections from the first disk shelf IOM B ACP square port to the last disk shelf IOM A ACP circle port and put the cable aside. <li data-bbox="591 495 1383 621">iii. If you have more than one stack, disconnect the stack-to-stack connection by removing the cable connecting the last disk shelf IOM B ACP circle port to the first disk shelf IOM A ACP square port of the next stack, and put the cable aside. <li data-bbox="591 642 1383 800">iv. If you have more than one stack, reestablish the controller-to-stack connection by moving the cable connecting the Ethernet port on the controller from the first disk shelf IOM A ACP square port so that it connects to the same ACP port in the first disk shelf of the second stack. <p data-bbox="591 821 1383 867">The second stack is now the first stack in your storage system.</p>
An interim stack	<ul style="list-style-type: none"> <li data-bbox="591 894 1383 957">i. Uncable the ACP shelf-to-shelf connections and put the cables aside. <li data-bbox="591 978 1383 1073">ii. Uncable the ACP intrastack connections from the first disk shelf IOM B ACP square port to the last disk shelf IOM A ACP circle port and put the cable aside. <li data-bbox="591 1094 1383 1314">iii. Recable the stack-to-stack connection to bypass the stack you are removing by removing the cable connecting the last disk shelf IOM B ACP circle port of the previous stack to the first disk shelf IOM A ACP square port of the stack you are removing and putting it aside; then, move the stack-to-stack cable connected from the last disk shelf IOM B ACP circle port in the stack you are removing to the same ACP port in the last disk shelf of the previous stack.
The last stack	<ul style="list-style-type: none"> <li data-bbox="591 1367 1383 1430">i. Uncable the ACP shelf-to-shelf connections and put the cables aside. <li data-bbox="591 1451 1383 1545">ii. Uncable the ACP intrastack connections from the first disk shelf IOM B ACP square port to the last disk shelf IOM A ACP circle port and put the cable aside. <li data-bbox="591 1566 1383 1692">iii. Disconnect the stack-to-stack connection by removing the cable connecting the last disk shelf IOM B ACP circle port of the previous stack to the first disk shelf IOM A ACP circle port of the stack you are removing, and put the cable aside. <li data-bbox="591 1713 1383 1839">iv. Reestablish the controller-to-stack connection by moving the cable connecting the Ethernet port on the controller from the last disk shelf IOM B of the stack you are removing so that it connects to the same ACP port in the last disk shelf of the previous stack. <p data-bbox="591 1860 1383 1894">The previous stack is now the last stack in your storage system.</p>

- c. Verify that ACP connectivity is reestablished by entering the following command from the console of either controller:

```
storage show acp
```

The ACP discovery cycle takes about 21 minutes to complete.

When ACP connectivity is reestablished, the output for line item `ACP connectivity status` shows `Full Connectivity`.

d. Go to Step [11](#).

6. If you are removing one or more disk shelves from a stack (but keeping the stack), recable the applicable path A stack connections to bypass the disk shelves you are removing by completing the applicable set of substeps:

If you are removing more than one disk shelf, complete the applicable set of substeps one disk shelf at a time.

If you need a graphical system cabling reference, use the platform specific *Installation and Setup Instructions* document that ships with each platform, or access these documents on the NetApp Support Site at mysupport.netapp.com by searching on your specific platform. For example, to find the *Installation and Setup Instructions* document for FAS3200 systems, search on “FAS3200 series”.

Note: Do not force a connector into a port. The SAS cable QSFP connectors are keyed; when oriented correctly into a SAS port, the QSFP connector clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector).

If you are removing...	Then...
The first disk shelf in a stack	<ol style="list-style-type: none"> a. Remove the cable connecting the IOM A SAS circle port of the first disk shelf and the IOM A SAS square port of the second disk shelf in the stack and set it aside. b. Move the cable connecting the controller to the IOM A SAS square port of the first disk shelf to the IOM A SAS square port of the second disk shelf in the stack
An interim disk shelf in a stack	<ol style="list-style-type: none"> a. Remove the cable connecting the IOM A SAS circle port of the disk shelf being removed and the IOM A SAS square port of the next disk shelf in the stack and set it aside. b. Move the cable connecting the IOM A SAS square port of the disk shelf being removed to the IOM A SAS square port of the next disk shelf in the stack
The last disk shelf in a stack	<ol style="list-style-type: none"> a. Remove the cable connecting the IOM A SAS square port of the last disk shelf and the IOM A SAS circle port of the previous disk shelf in the stack and set it aside. b. Move the cable connecting the controller to the IOM A SAS circle port of the last disk shelf to the IOM A SAS circle port of the previous disk shelf in the stack

7. Verify that the cabling on path A has successfully bypassed the disk shelves you are removing and all disk drives on the disk shelves you are removing are still connected through path B:

```
storage show disk -p
```

For multipath HA configurations operating in 7-Mode, you can run the command from the console of either controller. For clustered systems, you run this command from the nodeshell of either controller.

It might take up to a minute for the system to complete discovery.

Example

In this example of how the output should appear, the disk shelf being removed is disk shelf 3. One line item appears for each disk drive connected through path B (now the primary path); therefore, the disk drives are listed in the `PRIMARY` column and `B` appears in the first `PORT` column. There is no connectivity through path A for any of the disk drives in the disk shelf being removed; therefore, no information is shown in the `SECONDARY` or second `PORT` columns:

```
fas6200> storage show disk -p
```

PRIMARY	PORT	SECONDARY	PORT	SHELF	BAY
...					
1a.03.0	B			3	0
1a.03.1	B			3	1
1a.03.2	B			3	2
1a.03.3	B			3	3
1a.03.4	B			3	4
1a.03.5	B			3	5
1a.03.6	B			3	6
1a.03.7	B			3	7
1a.03.8	B			3	8
1a.03.9	B			3	9
1a.03.10	B			3	10
1a.03.11	B			3	11
1a.03.12	B			3	12
1a.03.13	B			3	13
1a.03.14	B			3	14
...					

Attention: If the output shows anything other than all the disk drives connected only through path B, you must correct the cabling by repeating Step 6.

8. Complete the following substeps:
 - a. Repeat Step 6 and Step 7 for path B.
 - b. Repeat Step 1 to confirm that your system configuration is the same as before you began this procedure.
 - c. Go to the next step.
9. If you are using ACP, recable the applicable ACP stack connections to bypass the disk shelves you are removing; otherwise, go to the next step.

Because ACP connections are independent of the data path, there is no need to recable according to path A and path B.

If you are removing...	Then...
The first shelf in a stack	<ul style="list-style-type: none"> a. Remove the cables connecting the ACP circle ports of IOM A and IOM B of the first disk shelf and the ACP square ports of the next disk shelf in the stack and set them aside. b. Move the cable connecting the Ethernet port on the controller to the IOM A ACP square port of the first shelf to the same port of the next disk shelf in the stack. c. Move the intrastack cable connected to the IOM B ACP square port of the first shelf to the same port of the next disk shelf in the stack. d. If you have more than one stack and the disk shelf you are removing is connected by the stack-to-stack connection, reconnect the stack-to-stack connection by moving the cable connecting the IOM A ACP square port of the disk shelf you are removing to the same port on the next disk shelf.
An interim shelf in a stack	<ul style="list-style-type: none"> a. Remove the cables connecting the ACP circle ports of IOM A and IOM B of the shelf being removed and the ACP square ports of the next disk shelf in the stack and set them aside. b. Move the cable connecting the ACP square ports of IOM A and IOM B of the disk shelf being removed to the ACP square ports of the next disk shelf in the stack.
The last shelf in a stack	<ul style="list-style-type: none"> a. Remove the cable connecting the ACP square ports of IOM A and IOM B of the last disk shelf and the ACP circle ports of the previous disk shelf in the stack and set them aside. b. Move the intrastack cable connected to the IOM A ACP circle port of the last disk shelf to the same port of the previous disk shelf in the stack. c. If the disk shelf is connected to the Ethernet port on the controller, move the cable connecting the Ethernet port on the controller to the IOM A ACP circle port of the last disk shelf to the same port of the previous disk shelf in the stack. d. If you have more than one stack and the disk shelf you are removing is connected by the stack-to-stack connection, reconnect the stack-to-stack connection by moving the cable connecting the IOM B ACP circle port of the disk shelf you are removing to the same port on the previous disk shelf.

10. If you are using ACP, verify that ACP connectivity is reestablished by entering the following command from the console of either controller:

```
storage show acp
```

The ACP discovery cycle takes about 21 minutes to complete.

When ACP connectivity is reestablished, the output for line item “ACP connectivity status” shows `Full Connectivity`.

11. If, when you removed ownership from the disk drives as part of the preparation for this procedure, you disabled disk autoassignment, then reenable disk autoassignment by entering the applicable command; otherwise, go to the next step:

Enter the applicable command from the console of each controller.

If your system is operating in...	Then...
7-Mode	<code>options disk.auto_assign on</code>
Clustered Data ONTAP	<code>storage disk option modify -autoassign on</code>

12. Power off the disk shelves you disconnected and unplug the power cords from the disk shelves.

13. Remove the disk shelves from the rack or cabinet.

To make disk shelves lighter and easier to maneuver, remove the power supplies and IOMs. Avoid removing the disk drives or carriers if possible, because excessive handling can lead to internal damage.

It is recommended that you use a mechanical hoist or lift if you are moving a fully populated DS4243, DS4246, or DS4486 disk shelf.

Note: A fully populated DS4243 or DS4246 disk shelf can weigh approximately 110 lbs (49.9 kg). A fully populated DS4486 disk shelf can weigh approximately 150 lbs (68 kg).

Removing disk shelves in systems running Data ONTAP 8.2 or earlier

If your system is running Data ONTAP 8.2 or earlier, you must halt your system to remove a disk shelf.

Steps

1. Properly ground yourself.
2. Shut down the storage system by entering the applicable command:

If your storage system is operating in...	Then enter the applicable command...
7-Mode	From the system console: halt
Clustered ONTAP	From the clustershell: halt -node local

3. Verify that your system halted.

If your storage system has an LCD display, `halted` should appear on the display; otherwise, you should check the storage system console to ensure the system is halted.

4. Turn off the power switch on the disk shelf.
5. Unplug all power cords from the disk shelf.
6. Unplug and remove the cables connecting the disk shelf to the other disk shelves or the controllers.
7. Use a Phillips screwdriver to remove the screws securing the disk shelf to the rack.
8. Remove the disk shelf from the rack.

To make the disk shelf lighter and easier to maneuver, remove the power supplies and I/O Modules (IOMs). Avoid removing the disk drives or carriers if possible because excessive handling can lead to internal damage.

You might want to use a mechanical hoist or lift if you are moving a fully loaded DS4243 or DS4486 disk shelf.

Attention: If you must remove disk carriers from the DS4486 disk shelf, do not place hands on the two disk drive boards exposed on the underside of the disk carrier.

Caution: A fully populated DS4243 or DS4246 disk shelf can weigh approximately 110 lbs (49.9 kg).

A fully populated DS2246 disk shelf can weigh approximately 49 lbs (22 kg).

A DS4486 disk shelf with the two IOMs, four power supplies, and only four disk carriers can weigh approximately 82 lbs (37 kg). A fully populated disk shelf can weigh approximately 150 lbs (68 kg).

9. Reestablish the stack by connecting the disconnected disk shelves, or by connecting the unconnected disk shelf to the controllers.

Note: Do not force a connector into a port. The SAS cable QSFP connectors are keyed; when oriented correctly into a SAS port, the QSFP connector clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector).

10. Turn on the power to the storage system.
11. Reboot the storage system.
12. If applicable, return the failed part to NetApp, as described in the RMA instructions that are shipped with the kit.

Contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific) if you need the RMA number or additional help with the replacement procedure.

Monitoring disk shelf components

You can monitor the health of your disk shelf by understanding the location and status conditions of the LEDs on your disk shelf components, the H0 and H1 shelf modes, and the error messages that can occur if there is a problem.

Monitoring the disk shelf

With Data ONTAP 8.1.1 and later 8.1.x releases, the H0 shelf mode is available on all disk shelf models so that you can visually identify a specific disk shelf in a system.

The H0 mode is useful when you receive an error message about a shelf device that requires attention and you need to physically locate the disk shelf in a data center with many large systems.

Note: The H1 shelf mode is available for systems with DS4486 disk shelves. It alerts you to the status of a faulted disk carrier. More information can be found in the *What the disk carrier LEDs and H1 shelf mode mean for DS4486 disk shelves* section.

How the H0 shelf mode and LEDs work

You initiate the H0 shelf mode manually when you want to identify a specific disk shelf more easily. Initiating the mode causes the green and amber LEDs on a specific disk shelf to blink in unison. In addition, the shelf digital display alternates between flashing *H0* and the shelf ID number.

The following table summarizes how the H0 shelf mode and LEDs behave when you initiate and exit the H0 shelf mode.

Note: The *Using the H0 shelf mode* section describes how to initiate and exit the H0 shelf mode.

H0 shelf mode (on/off)	Shelf digital display	LED color	Status indicator on a FRU	Description	Action to take
When H0 shelf mode is on	Alternates between <i>H0</i> and the shelf ID	Green (activity)	Blinking	All LEDs on the specified disk shelf blink in unison.	Visually locate the shelf.
		Amber (fault)	Blinking	All LEDs on the specified disk shelf blink in unison.	
			Solid		There is an error with the function of the specific FRU.
When H0 shelf mode is off	Shelf ID	Green (activity)	Solid	The specific FRU has power.	None.
			Blinking	The specific FRU has power and I/O is in progress.	
		Amber (fault)	Solid	There is an error with the function of the specific FRU.	See console error messages.

Using the H0 shelf mode

You initiate the H0 shelf mode manually when you want to visually identify a specific disk shelf in a system.

About this task

For DS4486 disk shelves, you can enter the H0 shelf mode while the shelf is in the H1 shelf mode. When you exit the H0 shelf mode, the shelf reverts to the H1 shelf mode and H1 shelf mode LED behavior.

Information about the H1 shelf mode can be found in the *What the disk carrier LEDs and H1 shelf mode mean for DS4486 disk shelves* section.

Steps

1. Initiate the H0 shelf mode by entering the following command at the console (of either controller in an HA pair).

```
storage shelf identify adapter_name.shelfshelf_ID on
```

Example

```
storage shelf identify 2a.shelf5 on
```

The following takes place once H0 shelf mode is initiated:

- The shelf digital display alternates between flashing *H0* with the shelf ID number.
- The green and amber LEDs on the disk drives or carriers of the specified shelf blink in unison.
- The power supply and I/O module (IOM) amber LEDs blink in unison.
- An EMS message, `shelf.identify.start` is generated to confirm that the H0 shelf mode has initiated.

Note: If a FRU or disk drive or carrier has faulted, its amber LED remains solid.

2. Exit the H0 shelf mode by entering the following command at the console (of either controller in an HA pair).

```
storage shelf identify adapter_name.shelfshelf_ID off
```

Example

```
storage shelf identify 2a.shelf5 off
```

The following takes place once the disk shelf has exited the H0 shelf mode:

- The shelf digital display only shows the shelf ID number.
- The LEDs on the disk drives or carriers, power supplies, and IOMs revert to their behavior prior to issuing the command in Step 1.
- An EMS message, `shelf.identify.stop` is generated to confirm that the disk shelf has exited the H0 shelf mode.

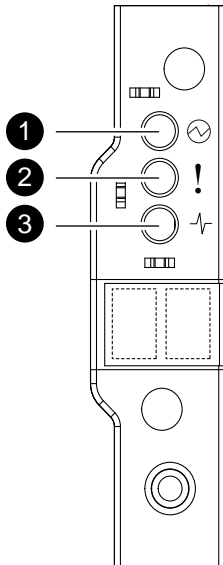
Monitoring the operator display panel

You can monitor the health of your disk shelf and its components by familiarizing yourself with the location of the operator display panel LEDs, their meanings, and the error messages that can occur when there is a problem.

Location of the operator display panel LEDs

The LEDs on the disk shelf front operator display panel indicate whether your disk shelf is functioning normally or there are problems with the hardware.

The following illustration shows an operator display panel and the location of the three LEDs. Depending on your disk shelf model, the operator display panel might look slightly different, but the LEDs are the same.






1	Power
2	Shelf fault
3	Activity

What the operator display panel LEDs mean

You can determine the status of the disk shelf and its components by understanding the meanings of the operator display panel LEDs when they are illuminated.

Note: The following table describes the LED behavior when the disk shelf is not in H0 shelf mode. The *How the H0 shelf mode and LEDs work* section has information about the H0 shelf mode.

Icon	LED	Color	When illuminated
	Power	Green	One or more power supplies are supplying AC or DC power to the disk shelf. IOMs and power supplies are functioning normally.
	Disk shelf fault	Amber	An error occurred with the function of a disk drive, IOM, or power supply.
	Activity	Green	A link is established between the disk shelf and the storage system or another disk shelf that it is attached to.

Operator display panel console error messages

When the SCSI Enclosure Services (SES) process on the disk shelf detects that the operator display panel failed or there is a problem with the disk shelf or its components, an error message appears on your storage system console.

Some of the corrective actions in these error messages can be disruptive.

ses.status.displayError

Description

This message occurs when the SES module in the disk shelf detects an error in the disk shelf display panel. The disk shelf might be unable to provide correct addresses to the disk shelf.

Corrective action

1. If possible, verify that the connection between the disk shelf and the display is secure.
2. Verify that the SES module or modules are fully seated; replacing them might solve the problem.
3. If the problem persists, the SES module that detected the error condition might be faulty.
4. If the problem persists after the module or modules are replaced, replace the disk shelf.
5. If the problem persists, contact technical support.

ses.status.displayWarning

Description

This message occurs when the enclosure services module detects a warning condition for the disk shelf display panel. The disk shelf might be unable to provide correct addresses to its disks.

Corrective action

1. If possible, verify that the connection between the disk shelf and the display is secure.
2. Verify that the SES module or modules are fully seated; replacing them might solve the problem.
3. If the problem persists, the SES module that detected the warning condition might be faulty.
4. If the problem persists after the module or modules are replaced, replace the disk shelf.
5. If the problem persists, contact technical support for assistance.

ses.status.temperatureError

Description

This message occurs when the indicated disk shelf temperature sensor reports a temperature that exceeds the specifications for the disk shelf or its components.

Corrective action

1. Verify that the ambient temperature where the shelf is installed is within the vendor's equipment specifications by using the `environment shelf [adapter]` command, and check that airflow clearances are maintained.
For clustered systems, you must run this command from the nodeshell of the target node.
2. If the same disk shelf also reports fan or fan module failures, correct that problem immediately.
3. If the problem is reported by the ambient temperature sensor (located on the operator display panel), verify that the connection between the disk shelf and the panel is secure, if possible.
4. If the problem persists, and if the shelf has multiple temperature sensors but only one exhibits the problem, replace the module that contains the sensor reporting the error.
5. If the problem persists, contact technical support.

ses.status.temperatureWarning

Description

This message occurs when the indicated disk shelf temperature sensor reports a temperature that is close to exceeding the specifications for the disk shelf or its components.

Corrective action

1. Verify that the ambient temperature where the shelf is installed is within the vendor's equipment specifications by using the `environment shelf [adapter]` command, and check that airflow clearances are maintained.
2. If the same disk shelf also reports fan or fan module failures, correct that problem now.
3. If the problem is reported by the ambient temperature sensor (located on the operator display panel), verify that the connection between the disk shelf and the panel is secure, if possible.
4. If the problem persists, and if the shelf has multiple temperature sensors but only one exhibits the problem, replace the module that contains the sensor reporting the error.
5. If the problem persists, contact technical support.

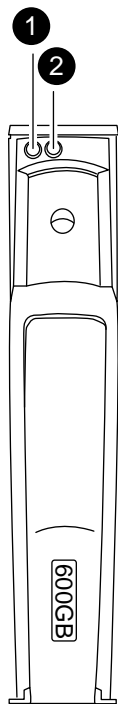
Monitoring the disk drives or carriers

You can monitor the health of the disk drives or carriers by familiarizing yourself with the location of the LEDs, their meanings, the H1 shelf mode if applicable, and the error messages that can occur when there is a problem.

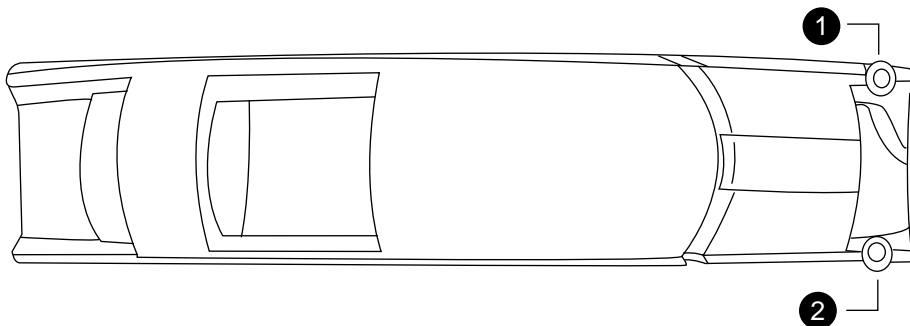
Location of the disk drive or carrier LEDs

The LEDs on the disk drive or carrier indicate whether it is functioning normally or there are problems with the hardware.

The following illustration shows the location of the LEDs on the front of a disk drive used in a DS2246 disk shelf.



The following illustration shows the location of the LEDs on the front of a disk drive used in a DS4243, DS4486, or DS4246 disk shelf.



1	Activity
2	Fault

What the disk drive LEDs mean for DS4243, DS2246, and DS4246 disk shelves

For DS4243, DS2246, and DS4246 disk shelves, you can determine the status of the disk drives by understanding the meaning of the disk drive LEDs when they are illuminated.

The following table shows LED behavior when the disk shelf is not in H0 shelf mode. The *How the H0 shelf mode and LEDs work* section has information about H0 shelf mode.

Shelf digital display	Disk drive or carrier LED color	Status indicator	Description	Action to take
Shelf ID	Green (activity)	Solid	The disk drive or carrier has power.	None.
		Blinking	The disk drive or carrier has power and I/O is in progress.	
	Amber (fault)	Solid	There is an error with the function of the disk drive or carrier.	See console error messages.

Note: In some versions of Data ONTAP, when a disk drive fails due to excessive link errors, adapter errors, or timeouts, the fault LED does not illuminate. This makes it difficult to physically locate the disk drive that needs to be replaced.

[NetApp Bugs Online Bug ID 767822: Disks in "not responding" state do not turn on the fault LED](#)

What the disk carrier LEDs and H1 shelf mode mean for DS4486 disk shelves

For DS4486 disk shelves, you can determine the status of a disk carrier by the color and behavior of the illuminated LEDs. If a disk carrier has faulted, in addition to the LED behavior, you can determine whether it is safe or unsafe to remove the disk carrier by the behavior of the H1 shelf mode in the shelf digital display.

When a disk carrier is operating correctly, the disk carrier activity LED is green as the following table shows:

Disk carrier LED color	Status indicator	Description	Action to take	Note
Green (activity)	Solid	The disk carrier has power.	None	The shelf digital display shows the shelf ID. (The shelf is not in H1 shelf mode.)
	Blinking	The disk carrier has power and I/O is in progress.		

When one of the two disk drives in a disk carrier has faulted, the system initiates the H1 shelf mode automatically. The disk shelf remains in H1 shelf mode until the data from the good disk drive in the disk carrier is copied to a spare.

When the shelf is in H1 shelf mode, the shelf digital display alternates between flashing *HI* and the shelf ID number. In addition, the amber LED on the disk carrier continues to blink until all the data is copied from the good disk drive to the spare. If multiple disk carriers display blinking amber LEDs while *HI* is flashing, it means that multiple disk carriers have data being copied.

After all the data is copied, the amber LED turns solid and the shelf digital display shows only the shelf ID, indicating that the system has exited H1 shelf mode and it is safe to remove the disk carrier.

Attention: It can take up to 12 hours or more for each terabyte of data to finish copying from a good disk to a spare disk. The disk copies operate in the background and are throttled to minimize impact to client I/O. Do not remove any faulted disk carrier while the disk shelf is in H1 shelf mode or while any amber LEDs are blinking. You can safely remove a disk carrier only when all amber LEDs are solid and the system has exited H1 shelf mode.

The following table summarizes how the H1 shelf mode and LEDs behave to indicate when it is unsafe and safe to remove a faulted disk carrier:

Disk carrier LED color	Status indicator	Description	H1 shelf mode (on/off)	Shelf digital display	Action to take
Amber (fault)	Blinking	There is an error with the function of the disk carrier, and data from the good disk drive in the faulted disk carrier is being copied to a spare.	H1 shelf mode is on	Alternates between <i>HI</i> and the shelf ID	Do not remove the disk carrier at this time.
	Solid	The data from the good disk drive in the faulted disk carrier has been copied successfully to a spare.	H1 shelf mode is off	Shelf ID	It is now safe to remove the faulted disk carrier.

Note: In some versions of Data ONTAP, when a disk carrier fails due to excessive link errors, adapter errors, or timeouts, the fault LED does not illuminate. This makes it difficult to physically locate the disk carrier that needs to be replaced.

NetApp Bugs Online Bug ID 767822: Disks in "not responding" state do not turn on the fault LED

Disk drive or carrier console error messages

When an SES element on a disk drive or carrier fails, an error message appears on your storage system console.

ses.status.driveError

Description

This message occurs when a critical condition is detected for the disk drive in the disk shelf. The disk drive might fail.

Corrective action

1. Make sure that the disk drive is not running on a degraded volume.
If it is, you should add as many spares as necessary to the system, up to the specified level.
2. After the volume is no longer in degraded mode, replace the disk drive that is failing.

ses.shelf.ctrIFailErr

Description

This message occurs when the adapter and loop ID of the SCSI Enclosure Services (SES)-controlled target for which the SES has control fail.

Corrective action

1. Check the LEDs on the disk shelf and the disk shelf modules on the back of the disk shelf to see whether there are any abnormalities.
If the modules appear to be problematic, replace the applicable module.
2. If the SES target is a disk drive, check to see whether the disk drive failed; if so, replace the disk drive.

config.mixedSASdomain

Description

This warning message occurs when the identified channel has solid-state drives and rotating drives connected in the same SAS domain.

Corrective action

Solid-state drives and rotating drives must be configured in different SAS domains.

shm.threshold.spareBlocksConsumed

Description

This notification message occurs when a specified number of solid-state drives have consumed at least 60 percent of their use-based internal spare capacity. The affected drives are also identified.

Corrective action

Plan for solid-state drive replacement.

shm.threshold.spareBlocksConsumedMax

Description

This warning message occurs when a specified number of solid state drives have consumed at least 80 percent of their use-based internal spare capacity. The affected drives are also identified.

Corrective action

Ensure that replacement drives are available, but do not initiate drive replacement. The drives will be failed by Data ONTAP if appropriate.

Monitoring the IOMs

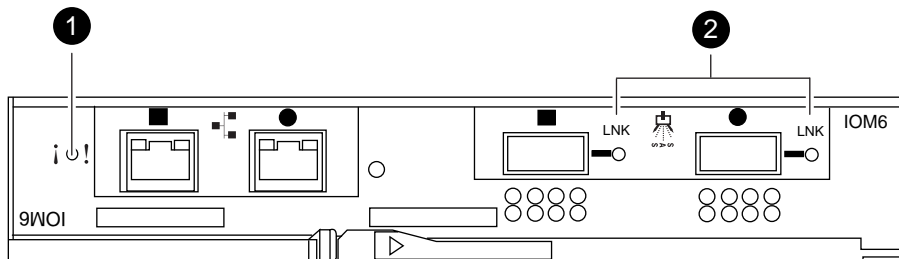
You can monitor the health of your I/O modules (IOMs) by familiarizing yourself with the location of the LEDs on the modules, their meanings, and the error messages that can occur when there is a problem.

Location of the IOM LEDs

The LEDs on the I/O Module (IOM) indicate whether the IOM is functioning normally, whether it is ready for I/O traffic, and whether there are any problems with the hardware.

The following illustration shows the front of the IOM and the location of the LEDs:

Note: Although IOM6 appears on the IOM in the illustration, the LED locations are the same for IOM3.



1	Fault
2	LNK

What the IOM LEDs mean

You can determine the status of the I/O modules (IOMs) by understanding the meaning of the IOM LEDs when they are illuminated.

At power up, the fault LED on the IOM illuminates by default. After a good operating condition is established, the fault LED turns off and the LNK LED illuminates.

The following table describes the LED behavior when the disk shelf is not in H0 shelf mode. The *How the H0 shelf mode and LEDs work* section has information about H0 shelf mode.

Icon	LED	Color	When illuminated
!	Fault	Amber	An error occurred with the function of the IOM.
LNK	Link	Green	A communication path with other disk shelves and the storage system is established.

IOM console error messages

When an SCSI Enclosure Services (SES) element on an IOM fails, an error message appears on the storage system console.

ses.status.electronicsError

Description

This message occurs when the system detects a failure in the module that provides disk SES monitoring capability.

Corrective action

Replace the module.

In some disk shelf types, this function is integrated into the Fibre Channel, SCSI, or Serial Attached SCSI (SAS) interface modules.

ses.status.ModuleError

Definition

This messages occurs when the reporting disk shelf detects an error in the indicated disk shelf module.

Corrective action

1. Verify that the disk shelf module is fully seated and secure.
2. If the problem persists, replace the disk shelf module.

ses.status.ACPError

Description

This message occurs when a failure has been detected in the ACP processor that provides alternate control path capability.

Corrective action

Replace the module.

In some disk shelf types, this function is integrated into the SAS interface modules.

ses.status.ACPWarn

Description

This messages occurs when a non-fatal condition has been detected in the ACP processor that provides alternate control path capability.

Corrective action

Replace the module.

In some disk shelf types, this function is integrated into the SAS interface modules.

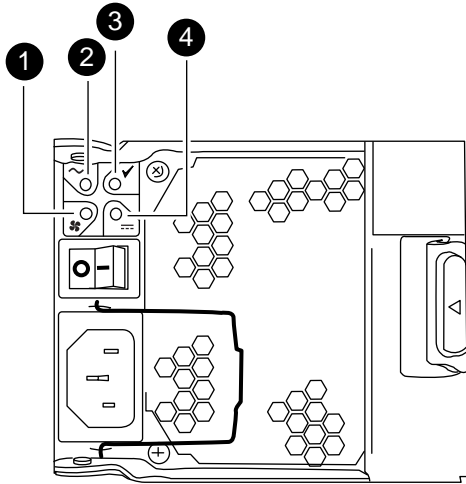
Monitoring the power supplies

You can monitor the health of your power supplies by familiarizing yourself with the location of the LEDs on the power supplies, their meanings, and the error messages that can occur when there is a problem.

Location of the power supply LEDs

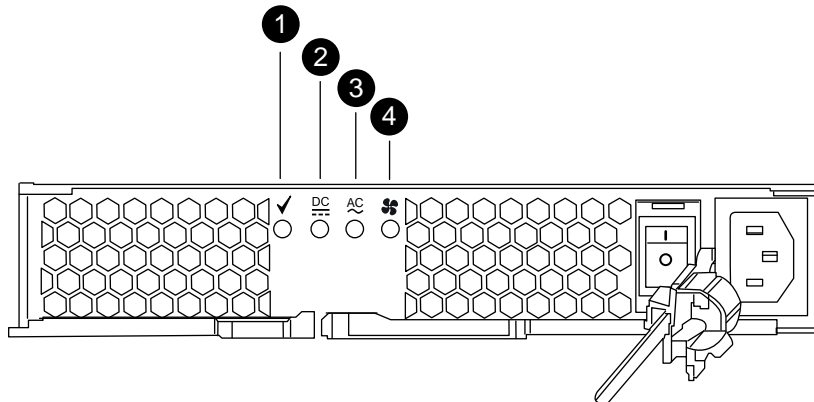
The LEDs on the power supply indicate whether the power supply or the two integrated fan modules are functioning normally or there are problems.

The following illustration shows the location of the LEDs on the power supply used in the DS4243 and DS4246 disk shelves:



1	Fan fault
2	AC fault
3	PSU OK
4	DC fault

The following illustration shows the location of the LEDs on the power supply used in the DS2246 and DS4486 disk shelves:



1	PSU OK
2	DC fault
3	AC fault

4	Fan fault
----------	-----------

Number of power supplies shipped in a DS4243 disk shelf

The type of the disk drives used in DS4243 disk shelves determines the number of power supplies required to ensure proper cooling, airflow, and power.

- DS4243 disk shelves that have solid-state disks (SSDs), or disk drives that are slower than 10,000 RPM, require two power supplies and two power supply blanks to fill the four power supply bays in the disk shelf.

These disk shelves require two power outlets.


- DS4243 disk shelves that have disk drives that are 10,000 RPM or faster—typically SAS disk drives—require four power supplies in the disk shelf.

These disk shelves require four power outlets.

What the power supply LEDs mean

You can determine the status of the power supplies by understanding the meaning of the power supply LEDs when they are illuminated.

Note: The following table describes the LED behavior when the disk shelf is not in H0 shelf mode. The *How the H0 shelf mode and LEDs work* section has information about the H0 shelf mode.

Icon	LED	Color	When illuminated
✓	PSU OK	Green	Power supply is functioning normally. Note: The other three LEDs are not illuminated.
	Fan fault	Amber	An error occurred with the function of the fan.
~	AC fault	Amber	The power supply is not turned on or the AC power cord is not plugged in.
≡	DC fault	Amber	The power supply cannot provide DC voltage to the disk shelf within margin.

Power supply console error messages

When an SES element on a power supply fails, an error message appears on your system console and the fault LED on the failed power supply illuminates.

ses.status.psError

Description

This message occurs when the system detects a critical condition in the indicated storage disk shelf power supply.

The power supply might fail.

Corrective action

1. Verify that power input to the disk shelf is correct.
If separate events of this type are reported simultaneously, the common power distribution point might be at fault.
2. If the disk shelf is in a system cabinet, verify that the power distribution unit is ON and functioning properly.

Make sure that the disk shelf power cords are fully inserted and secured, the supply is fully seated and secured, and the supply is switched ON.

3. Verify that power supply fans are functioning.
If they are, and the problem persists, replace the power supply.
4. If the problem persists, contact technical support.

ses.status.fanError

Description

This message occurs when the indicated disk shelf, cooling fan, or fan module fails, and the disk shelf or its components are not receiving required cooling airflow.

Corrective action

1. Verify that the power supply that contains the fan assembly is fully seated and secured.
2. If the problem persists, replace the power supply.
3. If the problem persists, contact technical support.

ses.status.volError

Description

This message occurs when a critical condition is detected in the indicated disk storage shelf voltage sensor.

The disk shelf might be able to continue operation.

Corrective action

1. Verify that the power supply and the AC line are supplying power.
2. Monitor the power grid for abnormalities.
3. Replace the power supply.
4. If the problem persists, contact technical support.

ses.status.currentError

Description

This message occurs when a critical condition is detected in the indicated disk storage shelf current sensor.

The disk shelf might be able to continue operation.

Corrective action

1. Verify that the power supply and the AC line are supplying power.
2. Monitor the power grid for abnormalities.
3. Replace the power supply.
4. If the problem persists, contact technical support.

ses.status.temperatureError

Description

This message occurs when the indicated disk shelf temperature sensor reports a temperature that exceeds the specifications for the disk shelf or its components.

Corrective action

1. Verify that the ambient temperature where the disk shelf is installed is within the vendor's equipment specifications by using the `environment shelf [adapter]` command, and check that airflow clearances are maintained.
2. If the same disk shelf also reports fan module failures, correct that problem immediately.
3. If the problem is reported by the ambient temperature sensor (located on the operator display panel), verify that the connection between the disk shelf and the panel is secure, if possible.
4. If the problem persists, and if the disk shelf has multiple temperature sensors but only one exhibits the problem, replace the module that contains the sensor reporting the error.
5. If the problem persists, contact technical support.

Note: You can display temperature thresholds for each disk shelf by using the `environment shelf` command. For clustered systems, you must run this command from the nodeshell of the target node.

Replacing disk shelf components

When a problem occurs with some disk shelf components, you can hot-swap them without disrupting the storage system. Problems with other disk shelf components requires you to halt the storage system.

Replacing SAS cables

You can replace SAS copper and optical cables for shelf-to-shelf and controller-to-shelf connections (using the same SAS ports) if a cable has failed, if a different length cable is needed, or if SAS optical cables are preferred instead of SAS copper cables. You can replace the cables nondisruptively with some system configurations, but other configurations require you to halt your system.

Before you begin

- Your system must not be a MetroCluster system, which requires a different procedure, depending on the type of MetroCluster system you have.
 - [Configuring a stretch MetroCluster system with SAS disk shelves and SAS optical cables in 7-mode](#)
 - [Configuring a MetroCluster system with SAS disk shelves and FibreBridge 6500N bridges in 7-Mode](#)
 - [MetroCluster Service Guide](#) for Clustered Data ONTAP
- For FAS22xx systems:
 - For FAS22xx HA pairs with external storage, the external storage must be cabled as multipath HA.
 - For FAS22xx single-controller configurations with external storage, the external storage must be cabled as dual path (multipath).
- Disk shelf (IOM), disk drive, and if applicable, ACP firmware should be current on all disk shelves in your system before adding new disk shelves, shelf FRU components, or SAS cables. Best practice is to always have the most current versions of firmware on your system.
 - [NetApp Downloads: Disk Shelf Firmware](#)
 - [NetApp Downloads: Disk Drive and Firmware](#)

Note: Do not revert firmware to a version that does not support the disk shelves, disk shelf FRU components, or SAS cables in your system.
- If you are using SAS optical cables or replacing one length of SAS copper cable for another, you must have verified that your platform, disk shelf firmware, and version of Data ONTAP that your system is running supports those cables.

The most current support information can be found in the [NetApp Hardware Universe](#).

About this task

- *Replacing* a SAS cable means that you are replacing a cable using the same ports for a controller-to-shelf or shelf-to-shelf connection.
- Your system must be a multipath HA or single-controller-dual-path (multipath) configuration to replace SAS cables nondisruptively.

If your system is a single-controller-single-path or single-controller-mixed-path configuration, you must halt your system.

- To prevent degraded performance, do not twist, fold, pinch, or step on the cables. Cables have a minimum bend radius. Cable manufacturer specifications define the minimum bend radius; however, a general guideline for minimum bend radius is 10 times the cable diameter.
- Using Velcro wraps instead of tie-wraps to bundle and secure system cables allows for easier cable adjustments.
- The SAS cables can be SAS copper, SAS optical, or a mix depending on whether or not your system meets the requirements for using the type of cable.
If you are using a mix of SAS copper cables and SAS optical cables, the following rules apply:
 - Shelf-to-shelf connections in a stack must be all SAS copper cables or all SAS optical cables.
 - If the shelf-to-shelf connections are SAS optical cables, the shelf-to-controller connections to that stack must also be SAS optical cables.
 - If the shelf-to-shelf connections are SAS copper cables, the shelf-to-controller connections to that stack can be SAS optical cables or SAS copper cables.
- SAS optical multimode QSFP-to-QSFP cables can be used for controller-to-shelf and shelf-to-shelf connections, and are available in lengths up to 50 meters.
- If you are using SAS optical multimode MPO cables with MPO QSFP modules, the following rules apply:
 - You can use these cables for controller-to-shelf and shelf-to-shelf connections.
 - The length of a single cable cannot exceed 150 meters for OM4 and 100 meters for OM3.
 - The total end-to-end path (sum of point-to-point paths from the controller to the last shelf) cannot exceed 510 meters.
The total path includes the set of breakout cables, patch panels, and inter-panel cables.
- If you are using SAS optical multimode breakout cables, the following rules apply:
 - You can use these cables for controller-to-shelf and shelf-to-shelf connections.
If you use multimode breakout cables for a shelf-to-shelf connection, you can only use it once within a stack of disk shelves. You must use SAS optical multimode QSFP-to-QSFP or MPO cables with MPO QSFP modules to connect the remaining shelf-to-shelf connections.
 - The point-to-point (QSFP-to-QSFP) path of any multimode cable cannot exceed 150 meters for OM4 and 100 meters for OM3.
The path includes the set of breakout cables, patch panels, and inter-panel cables.
 - The total end-to-end path (sum of point-to-point paths from the controller to the last shelf) cannot exceed 510 meters.
The total path includes the set of breakout cables, patch panels, and inter-panel cables.
 - Up to one pair of patch panels can be used in a path.
 - You need to supply the patch panels and inter-panel cables.
The inter-panel cables must be the same mode as the SAS optical breakout cable: multimode.
 - You received a set of QSFP-to-MPO cable modules with each set of SAS optical breakout cables, which you must attach to the MPO end of each SAS optical breakout cable.
The breakout cables have SC, LC, or MTRJ connectors on the opposite end, which connect to a patch panel.
 - You must connect all eight (four pairs) of the SC, LC, or MTRJ breakout connectors to the patch panel.
- You cannot change any disks, disk shelves, or components of a controller module as part of these procedures.

Replacing SAS cables in a multipath HA or single-controller-dual-path configuration

You can replace SAS cables nondisruptively in a multipath HA or single-controller-dual-path (multipath) configuration. Replacing a SAS cable means that you use the same SAS ports; you are only swapping out the cable.

Before you begin

You must have verified that your system meets the requirements listed in the *Replacing SAS cables* section.

About this task

If your non-FAS22xx system is shown as something other than `Multi-Path HA` or `Multi-Path`, you cannot complete this procedure. Your system must meet the procedure prerequisites.

Steps

1. Verify that your system configuration is correct:
 - For a system with Data ONTAP operating in 7-Mode, enter the following command at the system console:

```
sysconfig
```

For multipath HA configurations, you can run this command on either node.

- For clustered systems, enter the following command at the clustershell prompt:

```
run -node nodename|local sysconfig
```

It might take up to a minute for the system to complete discovery.

`Multi-Path HA` or `Multi-Path (single-controller-dual-path)` is listed in the `System Storage Configuration` field.

Note: For FAS22xx systems with external storage, the output is displayed as `Mixed-Path HA` for an HA pair. This is because the internal storage is cabled as `single-path HA` and the external storage is cabled as `multipath HA`.

2. If you are replacing SAS copper cables with SAS optical cables, verify that the disk shelves in the storage system have the latest version of disk shelf firmware by completing the following substeps; otherwise, go to Step 4.
 - a. Enter the applicable command:
 - For 7-Mode, enter the following command at the system console:

```
sasadmin expander_map
```

For multipath HA configurations, you can run this command on either node.

 - For clustered systems, enter the following command at the clustershell prompt:

```
run -node nodename|local sasadmin expander_map
```
 - b. Locate the disk shelf firmware information for the disk shelves in the output.

Example

0151 is the disk shelf firmware version for shelf number one (Slot A/IOM A) in the storage system:
 Expanders on channel 4a:

```
Level 3: WWN 500a0980000840ff, ID 1, Serial Number ' SHU0954292G114C',
Product 'DS424IOM6 ', Rev '0151', Slot A
```

- c. Compare the firmware information in the command output with the disk shelf firmware information at [NetApp Downloads: Disk Shelf Firmware](#) to determine the most current disk shelf firmware version.
3. The next step depends on how current the disk shelf firmware is on your disk shelves.

If the firmware version in the command output is...	Then...
The same as or later than the most current version on the NetApp Support Site	No disk shelf firmware update is needed.
An earlier version than the most current version on the NetApp Support Site	Download the disk shelf firmware file by using the procedure at NetApp Downloads: Disk Shelf Firmware . For HA pairs, you can run the commands from either controller.

4. Replace SAS cables by completing the following substeps:

You can ignore cabling messages that might appear on the console.

Note: When replacing a SAS cable, wait a minimum of 10 seconds before plugging in the new cable so that the system can detect the cable change.

Note: Do not force a connector into a port. The SAS cable QSFP connectors are keyed; when oriented correctly into a SAS port, the QSFP connector clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector). For controllers, the orientation of SAS ports can vary depending on the platform model; therefore, the correct orientation of the SAS cable connector varies.

- a. Replace cables on Side A one cable at a time.

The Side A cables are the cables connected to IOM A of each disk shelf.

- b. Verify that you have correctly replaced the SAS cables by entering the following command at the console of either controller:

```
sysconfig
```

The output should be the same as Step 1: the system should be `Multi-Path HA` or `Multi-Path`, and the SAS port and attached disk shelf information should be the same.

If the output is something other than `Multi-Path HA` or `Multi-Path`, you must identify the cabling error, correct it, and run the `sysconfig` command again.

- c. Repeat substeps a and b for Side B.

The Side B cables are the cables connected to IOM B of each disk shelf.

Replacing SAS cables in a single-controller-single-path or single-controller-mixed-path configuration

You must halt your system before replacing SAS cables in a single-controller-single-path or single-controller-mixed-path configuration.

Steps

1. Verify that your system configuration is correct:
 - For 7-Mode:

sysconfig

- For clustered systems, enter the following command at the clustershell prompt:

```
run -node nodename | local sysconfig
```

Note: It might take up to a minute for the system to complete discovery.

Single-Path or Mixed-Path is listed in the System Storage Configuration field.

2. Verify that your system meets the requirements listed in the *Replacing SAS cables* section.
3. If you are replacing SAS copper cables with SAS optical cables, verify that the disk shelves in the storage system have the latest version of disk shelf firmware by completing the following substeps; otherwise, go to step 5.

- a. Enter the following command:

```
sasadmin expander_map
```

For clustered systems, you must run this command from the nodeshell.

- b. Locate the disk shelf firmware information for the disk shelves in the output.

Example

0151 is the disk shelf firmware version for shelf number one (Slot A/IOM A) in the storage system:

```
Expanders on channel 4a:
Level 3: WWN 500a0980000840ff, ID 1, Serial Number ' SHU0954292G114C',
Product 'DS424IOM6 ', Rev '0151', Slot A
```

- c. Compare the firmware information in the command output with the disk shelf firmware information at [NetApp Downloads: Disk Shelf Firmware](#) to determine the most current disk shelf firmware version.
4. The next step depends on how current the disk shelf firmware is on your disk shelves.

If the firmware version in the command output is...	Then...
The same as the most current version on the NetApp Support Site	Complete Step 5 through Step 7. No disk shelf firmware update is needed.
An earlier version than the most current version on the NetApp Support Site	Complete Step 5 through Step 8. You need to update the disk shelf firmware.

5. Enter the applicable command from the system console to perform a clean shutdown:

For...	Then issue this command...
7-Mode	halt
Clustered systems	halt local

6. Replace any SAS cables.

If you are replacing more than one SAS cable, replace them one at a time to avoid confusion.

Note: Do not force a connector into a port. The SAS cable QSFP connectors are keyed; when oriented correctly into a SAS port, the QSFP connector clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector). For controllers, the orientation of

SAS ports can vary depending on the platform model; therefore, the correct orientation of the SAS cable connector varies.

7. Verify that you have correctly replaced the cables by bringing your system back up.
 - a. Boot the system.
 - b. Enter the following command at the system console:

```
sysconfig
```

For clustered systems, you must run this command from the nodeshell.

The output should be the same as Step 1; The system should be `Single-Path` or `Mixed-Path`, and the SAS port and attached disk-shelf information should be the same.

8. In Step 4, if you had a version of disk shelf firmware other than the most current version on the NetApp Support Site, download the disk shelf firmware file by using the procedure at [NetApp Downloads: Disk Shelf Firmware](#).

Hot-swapping a disk drive or carrier

When a disk drive or carrier fails, the storage system logs a warning message to the system console indicating which disk drive or carrier has failed. In addition, both the fault LED on the operator display panel and the fault LED on the failed disk drive or carrier are illuminated. For DS4486 disk shelves, the disk carrier fault LED blinks and the H1 shelf mode appears in the shelf digital display. You can hot-swap a disk drive or carrier while the system remains powered on.

Before you begin

- The disk drive that you are installing must be supported by your disk shelf model. [NetApp Hardware Universe](#)
- If you have a DS4486 disk shelf, the following requirements apply:
 - You can only hot-swap a disk carrier (you replace the disk carrier, not individual disk drives in the carrier) after the disk shelf has exited H1 shelf mode.

Attention: Removing a faulted disk carrier while the shelf is still in H1 shelf mode causes a double-disk failure.

The disk shelf with the faulted disk carrier exits the H1 shelf mode after the data from the good disk drive in the faulted disk carrier has been copied to a spare disk drive. It can take eight to more than 12 hours for each terabyte of data to finish copying from a good disk to a spare disk. The disk copies operate in the background and are throttled to minimize impact to client I/O.

The “What the disk carrier LEDs and H1 shelf mode mean for DS4486 disk shelves” section describes the LED and H1 shelf mode behavior that indicates when it is safe to remove a faulted disk carrier.

- You must have read and understood “Rules for handling disk carriers for DS4486 disk shelves” to prevent damage to the disk drives in the disk carriers.
- Disk shelf (IOM), disk drive, and if applicable, ACP firmware should be current on all disk shelves in your system before adding new disk shelves, shelf FRU components, or SAS cables. Best practice is to always have the most current versions of firmware on your system.

[NetApp Downloads: Disk Shelf Firmware](#)

[NetApp Downloads: Disk Drive and Firmware](#)

Note: Do not revert firmware to a version that does not support the disk shelves, disk shelf FRU components, or SAS cables in your system.

About this task

- When removing a disk drive or carrier in a disk shelf, wait a minimum of 10 seconds before inserting a new disk drive to allow the storage system to recognize that the disk drive was removed.
- Always use two hands when removing, installing, or carrying a disk drive or carrier.
 - Attention:** Do not place hands on the disk drive boards exposed on the underside of the disk carrier.
- If you have a DS4243, DS4246, or DS2246 disk shelf, how you hot-swap the disk drive depends how the disk drive is being used.

By using the correct procedure, you can prevent unwanted AutoSupport notifications from being generated. Depending on your system, disk drives with Storage Encryption might require additional steps before and after the hot-swap. For information about the commands that apply to your system, see the applicable Data ONTAP 8.x *Storage Management Guide*. If your system is operating in clustered Data ONTAP, the document is titled *Physical Storage Management Guide*. [Find a Storage Management Guide for your version of Data ONTAP 8](#)

Steps

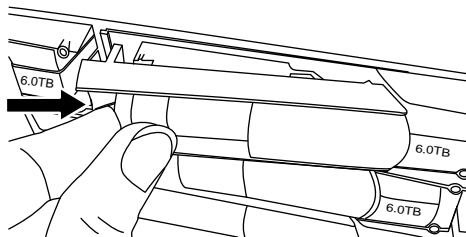
1. Properly ground yourself.
2. Identify the failed disk drive or carrier from the system console warning message and the illuminated fault LED on the disk drive or carrier.
3. If you are replacing a disk carrier in a DS4486 disk shelf, verify that the data evacuation is complete and it is safe to remove the disk carrier; otherwise, go to the next step.

When the data evacuation has been completed and it is safe to remove a disk carrier, the amber LED on the faulted disk carrier is solid (no longer blinking) and a console error message appears telling you it is safe to remove the disk carrier.

4. Press the release button on the disk drive or carrier face.

Depending on the disk shelf model, the disk drives or carriers have the release button located at the top or on the left of the disk drive or carrier face.

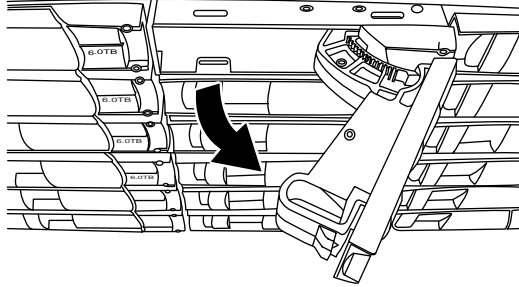
For example, the following illustration shows a disk drive with the release button located on the left of the disk drive or carrier face:



The cam handle on the disk drive or carrier springs open partially and the disk drive or carrier releases from the midplane.

5. Pull the cam handle to its fully open position to unseat the disk drive or carrier from the midplane.

For example, the following illustration shows a disk drive or carrier with the cam handle in its fully open position:



6. Slide out the disk drive or carrier slightly and allow the disk to safely spin down, which can take less than one minute, and then remove the disk drive or carrier from the disk shelf.
7. With the cam handle in the open position, insert the replacement disk drive or carrier into the disk shelf slot, firmly pushing until the disk drive or carrier stops.

Note: Wait a minimum of 10 seconds before inserting a new disk drive or carrier. This allows the system to recognize that a disk drive or carrier was removed.

Note: Use two hands when inserting the disk drive or carrier, but do not place hands on the disk drive boards that are exposed on the underside of the disk carrier.

8. Close the cam handle so that the disk drive or carrier is fully seated into the midplane and the handle clicks into place.

Be sure to close the cam handle slowly so that it aligns correctly with the face of the disk drive or carrier.

9. If you are replacing another disk drive or carrier, repeat Steps 2 through 8.
10. If disk autoassignment is not enabled on your system, manually assign disk ownership.

Information about disk ownership and the procedure for assigning disk ownership are in the *Data ONTAP Storage Management Guide for 7-Mode* or *Clustered Data ONTAP Physical Storage Management Guide*, as appropriate for your version of Data ONTAP.

[Find a Storage Management Guide for your version of Data ONTAP 7G](#)

[Find a Storage Management Guide for your version of Data ONTAP 8](#)

11. Return the failed part to NetApp, as described in the RMA instructions shipped with the kit.

Contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific) if you need the RMA number or additional help with the replacement procedure.

Replacing a power supply

When a power supply fails, the storage system logs a warning message to the system console indicating which power supply failed, and the fault LED on the operator display panel and the fault LED on the failed power supply both illuminate.

Before you begin

- Disk shelf (IOM), disk drive, and if applicable, ACP firmware should be current on all disk shelves in your system before adding new disk shelves, shelf FRU components, or SAS cables. Best practice is to always have the most current versions of firmware on your system.

[NetApp Downloads: Disk Shelf Firmware](#)

[NetApp Downloads: Disk Drive and Firmware](#)

Note: Do not revert firmware to a version that does not support the disk shelves, disk shelf FRU components, or SAS cables in your system.

About this task

- If you are replacing more than one power supply, you must do so one at a time so that the disk shelf maintains power.
- If you must remove all power supplies—leaving the disk shelf without any power supplies—you must first power off the disk shelf.
- You must replace a power supply within two minutes of removal to minimize disruption to the disk shelf's airflow.

Steps

1. Properly ground yourself.
2. Physically identify the failed power supply from the system console warning message and the illuminated fault LED on the power supply.
3. Turn off the power supply and disconnect the power cables:
 - a. Turn off the power switch on the failed power supply.
 - b. Open the power cord retainer and unplug the power cord from the power supply.
 - c. Unplug the power cord from the power source.
4. Squeeze the latch on the cam handle until it releases, and then open the cam handle fully to release the power supply from the midplane.
If you have a DS2246 or DS4486 disk shelf, a plastic flap within the now empty slot releases to cover the opening and maintain air flow and cooling.
5. Use the cam handle to slide the power supply out of the disk shelf.
Attention: When removing a power supply, always use two hands to support its weight.
6. With the cam handle in the open position, insert the replacement power supply into the disk shelf, firmly pushing until the power supply engages the midplane.
Attention: Do not use excessive force when sliding the power supply into the disk shelf; you can damage the connector.
7. Close the cam handle so that the latch clicks into the locked position and the power supply is fully seated.
8. Reconnect the power supply cabling:
 - a. Reconnect the power cord to the power supply and the power source.
 - b. Secure the power cord to the power supply by using the power cord retainer.
9. Turn on the power to the new power supply and verify the operation of the power supply LEDs.
10. Return the failed part to NetApp, as described in the RMA instructions shipped with the kit.
Contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific) if you need the RMA number or additional help with the replacement procedure.

Hot-swapping or replacing an IOM

Your type of configuration determines whether you must run a version of Data ONTAP containing certain bug fixes before you hot-swap or replace an IOM, and whether you can perform a nondisruptive IOM hot-swap or a disruptive IOM replacement.

Before you begin

- Your multipath HA, single-controller-dual-path, or single-path HA configuration must be running Data ONTAP 8.1.4 or later, Data ONTAP 8.2.1 or later, or Data ONTAP 8.3 or later. These versions of Data ONTAP contain required bug fixes described in Bug ID 691240.

[NetApp Bugs Online Bug ID 691240: Replacing an IOM too quickly can result in shelf ID conflict errors](#)

Attention: If you attempt to hot-swap or replace an IOM on one of these configurations without these bug fixes, the system might panic and cause a disruption.

If you cannot upgrade to a version of Data ONTAP that contains these two bug fixes, then you should wait for a maintenance period to hot-swap or replace an IOM.

Note: Single-controller-single-path configurations must be halted to replace an IOM; therefore, this type of configuration does not require a version of Data ONTAP that contains the two bug fixes.

- Your disk shelf model must support the IOM that you are using to replace the failed IOM. For example, only 6 Gb I/O modules (IOM6) are supported in the DS2246, DS4246, and DS4486 disk shelves.

[NetApp Hardware Universe](#)

About this task

- Disk shelf (IOM), disk drive, and if applicable, ACP firmware should be current on all disk shelves in your system before adding new disk shelves, shelf FRU components, or SAS cables. Best practice is to always have the most current versions of firmware on your system.

[NetApp Downloads: Disk Shelf Firmware](#)

[NetApp Downloads: Disk Drive and Firmware](#)

Note: Do not revert firmware to a version that does not support the disk shelves, disk shelf FRU components, or SAS cables in your system.

- Your type of configuration determines whether you can perform a nondisruptive IOM hot-swap or must perform a disruptive IOM replacement:
 - Multipath configurations (multipath HA or single-controller-dual-path) enable you to hot-swap an IOM.
 - Single-path HA configurations (FAS2040, FAS22xx, and FAS25xx) require a takeover and giveback to replace an IOM.
 - Single-controller-single-path configurations must be halted to replace an IOM.

Attention: If you attempt to hot-swap the IOM on a disk shelf in a single-controller configuration that has a single-path connection to the disk shelf, you will lose all access to the disk drives on this disk shelf as well as any disk shelves beneath. You could also bring down your entire storage system.

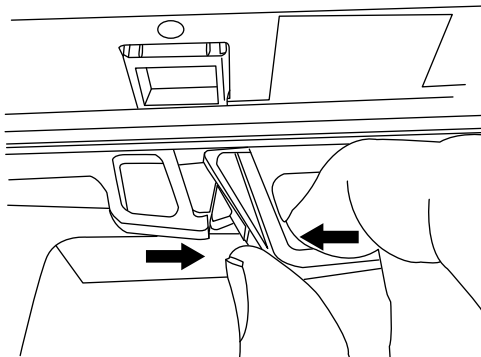
- After you remove an IOM, you must wait at least 70 seconds before you install the new IOM so that the driver registers the shelf ID correctly.

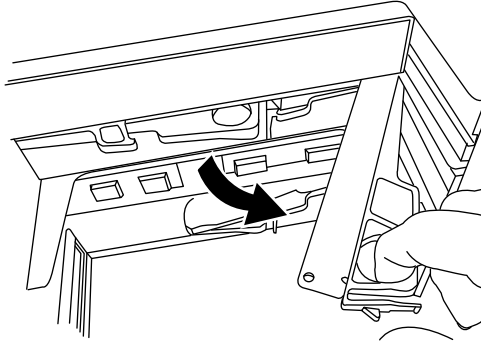
Steps

1. Properly ground yourself.
2. Physically identify the failed IOM from the system console warning message.
The fault LED on the operator display panel and on the failed IOM illuminate.
3. Perform one of the following actions based on the type of configuration you have:

If you have...	Then...
<ul style="list-style-type: none"> • A multipath HA configuration • A single-controller-dual-path (multipath) configuration 	<p>Go to the next step.</p>
<p>A single-path HA configuration (supported on FAS2040, FAS22xx and FAS25xx)</p>	<ol style="list-style-type: none"> a. Determine the target node (which node/controller the failed IOM belongs to). IOM A belongs to Controller 1. IOM B belongs to Controller 2. b. Take over the target node: For systems operating Data ONTAP in 7-Mode, from the console of the partner node: cf takeover For clustered systems, from the clustershell: storage failover takeover -bynode partner HA node
<p>A single-controller-single-path configuration (only supported in 7-Mode)</p>	<ol style="list-style-type: none"> a. Shut down the storage system from the system console: halt b. Verify that your system halted. If your storage system has an LCD display, <code>halted</code> should appear on the display; otherwise, you should check the storage system console.

4. Disconnect the cabling from the IOM that you are removing.
5. Squeeze the latch on the cam handle until it releases, open the cam handle fully to release the IOM from the midplane, and then, using two hands, pull the IOM out of the disk shelf.





If you have a DS2246 or DS4486 disk shelf, a plastic flap within the now-empty slot releases to cover the opening and maintain air flow and cooling.

6. Wait at least 70 seconds after removing the IOM before you install the new IOM.

Waiting at least 70 seconds enables the driver to register the shelf ID correctly.

7. With the cam handle in the open position, insert the new IOM into the disk shelf, firmly pushing until the IOM meets the midplane, and then close the cam handle so that the latch clicks into the locked position and the IOM is fully seated.

Attention: Do not use excessive force when sliding the IOM into the disk shelf; you might damage the connectors.

8. Reconnect the stack cabling.

Do not force a connector into a port. The SAS cable QSFP connectors are keyed; when oriented correctly into a SAS port, the QSFP connector clicks into place and the disk shelf SAS port LNK LED illuminates green. For disk shelves, you insert a SAS cable connector with the pull tab oriented down (on the underside of the connector).

9. Perform one of the following actions based on the type of configuration you have:

If you have...	Then...
<ul style="list-style-type: none"> • A multipath HA configuration • A single-controller-dual-path (multipath) configuration 	Go to the next step.
A single-path HA configuration (supported on FAS2040, FAS22xx and FAS25xx)	Give back the target node: For systems running Data ONTAP in 7-Mode, from the partner node's console: cf giveback For clustered systems, from the cluster shell: storage failover giveback -fromnode partner_HA_node
A single-controller-single-path configuration	Reboot your storage system.

10. Verify that the IOM link has been established by checking that the LNK LEDs on the IOM are illuminated.
11. Return the failed part to NetApp, as described in the RMA instructions shipped with the kit.

Contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific) if you need the RMA number or additional help with the replacement procedure.

Replacing an operator display panel in a DS2246 disk shelf

Issues with the DS2246 operator display panel LEDs or shelf ID function can indicate that the operator display panel should be replaced.

About this task

Replacing the operator display panel requires that you halt your system. Attempting to remove the operator display panel before halting your system causes a system panic.

Steps

1. Ground yourself to the storage system chassis using the grounding leash.
2. Shut down the storage system by entering the applicable command:

If your storage system is operating in...	Then enter the applicable command...
7-Mode	From the system console: halt
Cluster-Mode	From the clustershell: halt -node local

3. Verify that your system halted.
If your storage system has an LCD display, `halted` appears on the display; otherwise, you should check the storage system console.
4. Turn off power to the disk shelf for which you are replacing the operator display panel.
5. Unplug the power cords from the power supplies in the disk shelf for which you are replacing the operator display panel.
6. If applicable, remove the left ear cover covering the operator display panel.
7. Remove four or more disk drives to the right of the operator display panel to allow enough space for your hand to fit inside the chassis.
You need to be able to grasp the touch-point release pin on the side of the operator display panel.
8. Insert one hand into the chassis, pull the touch-point release pin straight out to release the operator display panel, and then grasp the front of the operator display panel with your other hand and slide it out of the chassis.
9. Slide the new operator display panel into the slot until it meets the midplane and clicks into place.
10. Replace the disk drives that you removed.
11. Plug the power cords back into the power supplies.
12. Turn on the power to the disk shelf, and wait for the disk drives to spin up.

If the operator display panel replacement is successful, the operator display panel power and activity LEDs illuminate. If the replacement was unsuccessful, the operator display panel fault LED illuminates and an error message appears on the storage system console.

13. Turn on the power to the storage system.
14. Return the failed part to NetApp, as described in the RMA instructions shipped with the kit.
Contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific) if you need the RMA number or additional help with the replacement procedure.

Replacing disk shelves

You can replace a disk shelf in an HA pair or single-controller system with a fully populated disk shelf or a disk shelf chassis for which you will transfer components from the shelf you are removing. You must halt your system to replace a disk shelf.

Before you begin

The disk shelf model you are installing must meet the storage system requirements specified in the *Hardware Universe*, which includes supported shelf models, supported disk drive types, maximum number of disk shelves in a stack, and supported Data ONTAP versions.

[NetApp Hardware Universe](#)

About this task

- If you are installing DS4486 disk shelves, you must have read and understood the “Rules for handling disk carriers for DS4486 disk shelves” section to prevent damage to the disk drives in the disk carriers.
- DS4486 disk shelves are shipped with all but four disk carriers removed to make the disk shelf lighter and easier to install into a rack.
The four disk carriers might contain the Data ONTAP root volume and should remain in the disk shelf. Because you must insert the remaining disk carriers into the disk shelf after it is installed into the rack, additional handling could damage disk drives in the disk carriers if they are not handled correctly.
- To prevent degraded performance, do not twist, fold, pinch, or step on the cables.
Cables have a minimum bend radius. Cable manufacturer specifications define the minimum bend radius; however, a general guideline for minimum bend radius is 10 times the cable diameter.
- Using Velcro wraps instead of tie-wraps to bundle and secure system cables allows for easier cable adjustments.

Steps

1. Properly ground yourself.
2. Shut down the storage system:

If your storage system is operating in...	Then enter...
7-Mode	From the system console: halt
Clustered Data ONTAP	From the clustershell: halt -node local

3. Verify that your system halted.

If your storage system has an LCD display, `halted` should appear on the display; otherwise, you should check the storage system console to ensure the system is halted.

4. Turn off the power switch on the disk shelf.
5. Unplug all power cords from the disk shelf.
6. Unplug and remove the cables connecting the disk shelf to the other disk shelves or the storage system.
 - Note:** Make note of the ports from which you unplugged the cables so that you can cable the new disk shelf in the same way.
7. Use a Phillips screwdriver to remove the screws securing the disk shelf to the rack.
8. Remove the disk shelf from the rack.

To make the disk shelf lighter and easier to maneuver, remove the power supplies and I/O Modules (IOMs). If you will be installing a disk shelf chassis, also remove the disk drives or carriers; otherwise, avoid removing disk drives or carriers if possible because excessive handling can lead to internal damage.

 - Attention:** If you must remove disk carriers from the DS4486 disk shelf, do not place hands on the two disk drive boards exposed on the underside of the disk carrier.
 - Note:** You might want to use a mechanical hoist or lift if you decide to move a DS4243 or DS4486 that is fully populated.
 - Caution:** A fully populated DS4243 or DS4246 disk shelf can weigh approximately 110 lb (49.9 kg).

A fully populated DS2246 disk shelf can weigh approximately 49 lb (22 kg).

A DS4486 disk shelf with the two IOMs, four power supplies, and only four disk carriers can weigh approximately 82 lbs (37 kg). A fully populated disk shelf can weigh approximately 150 lbs (68 kg).
9. Install and secure the replacement disk shelf onto the support brackets and rack.
10. If you installed a disk shelf chassis, insert all of the components that you removed in Step 8; otherwise, go to the next step.
11. Reestablish the stack of disk shelves by connecting the cables to the replacement disk shelf's ports exactly as they were connected to the disk shelf you removed.
12. Reconnect the power cords to each disk shelf and secure them in place with the power cord retainer.
 - Note:** If you have a disk shelf with four power supplies, be sure that you reconnect the power supplies in slot 1 and slot 3 to one power source and the power supplies in slot 2 and slot 4 to a different power source for resiliency.
13. Turn on the power to the replacement disk shelf, and wait for the disk drives to spin up.
 - Note:** When the disk shelf has the maximum number of supported power supplies, all disk drives or carriers spin up at the same time. However, if one or two power supplies have faulted in a disk shelf with four power supplies, or if one power supply has faulted in a disk shelf with two power supplies, disk drives spin up in sets of six at 12-second intervals.
14. Change the disk shelf ID to a unique ID from 0 through 98.

If needed, see the "Changing the disk shelf ID" section.
15. Turn on the power to the storage system.
16. Check whether your system has disk auto assignment enabled:

If you have an HA pair, you can enter the applicable command at the console of either controller.

If your system is operating in....	Then enter...
7-Mode	<code>options disk.auto_assign</code>
Clustered Data ONTAP	<code>storage disk option modify -autoassign</code>

If disk auto assignment is enabled, the output shows `disk.auto_assign on`.

17. If your system does not have disk auto assignment enabled, or if disk drives in the same stack are owned by both controllers, assign disk drive ownership.

The following substeps address basic disk ownership assignment for systems operating in 7-Mode. To specify the disk drives to be assigned or the system to own the disk drives, see the *Data ONTAP Storage Management Guide for 7-Mode*. For HA pairs, you can run these commands from the system console of either node.

For assigning disk drive ownership on clustered systems, see the *Clustered Data ONTAP Physical Storage Management Guide*.

Guides are available on the NetApp Support Site at mysupport.netapp.com.

[NetApp Support](#)

- a. View all of the unassigned disk drives:

```
disk show -n
```

The disk drives in the hot-added shelf have the ownership state of **Not Owned**.

- b. Assign ownership of the disk drives:

```
disk assign all
```

If you need to assign the disk drives to a non-local storage system, you can specify that storage system by using the `-o owner_name` option. To determine the `owner_name`, you can run the `hostname` command at the console of either controller.

- c. Verify the assignments that you made:

```
disk show -v
```

18. If applicable, return the failed part to NetApp, as described in the RMA instructions that are shipped with the kit.

Contact technical support at [NetApp Support](#), 888-463-8277 (North America), 00-800-44-638277 (Europe), or +800-800-80-800 (Asia/Pacific) if you need the RMA number or additional help with the replacement procedure.

Recommended power line sizes

When installing your storage system, you must determine the AC and DC power line lengths running from the storage system to the power source.

Recommended AC power line sizes

By properly designing longer AC power feeds, you can preserve voltage levels to the equipment. The longer power feeds—the wiring from the breaker panel to the power strip, which supplies power to the storage system and disk shelves—can often exceed 50 feet.

Note: Total AC wire length = breaker to wall or ceiling outlet + extension cable or ceiling drop.

The following tables list the recommended conductor size for 2 percent voltage drop for a particular distance measured in feet (taken from the Radio Engineer's Handbook). The circuits in the following tables are described in American Wire Gauge (AWG) measurements:

110V, single-phase	20A circuit	30A circuit	40A circuit	50A circuit
25 feet	12 AWG	10 AWG	8 AWG	8 AWG
50 feet	8 AWG	6 AWG	6 AWG	4 AWG
75 feet	6 AWG	4 AWG	4 AWG	2 AWG

220V, single-phase	20A circuit	30A circuit	40A circuit	50A circuit
25 feet	14 AWG	12 AWG	12 AWG	10 AWG
50 feet	12 AWG	10 AWG	8 AWG	8 AWG
75 feet	10 AWG	8 AWG	6 AWG	6 AWG

The following table lists the approximate equivalent wire gauge (AWG to Harmonized Cordage).

AWG	8	10	12
Harmonized, mm-mm mm-mm = millimeter squared	4.0	2.5	1.5

Calculating the length of DC wires for DS4243 disk shelves

If your DS4243 disk shelf is using DC power supplies, you must calculate the maximum combined length of the positive and negative wires that connect the DC source and DC power supply by using the variable definitions and examples provided.

Variable definitions

V_{SOURCE}

Voltage across the internal source resistance

V_{OC}

Voltage across an open circuit of the input source

V_{LOAD}

Voltage across a load, R_{TEST} connected to the input source

R_{TEST}

Test resistor of known value, that is, 10Ω at 300W

R_{CABLE}

DC resistance of the cable at a given length

R_{SOURCE}

DC resistance of the source

R_{TOTAL}

Combined DC resistance of the cable and DC source:

$$R_{TOTAL} = R_{SOURCE} + R_{CABLE}$$

$V = IR$

Ohm's Law

$V_{OC} = V_{SOURCE} + V_{LOAD}$

Kirchoff's Voltage Law

Example 1

This example uses the following given values:

Given

$V_{DROP} = 2V$

Maximum voltage drop through input source and cable

$V_{MIN} = 40V$

Minimum input voltage

$I_{MAX} = 8.6A$

Maximum input current at 40V

$V_{OC} = 48V$

Measured

$V_{LOAD} = 47.5V$

Measured

$R_{TEST} = 10\Omega$

(300W)

Solution

$$V_{\text{DROP}} = I_{\text{MAX}} R_{\text{TOTAL}}$$

$$2 = 8.6 R_{\text{TOTAL}}$$

$$R_{\text{TOTAL}} = 2/8.6$$

$$R_{\text{TOTAL}} = .233\Omega$$

$$V_{\text{LOAD}} = I R_{\text{TEST}}$$

$$I = V_{\text{LOAD}}/R_{\text{TEST}}$$

$$V_{\text{OC}} = V_{\text{SOURCE}} + V_{\text{LOAD}}$$

$$V_{\text{OC}} = I R_{\text{S}} + V_{\text{LOAD}}$$

$$R_{\text{S}} = \frac{V_{\text{OC}} - V_{\text{LOAD}}}{I}$$

$$R_{\text{S}} = \frac{(V_{\text{OC}} - V_{\text{LOAD}})}{V_{\text{LOAD}}/R_{\text{TEST}}}$$

$$R_{\text{S}} = \frac{V_{\text{OC}} - V_{\text{LOAD}}}{V_{\text{LOAD}}} \times R_{\text{TEST}}$$

$$= \frac{48\text{V} - 47.5\text{V}}{47.5\text{V}} \times 10\Omega$$

$$= 0.105\Omega$$

$$R_{\text{TOTAL}} = R_{\text{CABLE}} + R_{\text{SOURCE}}$$

$$R_{\text{CABLE}} = R_{\text{TOTAL}} - R_{\text{SOURCE}}$$

$$R_{\text{CABLE}} = 0.233\Omega - 0.105\Omega$$

$$= 0.128\Omega$$

For example, if you have a 12-gauge wire, solid strand, at room temperature, you use the following calculation:

$$\text{Total cable length} = \frac{R_{\text{CABLE}}}{\text{DC resis.}^1}$$

$$\text{Total cable length} = \frac{.128\Omega}{.0017\Omega/\text{ft}} = 75 \text{ ft}$$

AWG	Strand	DC resistance ¹ [Ω /ft.]		Total cable length ² [ft]	
		25°C	75°C	25°C	75°C
12	Solid	.0017	.0020	75	64
12	7/20	.0015	.0018	85	71
12	19/25	.0017	.0020	75	64

AWG	Strand	DC resistance ¹ [Ω /ft.]		Total cable length ² [ft]	
		25°C	75°C	25°C	75°C
12	65/30	.0018	.0022	71	58
12	165/34	.0016	.0019	80	67
¹ Data from Alpha Wire, wire manufacturer ² Combined positive and negative run					

Example 2

This example uses the following given values:

Given

$$V_{\text{DROP}} = 2\text{V} \quad \text{Maximum voltage drop through input source and cable}$$

$$V_{\text{MIN}} = 40\text{V} \quad \text{Minimum input voltage}$$

$$I_{\text{MAX}} = 8.6\text{A} \quad \text{Maximum input current at 40V}$$

$$R_{\text{SOURCE}} \cong 0$$

Solution

$$V_{\text{DROP}} = I_{\text{MAX}} R_{\text{TOTAL}}$$

$$R_{\text{TOTAL}} = \frac{V_{\text{DROP}}}{I_{\text{MAX}}}$$

$$R_{\text{TOTAL}} = 2/8.6$$

$$R_{\text{TOTAL}} = 0.233\Omega$$

$$R_{\text{TOTAL}} = R_{\text{SOURCE}} + R_{\text{CABLE}}$$

$$R_{\text{CABLE}} = R_{\text{TOTAL}} - R_{\text{SOURCE}}$$

$$R_{\text{CABLE}} = 0.233 - 0$$

$$R_{\text{CABLE}} = 0.233$$

For example, if you have a solid-strand, 12-gauge wire at room temperature, you use the following calculation:

$$\text{Total cable length} = \frac{R_{\text{CABLE}}}{\text{DC resis.}^1}$$

$$\text{Total cable length} = \frac{.233\Omega}{.0017\Omega/\text{ft}} = 136 \text{ ft}$$

AWG	Strand	DC resistance ¹ [Ω /ft.]		Total cable length ² [ft]	
		25°C	75°C	25°C	75°C
12	Solid	.0017	.0020	136	116
12	7/20	.0015	.0018	155	129
12	19/25	.0017	.0020	136	116
12	65/30	.0018	.0022	129	105
12	165/34	.0016	.0019	145	122
¹ Data from Alpha Wire, wire manufacturer. ² Combined positive and negative run.					

Using other wire sizes

If you need greater length for your combined positive and negative DC wires, you must choose a wire with a lower resistance and calculate the total cable length.

For example, a solid #10 AWG has a lower DC resistance than a serial #12 AWG.

Rules for handling disk carriers for DS4486 disk shelves

DS4486 disk shelves are shipped with the majority of the disk carriers—each containing two drives—removed to reduce the chassis weight for installation. Because you must unpack and install the disk carriers into the disk shelf, you must understand and follow the disk carrier handling rules to avoid damaging the disk drives.

To avoid damaging the disk drives in the disk carrier, always follow these rules:

Attention: The two disk drives housed in each disk carrier are fragile! Improper handling of disk drives is the leading cause of disk drive damage.

- Prevent electrostatic discharge (ESD):
 - Keep the disk carrier in the ESD bag until you are ready to install it.
 - Do not insert a metal tool or knife into the ESD bag.
Open the ESD bag by hand or cut the top off with a pair of scissors.
 - Retain the ESD bag and any packing material for the disk carrier in case you must return it later.

Note: NetApp requires that all returned disk carriers be in an ESD-rated bag.
 - Always wear an ESD wrist strap grounded to an unpainted surface on your storage enclosure chassis.
If a wrist strap is unavailable, touch an unpainted surface on your storage enclosure chassis before handling the disk carrier.
- Handle disk carriers gently:
 - Never touch the connector pins on a disk carrier.
 - Do not force the disk carrier into the enclosure.
The disk carrier slides easily into the enclosure, and gentle, firm pressure completely engages the carrier latch.
 - Do not stack disk carriers on top of each other.
 - Do not bang disk carriers against surfaces.

Glossary

SAS disk shelf and connectivity terminology is defined in the glossary.

ACP

Alternate Control Path. A protocol that enables Data ONTAP to manage and control the disk shelf storage subsystem. It uses a separate network from the data path, so management communication is not dependent on the data path being intact and available. Use of ACP requires that all disk shelf IOMs and storage controllers connect through the ACP ports on the IOMs and the designated network interface on each controller.

add-on disk shelf

In a SAS disk shelf environment, a disk shelf that is shipped individually—not shipped as part of a configured storage system.

configured system

In a SAS disk shelf environment, a new storage system that ships with SAS disk shelves and preinstalled SAS HBAs (if applicable).

controller

The component of a storage system that runs the Data ONTAP operating system and controls its disk subsystem. The controller located in the top slot in a storage system chassis can be referred to as *Controller 1* or *Controller A*. The controller located in the bottom slot in the storage system chassis can be referred to as *Controller 2* or *Controller B*.

Controllers are also sometimes called *storage controllers*, *storage appliances*, *appliances*, *storage engines*, *heads*, *CPU modules*, or *controller modules*.

dual-path

A configuration in which a single-controller storage system has two ways to connect to a disk drive. This is the supported configuration for a single-controller configuration.

first shelf connection

In a SAS disk shelf environment, the cabling connection from the controller to the first disk shelf in a stack of disk shelves.

IOM

The SAS shelf I/O module that is located in the back of the disk shelf. It connects the individual disk drives to the rest of the storage system and controls the disk shelf operator display panel LEDs. Each disk shelf has two IOMs: IOM A and IOM B. These are also referred to as *SBB A* and *SBB B* on the slot map label on the back of the disk shelf.

last shelf connection

In a SAS disk shelf environment, the cabling connection from the controller to the last disk shelf in a stack of disk shelves.

multipath HA

In an HA pair, a configuration in which each controller has multiple ways to connect to a disk drive. Multipath HA cabling is the most resilient and only supported configuration for HA pairs. This is because it takes full advantage of the resiliency capability of the disk shelves, which means that the node continues to have access to disk drives in the event of cable, HBA, or shelf module failure. A single failure of a cable, HBA, or module does not result in a controller failover.

node

The term node can have two specific meanings:

- A single controller that can be deployed stand-alone, in an HA pair, or in an HA pair within a cluster.
- In Protection Manager and Provisioning Manager, the set of storage containers (storage systems, aggregates, volumes, or qtrees) that are assigned to a dataset and are designated either primary data (primary node), secondary data (secondary node), or tertiary data (tertiary node).

QSFP

The standard SAS cabling connector for all NetApp SAS systems. QSFP to QSFP SAS cables are used to daisy-chain SAS disk shelf ports and connect to the quad-port SAS host bus adapter (HBA) or onboard SAS ports. QSFP to mini-SAS cables are used to connect disk shelves to the dual-port mini-SAS HBA.

SAS stack

Also referred to as *stack*. A group of one or more SAS disk shelves connected (daisy-chained) together and connected to the controller through the first disk shelf in the stack and the last disk shelf in the stack (as needed). The maximum number of disk shelves in a stack of disk shelves and the number of disk shelf stacks supported in a configuration are dependent on the type of storage system.

shelf-to-shelf connection

In a SAS disk shelf environment, the cabling connection between disk shelves in a stack of more than one disk shelf. Each disk shelf is daisy-chained through its SAS ports and, if you are using the ACP capability, each disk shelf is also daisy-chained through its ACP ports. Sometimes called *daisy-chain* connection.

single-controller configuration

A storage system having one controller.

single path

A configuration in which a single-controller storage system has one way to connect to a disk drive. This configuration has multiple single points of failure and is not a preferred configuration.

single-path HA

A configuration in which each controller in the HA pair has one way to connect to the disk drive. This means that an IOM or cable failure requires a controller failover.

software-based disk ownership

An ownership scheme used by SAS disk drives to store ownership information on the disk drive rather than having it be determined by the topology of the storage system's physical connections. It provides increased flexibility and control over disk drive use than hardware-based disk ownership.

square and circle symbols

The SAS ports and ACP ports on the disk shelf IOMs are designated by square and circle symbols. All cabling is done in reference to connecting to a square port or a circle port.

SAS connectivity does not use the concept of In ports and Out ports.

storage system

The hardware device running Data ONTAP that receives data from and sends data to native disk shelves, storage arrays, or both. Storage systems include a controller component and an internal or external disk storage subsystem component. Storage systems are sometimes referred to as *filers*, *appliances*, *storage appliances*, V-Series systems, Data ONTAP systems, or *systems*.

Document update record

When updates are made to this document, they are logged for your reference.

Feature release date	Feature updates
September 2015	<ul style="list-style-type: none"><li data-bbox="646 453 1349 541">• Updated “About this task” sections in several procedures to include recommendations for cable minimum bend radius and use of Velcro ties for bundling cables.<li data-bbox="646 569 1360 722">• Updated the “Replacing shelf components” and “Hot-adding a SAS disk shelf” procedures to include the best practice for having the most current disk shelf, disk drive, and if applicable, ACP firmware on all disk shelves in the system before adding new hardware components.<li data-bbox="646 749 1370 869">• Updated the “Hot-removing disk shelves or stacks in systems running Data ONTAP 8.2.1 or later” procedure “Before you begin” section to include the prerequisite for reassigning epsilon on clustered Data ONTAP systems with more than two nodes.<li data-bbox="646 896 1370 989">• Updated the “Changing the disk shelf ID” procedure “About this task” section to state that, although Data ONTAP 8.3 made 99 available as a valid shelf ID, 99 cannot be used because of a bug.<li data-bbox="646 1016 1370 1073">• Updated the “Hot-swapping a disk drive or carrier” procedure to include a step for assigning disk ownership.

Feature release date	Feature updates
January 2015	<ul style="list-style-type: none"> • Updated the “What the disk shelf LEDs mean for DS4243, DS2246, and DS4246 disk shelves” section to add a note that because of a bug, in some versions of Data ONTAP, when a disk drive fails due to excessive link errors, adapter errors, or timeouts, the fault LED does not illuminate. • Updated the “Hot-swapping or replacing an IOM” procedure to include the requirement that your system must be running Data ONTAP 8.1.4 or later, Data ONTAP 8.2.1 or later, or Data ONTAP 8.3 or later to hot-swap an IOM. • Updated the “Changing the disk shelf ID” procedure note in Step 8 to state that if you decide to change the shelf ID after your storage system is running Data ONTAP, you must wait at least 70 seconds (instead of 30 seconds) before turning the power back on to complete the power cycle. • Modified the “Installing SAS disk shelves in a new HA pair or single-controller configuration” procedure to remove shelf power on and checking shelf ID steps, which are now part of the “Cabling disk shelves in a new HA pair or single-controller configuration” procedure in the <i>Universal SAS and ACP Cabling Guide</i>. The “Installing SAS disk shelves in a new HA pair or single-controller configuration” procedure was modified to coincide with the steps in the platform “Installation and Setup Instructions” that ship with new platforms. You are instructed to power on disk shelves and check IDs after cabling SAS and ACP connections rather than before.
Feature release date	Feature updates
December 2013	<ul style="list-style-type: none"> • Included the procedure for shelf hot-removal, which is supported on multipath HA and single-controller dual path 7-Mode and clustered Data ONTAP systems running Data ONTAP 8.2.1 or later. • Included the <code>acpadmin configure</code> command, which is used when enabling the ACP capability on systems running Data ONTAP 8.2.1 or later. The <code>options acp.enabled on</code> command is used to enable the ACP capability on systems running versions of Data ONTAP prior to 8.2.1.

Feature release date	Feature updates
September 2013	<ul style="list-style-type: none"> • Included information about the SAS optical cables in applicable installation procedures: “Installing SAS disk shelves in a new storage system” and “Hot-adding a disk shelf”. • Added new sections for replacing SAS cables (copper and optical) in multipath HA and single-controller systems. • Removed supported Data ONTAP release information and instead point to the <i>Hardware Universe</i>, which has the most current support information.
Feature release date	Feature updates
June 2012	<ul style="list-style-type: none"> • Initial release of the DS4486 disk shelf, which is supported on a minimum release of Data ONTAP 8.1.1. • Initial release of the DS4246 disk shelf, which is supported on the following Data ONTAP releases: <ul style="list-style-type: none"> ◦ Data ONTAP 7.3.6 or later 7.x release. For FAS2040 and FAS2050 systems, Data ONTAP 7.3.4 or later 7.x release. ◦ Data ONTAP 8.0.2P3 or later 8.x release. For FAS2040 systems, Data ONTAP 8.0.2 or later 8.x release. • Merged the <i>DS4243 Installation and Service Guide</i> and <i>DS2246 Installation and Service Guide</i> contents into this SAS shelf guide, which addresses all of the SAS disk shelves. <p style="margin-left: 40px;">Note: The past feature update records from the DS4243 and DS2246 guides are captured below.</p> • Updated the minimum supported Data ONTAP releases for the DS4243 and DS2246 disk shelves (to address fixed in Bug ID 509721 and 525950). The minimum supported Data ONTAP releases are the same for DS2246, DS4243, and DS4246 disk shelves.
DS2246 Feature release date	Feature updates
May 2011	<ul style="list-style-type: none"> • Removed support for the FAS2050 platform on Data ONTAP 8.x because it is not supported on any 8.x releases. • Updated the ACP firmware verification procedure to include steps for updating out-of-date ACP firmware.

DS2246 Feature release date	Feature updates
September 2010	<p>Initial release of the DS2246 disk shelf.</p> <p>For new storage system installations and add-on disk shelves to existing storage systems, the DS2246 disk shelf is supported on the following releases:</p> <ul style="list-style-type: none"> • Data ONTAP 7.x releases: Data ONTAP 7.3.3P2 or later, except FAS2040 and FAS2050 systems, 7.3.4, or later. • Data ONTAP 8.x releases: Data ONTAP 8.0P1 or later, except FAS2040 and FAS2050 systems, 8.0.1 or later.

DS4243 Feature release date	Feature updates
February 2011	<p>The procedure for “Verifying the disk drive, disk shelf, and ACP firmware versions” for hot-added disk shelves was corrected. Step 5 was updated and Step 6 was added.</p>
September 2010	<ul style="list-style-type: none"> • Removed support for the FAS2050 platform on Data ONTAP 8.x because it is not supported on any 8.x releases. • Updated the ACP firmware verification procedure to include steps for updating out-of-date ACP firmware. • Specified that DS4243 disk shelves that are part of new storage systems must be running Data ONTAP 7.3.3P2 or a later version of the 7.x release family, or Data ONTAP 8.0P1 or a later release in the 8.x release family. Hot-added disk shelves on existing storage systems require Data ONTAP 7.3.2 or a later version of the 7.x release family, or Data ONTAP 8.0 or a later release in the 8.x release family. • SAS and ACP cabling information and procedures moved to the <i>Universal SAS and ACP Cabling Guide</i>. • Cluster-Mode commands were included for applicable procedures. • Photos of the PSUs were updated; they now show the correct LED label on the back of the PSUs. • The PSU LED OK icon was corrected; it is now a check mark. • Specified the use of only IOM3 modules in DS4243 disk shelves. • The term <i>active/active</i> was updated to <i>HA pair</i> throughout. • The term <i>multipath</i> was updated to <i>multipath HA</i>.
September 2009	<p>Initial release of the DS4243 disk shelf, which is supported on a minimum release of Data ONTAP 7.3.2.</p>

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