

StorageWorks by Compaq

Enterprise Virtual Array Expansion Rack Addendum

This addendum only applies to the following documents:

Compaq StorageWorks Enterprise Virtual Array Drive Enclosure User Guide
EK-52DRV-UA-A01(August 2001)

Compaq StorageWorks Enterprise Virtual Array Drive Enclosure EMU User Guide
EK-52EMU-UA. A01(August 2001)

Compaq StorageWorks Enterprise Virtual Array HSV Controller User Guide
EK-E1HSV-UA. A01(August 2001)

Compaq StorageWorks Enterprise Virtual Array Rack User Guide
EK-E1RAK-UA. A01(August 2001)

Compaq StorageWorks Enterprise Virtual Array Initial Setup User Guide
EK-E1SET-UA. A01(August 2001)

Enterprise Virtual Array Expansion Racks

Two Expansion Racks are available for integration to and expansion of your existing Enterprise Virtual Array. Characteristics of the two available racks are:

- The 0C6D model can add a maximum of 2.6 TB (72 36-GB disks) or 5.2 TB (72 72.8-GB disks) of storage capacity to an existing Enterprise Virtual Array.
- The 0C12D model can add a maximum of 5.2 TB (144 36-GB disks) or 10.5 TB (144 72.8-GB disks) of storage capacity. Typically, this storage capacity is evenly divided between two Enterprise Storage Systems (2C12D).
- Expansion Racks require a 17.5 TB Snapshot license. You must upgrade the Snapshot licenses before using an Expansion Rack. The following license upgrades are available:
 - 1.6 TB to 17.5 TB
 - 3.1 TB to 17.5 TB
 - 6.2 TB to 17.5 TB
 - 12.5 TB to 17.5 TB

Enterprise Expansion Components

With the purchase of an Enterprise Expansion Rack, the following components may be included with your rack, depending on the configuration option that was purchased.

- One or more of the following Enterprise Virtual Array Expansion Racks:
 - 0C6D (50 Hz/60 Hz)
 - 0C12D (50 Hz/60 Hz)
- One or more M5214 drive enclosure kits
- One or more Expansion Panel kits
- Customer To Order (CTO) options for 2C6D

Configuration Options

The following Expansion Rack configuration options are available:

- 2C12D + 0C6D (up to 17.5 TB)
- 2 x 2C12D + 0C12D (up to 35 TB)
- 2C6D + 2D (or + 4D) (installed by a Compaq Authorized Service Provider or CTO) This upgrade consists of adding drive enclosures to a 2C6D Enterprise Virtual Array. This configuration can be built with a single controller pair and 6-, 8-, or 10-drive enclosures
- 0C6D + 6D (installed by a Compaq Authorized Service Provider)
- 2C6D + 6D (installed by a Compaq Authorized Service Provider)

NOTE: M5214 FC Drive enclosures are saleable options that allow 2C6D or 0C6D customers to expand their Enterprise configurations.

Expansion panels are included standard in 2C12D, 0C6D, and 0C12D models, but are made available as a kit (274313-B21) for customers to expand (with M5214 Drive enclosures) from 2C6D to 2C12D and from 0C6D to 0C12D.

Model 0C6D Features

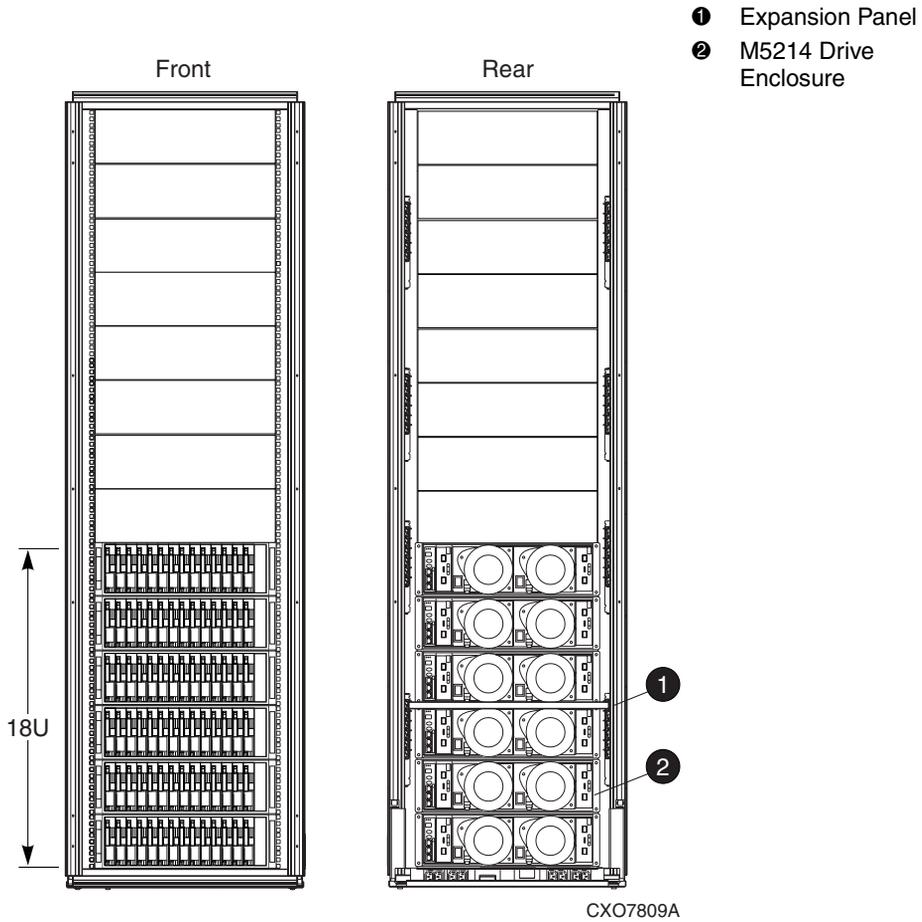
The following features are included with the Enterprise Model 0C6D Expansion Rack, shown in Figure 1–1.

- One 42U Modular Storage Rack
- Six 14-bay FC Enclosures
- Sixteen Internal FC Cables
- Six 2-port Enclosure Address Bus Junction Boxes
- Eight AC strips
- Two 0U PDUs
- One Expansion Panel
- Eight 5-meter FC rack-to-rack cables

NOTE: Disks must be ordered separately.

The 0C6D can add a maximum of 2.6 TB (72 36-GB disks) or 5.2 TB (72 72.8-GB disks) of storage capacity to an existing Enterprise Virtual Array. If the 0C6D is added to a 2C12D, the Enterprise Storage System storage capacity would increase to 8.6 TB (240 36-GB disks) or 17.5 TB (240 72.8-GB disks).

Figure 1–1: Enterprise Expansion Rack Model 0C6D



Model 0C12D Features

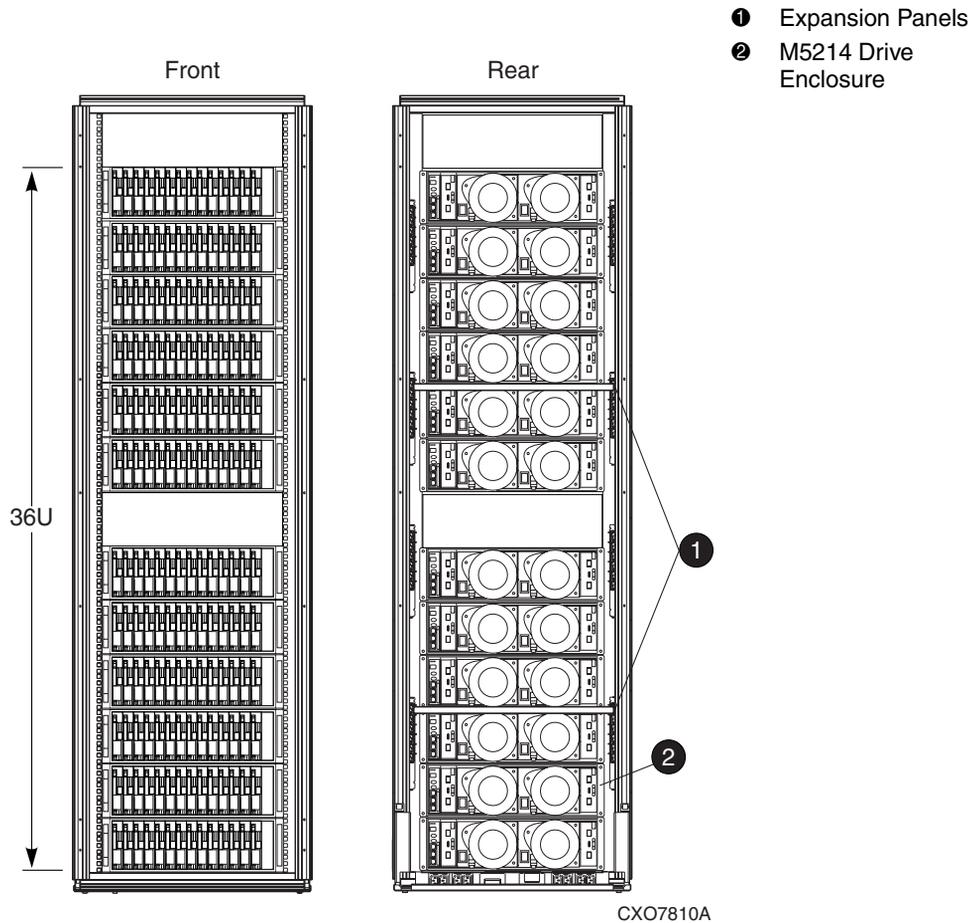
The following features are included with the Enterprise Model 0C12D Expansion Rack, as shown below in Figure 1–2.

- One 42U Modular Storage Rack
- Twelve 14-bay FC Enclosures
- Thirty-two Internal FC Cables
- Six 2-port Enclosure Address Bus Junction Boxes
- Eight AC strips
- Two 0U PDUs
- Two Expansion Panels
- Sixteen 5-meter FC rack-to-rack cables

NOTE: Disks must be ordered separately.

The 0C12D model can add a maximum of 5.2 TB (144 36-GB disks) or 10.5 TB (144 72.8-GB disks) of storage capacity. Typically, this storage capacity is evenly divided between two Enterprise Storage Systems (2C12D). If the 0C12D is added to two 2C12Ds, the storage capacity for each 2C12D would increase to 8.6 TB (240 36-GB disks) or 17.5 TB (240 72.8-GB disks).

Figure 1–2: Enterprise Expansion Rack Model 0C12D



Expansion Panel Features

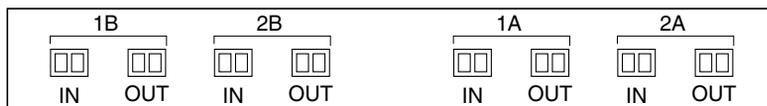
The Expansion Panel is a thin panel mounted on the rear of the rack. The Expansion Panel connects the Expansion Rack FC cables to the controller pair in the Master Rack of your existing Enterprise Storage System (via the Master Expansion Panel). The 0C6D rack contains one Expansion Panel, and the 0C12D rack contains two Expansion Panels. The Expansion Panel contains eight ports. Each port allows the controller pair to connect to the I/O ports on each drive enclosure.

The eight ports on the Expansion Panel correspond to the four Fibre Channel loops contained in a rack: 1A, 1B, 2A, 2B. Each loop has an In and an Out port. Fibre Channel cables returning from the drive enclosures enter the In port. Fibre Channel cables going to the drive enclosures enter the Out port.

NOTE: Contact your Compaq Authorized Service Provider for initial Expansion Panel connections.

Figure 1–3 shows the Expansion Panel.

Figure 1–3: Expansion Panel



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Enterprise Configuration 2C12D + 0C6D

Configuration 2C12D + 0C6D provides up to 17.5 TB of storage by expanding from 168 disks to 240 disks. The 0C6D rack connects to the 2C12D rack with enclosure address bus cables and Fibre Channel cables.

Enclosure Address Bus Configuration

Each rack contains enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. The 0C6D rack contains six enclosure address bus junction boxes; however, the M5214 drive enclosures use only three of the enclosure address bus junction boxes. The 2C12D rack contains seven enclosure address bus junction boxes. The M5214 drive enclosures and controller pair in the 2C12D rack use all seven enclosure address bus junction boxes.

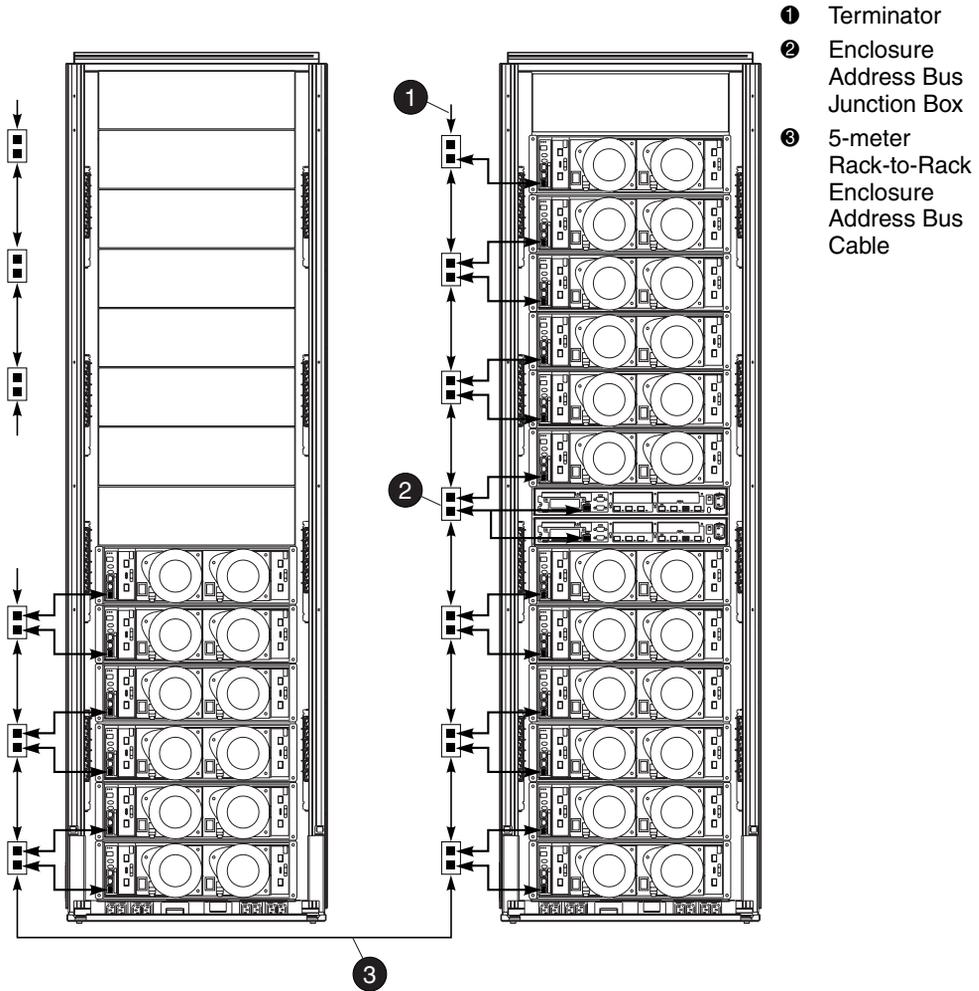
The two racks are connected by one enclosure address bus cable, which connects to the bottom enclosure address bus junction box on each rack. The enclosure address bus cable between the racks is polarized. The P1 end of the cable connects to the bottom enclosure address bus junction box on the 2C12D rack. The P2 end of the cable connects to the bottom enclosure address bus junction box on the 0C6D rack.

CAUTION: Make sure the P1 end of the enclosure address bus cable is plugged into the 2C12D rack and the P2 end of the enclosure address bus cable is plugged into the 0C6D rack. If the cable is connected to the racks incorrectly, you will not be able to access the drive enclosures or data.

NOTE: A Compaq Authorized Service Provider must remove the bottom terminator on the Master Rack in order to connect the two racks with an enclosure address bus cable. The service provider might have to remove the bottom enclosure address bus junction box or loosen the adjacent shelf rail to remove the bottom terminator.

Figure 1-4 shows the enclosure address bus cable configuration in the 2C12D + 0C6D Enterprise configuration.

Figure 1-4: Configuration 2C12D + 0C6D—Enclosure Address Bus Cables

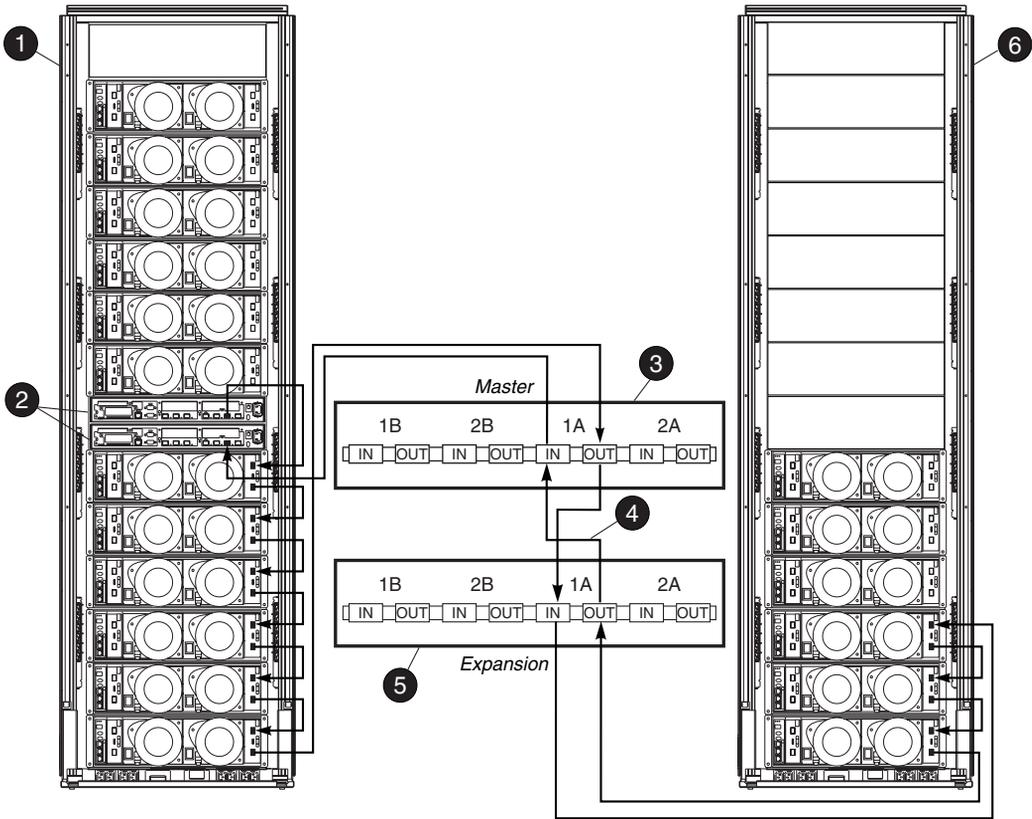


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Fibre Channel Loop Configurations

Each rack has four Fibre Channel loops. Fibre Channel Loop 1A is located on the lower right side of each rack (viewed from the rear). Loop 1A is one continuous loop that connects the M5214 drive enclosures in both racks to the controller pair in the Master Rack. Figure 1–5 shows Fibre Channel Loop 1A.

Figure 1–5: Configuration 2C12D + 0C6D—Fibre Channel Loop 1A

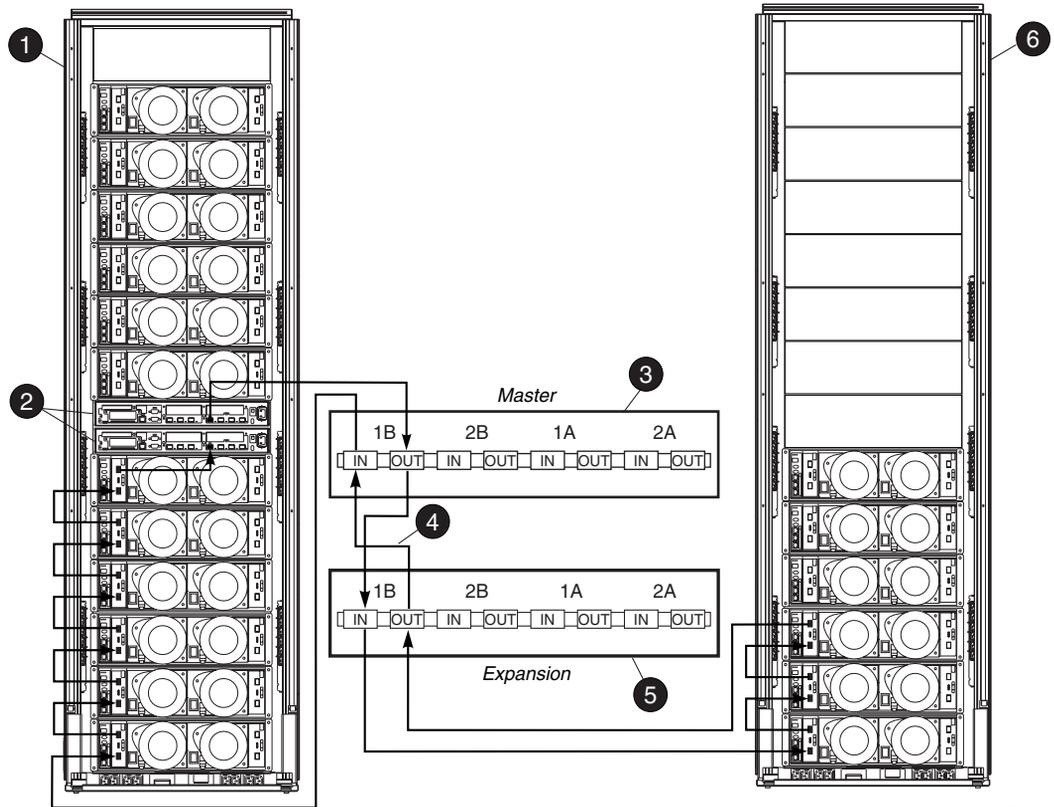


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- ❶ Master Rack
- ❷ Controller Pair
- ❸ Master Rack Expansion Panel
- ❹ 5-meter Rack-to-Rack Fibre Channel Cables
- ❺ Expansion Rack Expansion Panel
- ❻ Expansion Rack

Fibre Channel Loop 1B is located on the lower left side of each rack (viewed from the rear). Loop 1B is one continuous loop that connects the M5214 drive enclosures in both racks to the controller pair in the Master Rack. Figure 1–6 shows Fibre Channel Loop 1B.

Figure 1–6: Configuration 2C12D + 0C6D—Fibre Channel Loop 1B

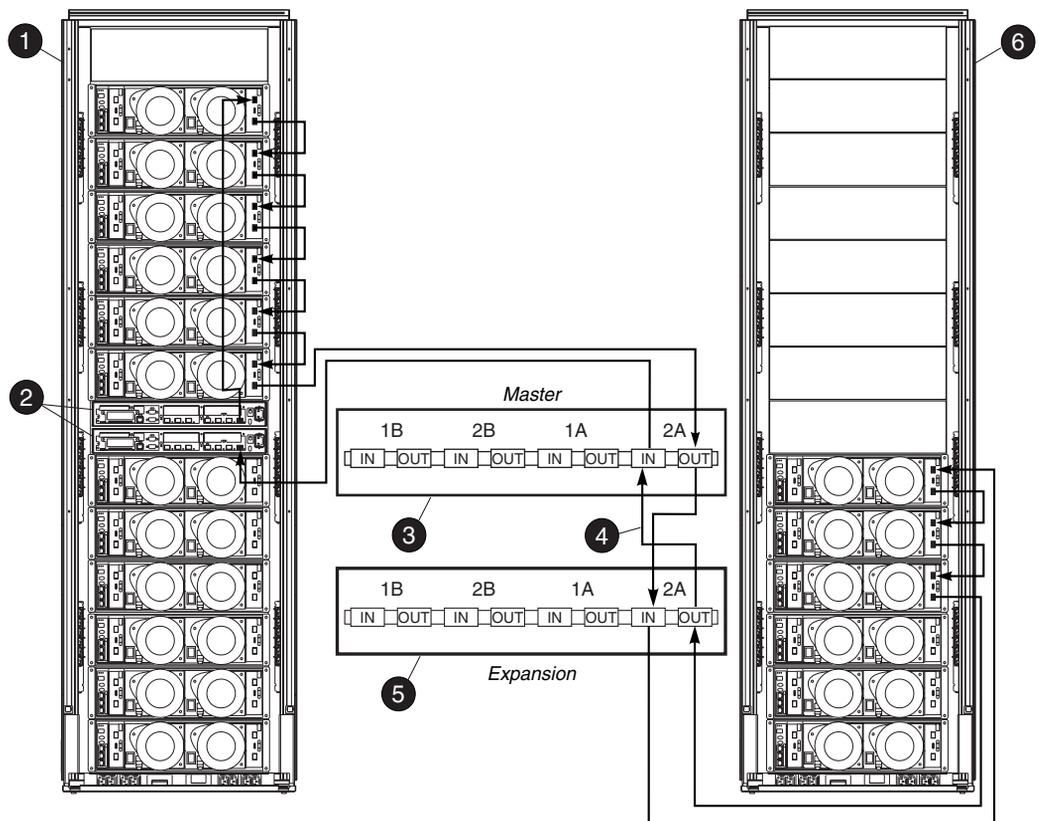


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- ❶ Master Rack
- ❷ Controller Pair
- ❸ Master Rack Expansion Panel
- ❹ 5-meter Rack-to-Rack Fibre Channel Cables
- ❺ Expansion Rack Expansion Panel
- ❻ Expansion Rack

Fibre Channel Loop 2A is located on the upper right side of each rack (viewed from the rear). Loop 2A is one continuous loop that connects the M5214 drive enclosures in both racks to the controller pair in the Master Rack. Figure 1–7 shows Fibre Channel Loop 2A.

Figure 1–7: Configuration 2C12D + 0C6D—Fibre Channel Loop 2A

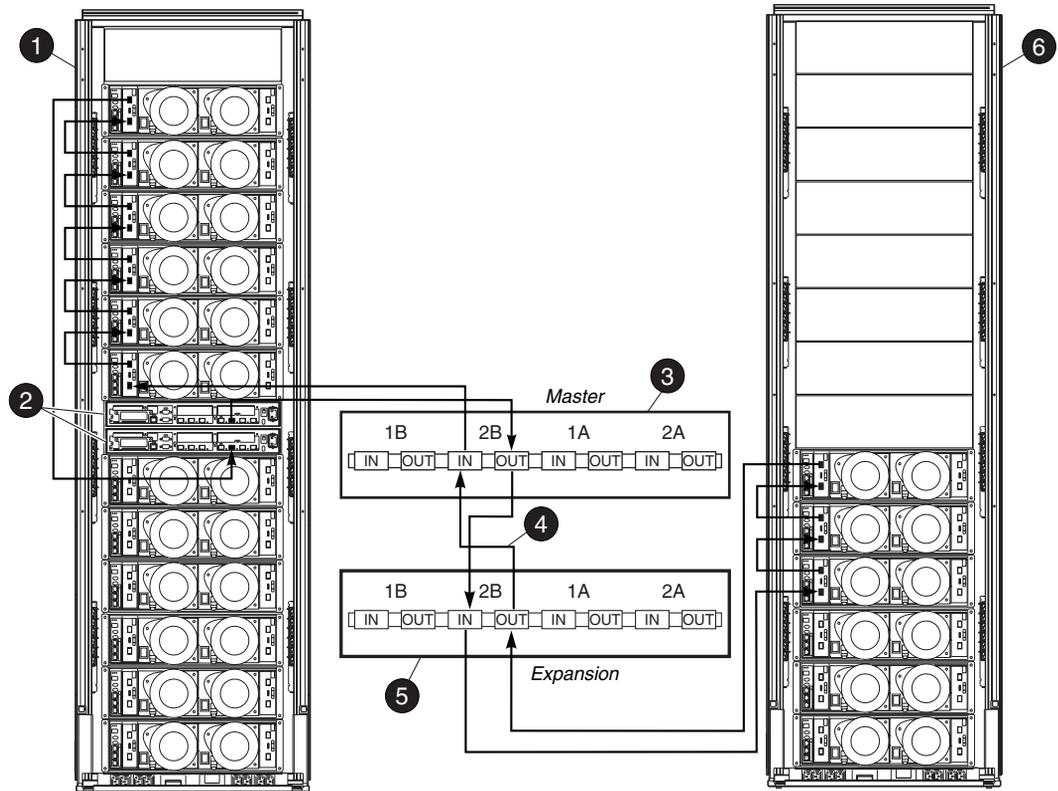


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- ❶ Master Rack
- ❷ Controller Pair
- ❸ Master Rack Expansion Panel
- ❹ 5-meter Rack-to-Rack Fibre Channel Cables
- ❺ Expansion Rack Expansion Panel
- ❻ Expansion Rack

Fibre Channel Loop 2B is located on the upper left side of each rack (viewed from the rear). Loop 2B is one continuous loop that connects the M5214 drive enclosures in both racks to the controller pair in the Master Rack. Figure 1–8 shows Fibre Channel Loop 2B.

Figure 1–8: Configuration 2C12D + 0C6D—Fibre Channel Loop 2B



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- ❶ Master Rack
- ❷ Controller Pair
- ❸ Master Rack Expansion Panel
- ❹ 5-meter Rack-to-Rack Fibre Channel Cables
- ❺ Expansion Rack Expansion Panel
- ❻ Expansion Rack

Enterprise Configuration 2 x 2C12D + 0C12D

Configuration 2 x 2C12D + 0C12D provides up to 35 TB of storage by expanding each unit to 240 disks each for a total of 480 disks. The two 2C12D Master Racks connect to the 0C12D Expansion Rack with enclosure address bus and Fibre Channel cables.

Enclosure Address Bus Configuration

Each rack contains enclosure address bus junction boxes at 6U increments in the left rear rail of the rack. The 0C12D rack contains six enclosure address bus junction boxes. The M5214 drive enclosures in the 0C12D rack use all six enclosure address bus junction boxes. The 2C12D rack contains seven enclosure address bus junction boxes. The M5214 drive enclosures and controller pair in the 2C12D rack use all seven enclosure address bus junction boxes.

The three racks are connected by two enclosure address bus cables. Each Master Rack is connected to the Expansion Rack by one enclosure address bus cable. One Master Rack runs an enclosure address bus cable to the bottom enclosure address bus junction box on the Expansion Rack; the other Master Rack runs an enclosure address bus cable to the fourth enclosure address bus junction box (from the bottom) on the Expansion Rack.

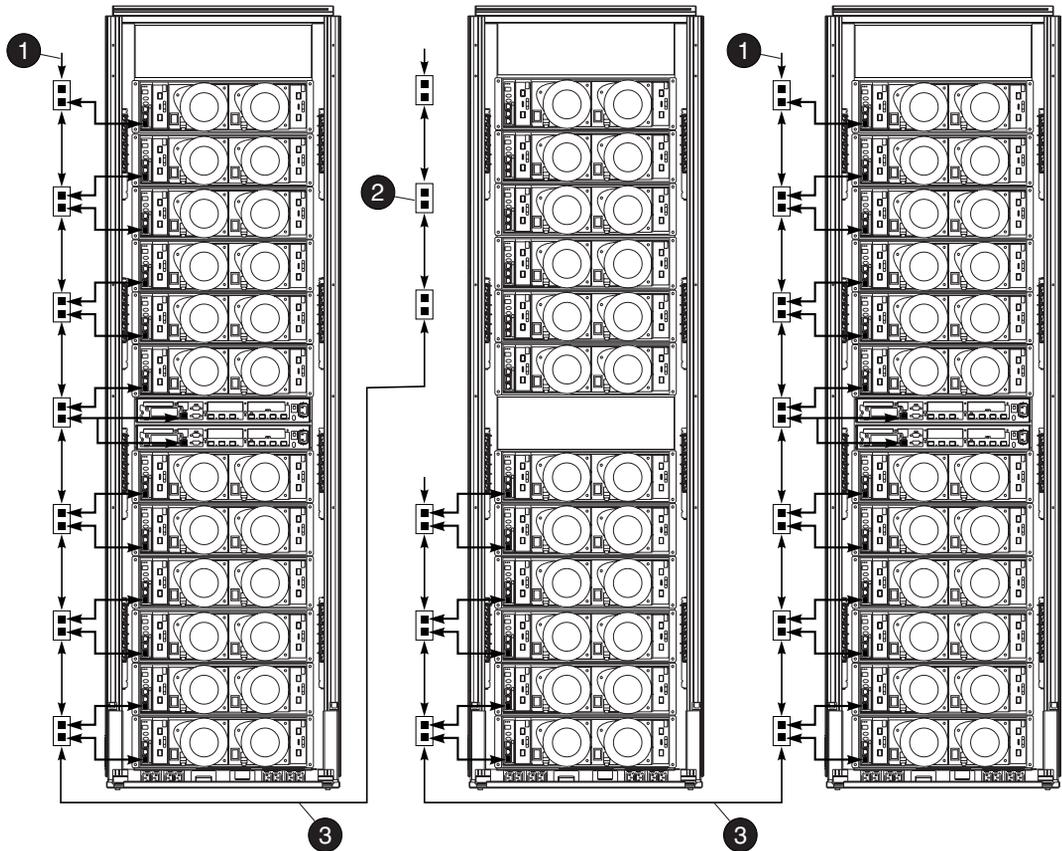
The enclosure address bus cables are polarized. The P1 end of the cable connects to the bottom enclosure address bus junction box on the 2C12D rack. The P2 end of the cable connects to the enclosure address bus junction box on the Expansion Rack.

CAUTION: Make sure the P1 end of the enclosure address bus cable is plugged into the 2C12D rack and the P2 end of the enclosure address bus cable is plugged into the Expansion Rack. If the cable is connected to the racks incorrectly, you will not be able to access the drive enclosures or data.

NOTE: A Compaq Authorized Service Provider must remove the bottom terminator on each Master Rack in order to connect the racks with the enclosure address bus cables. The service provider might have to remove the bottom enclosure address bus junction box or loosen the adjacent shelf rail to remove the bottom terminator.

Figure 1–9 shows the enclosure address bus cable configuration in the 2C12D + 0C12D Enterprise configuration.

Figure 1–9: Configuration 2 x 2C12D + 0C12D—Enclosure Address Bus Cables



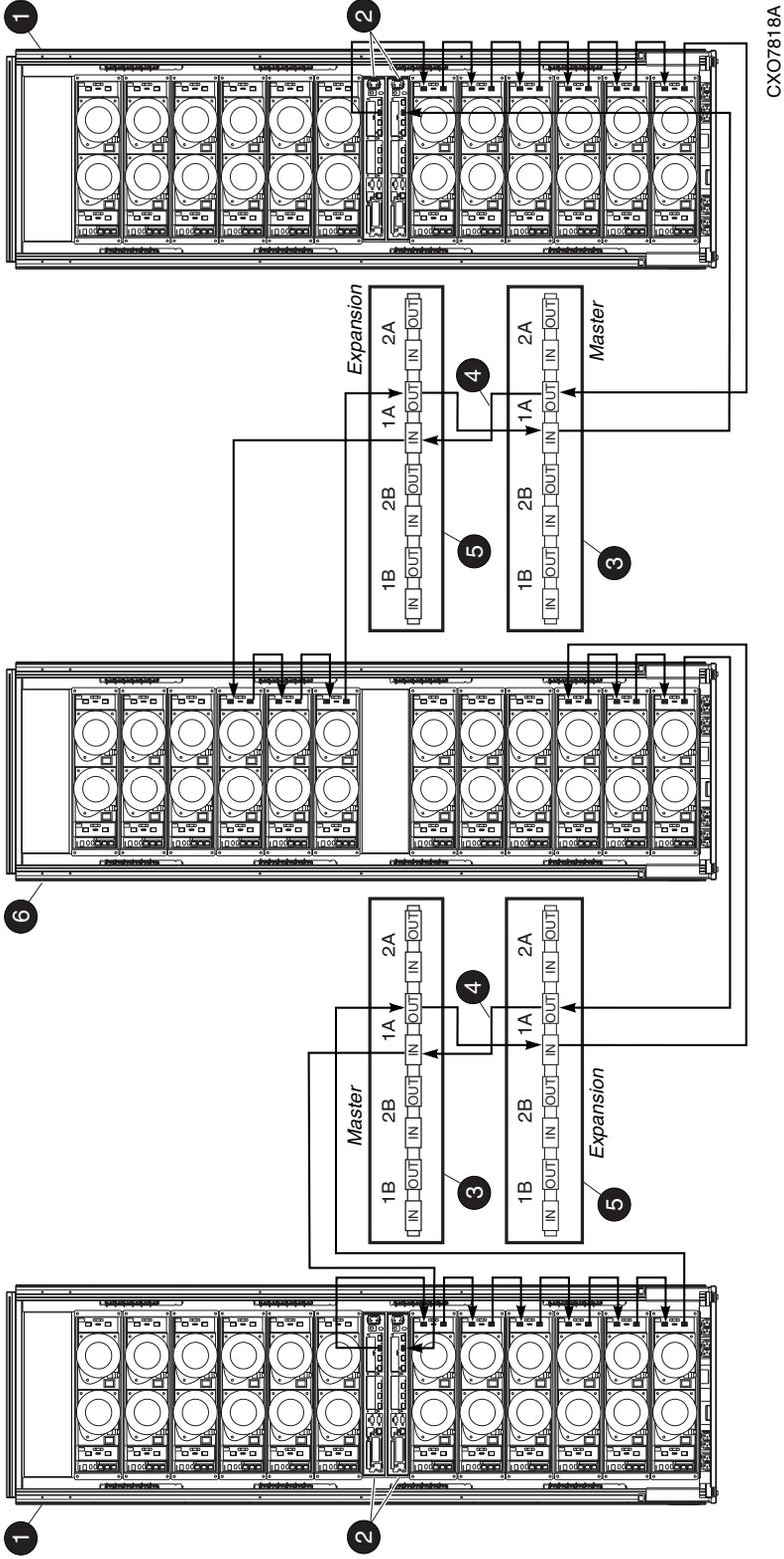
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- ❶ Terminator
- ❷ Enclosure Address Bus Junction Box
- ❸ 5-meter Rack-to-Rack Enclosure Address Bus Cable

Fibre Channel Loop Configurations

There are four Fibre Channel loops in each rack. Fibre Channel Loop 1A is located on the lower right side of each rack (viewed from the rear). The 2 x 2C12D + 0C12D configuration contains two Loop 1As. The 0C12D rack is divided into an upper and lower half. The upper half of the 0C12D rack connects to the Master Rack on the right, and the lower half of the 0C12D rack connects to the Master Rack on the left. Each Loop 1A connects the M5214 drive enclosures to a controller pair. Figure 1–10 shows Fibre Channel Loop 1A.

Figure 1–10: Configuration 2 x 2C12D + 0C12D—Fibre Channel Loop 1A

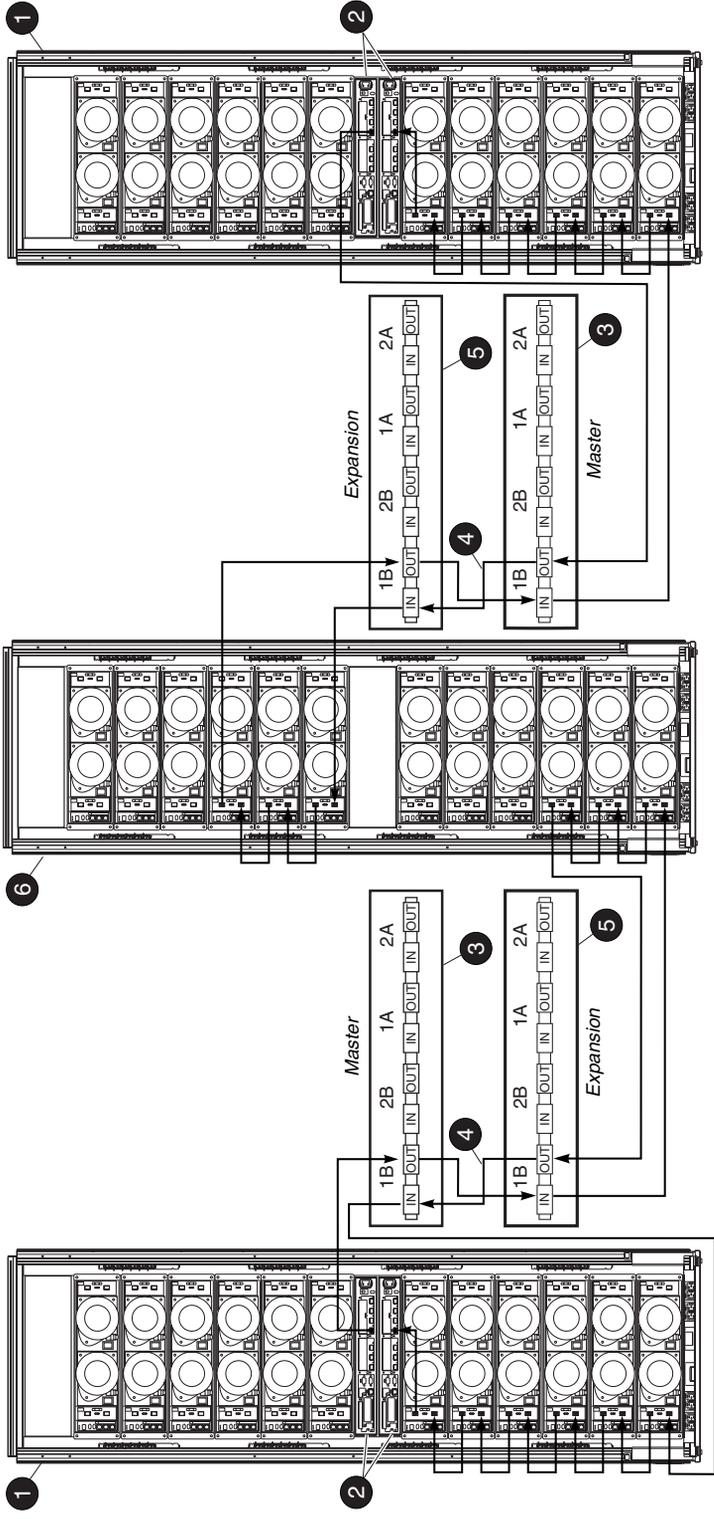


- 1 Master Rack
- 2 Controller Pair
- 3 Master Rack Expansion Panel
- 4 5-meter Rack-to-Rack Fibre Channel Cables
- 5 Expansion Rack Expansion Panel
- 6 Expansion Rack

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Fibre Channel Loop 1B is located on the lower left side of each rack (viewed from the rear). The 2 x 2C12D + 0C12D configuration contains two Loop 1Bs. The 0C12D rack is divided into an upper and lower half. The upper half of the 0C12D rack connects to the Master Rack on the right, and the lower half of the 0C12D rack connects to the Master Rack on the left. Each Loop 1B connects the M5214 drive enclosures to a controller pair. Figure 1–11 shows Fibre Channel Loop 1B.

Figure 1–11: Configuration 2 x 2C12D + 0C12D—Fibre Channel Loop 1B

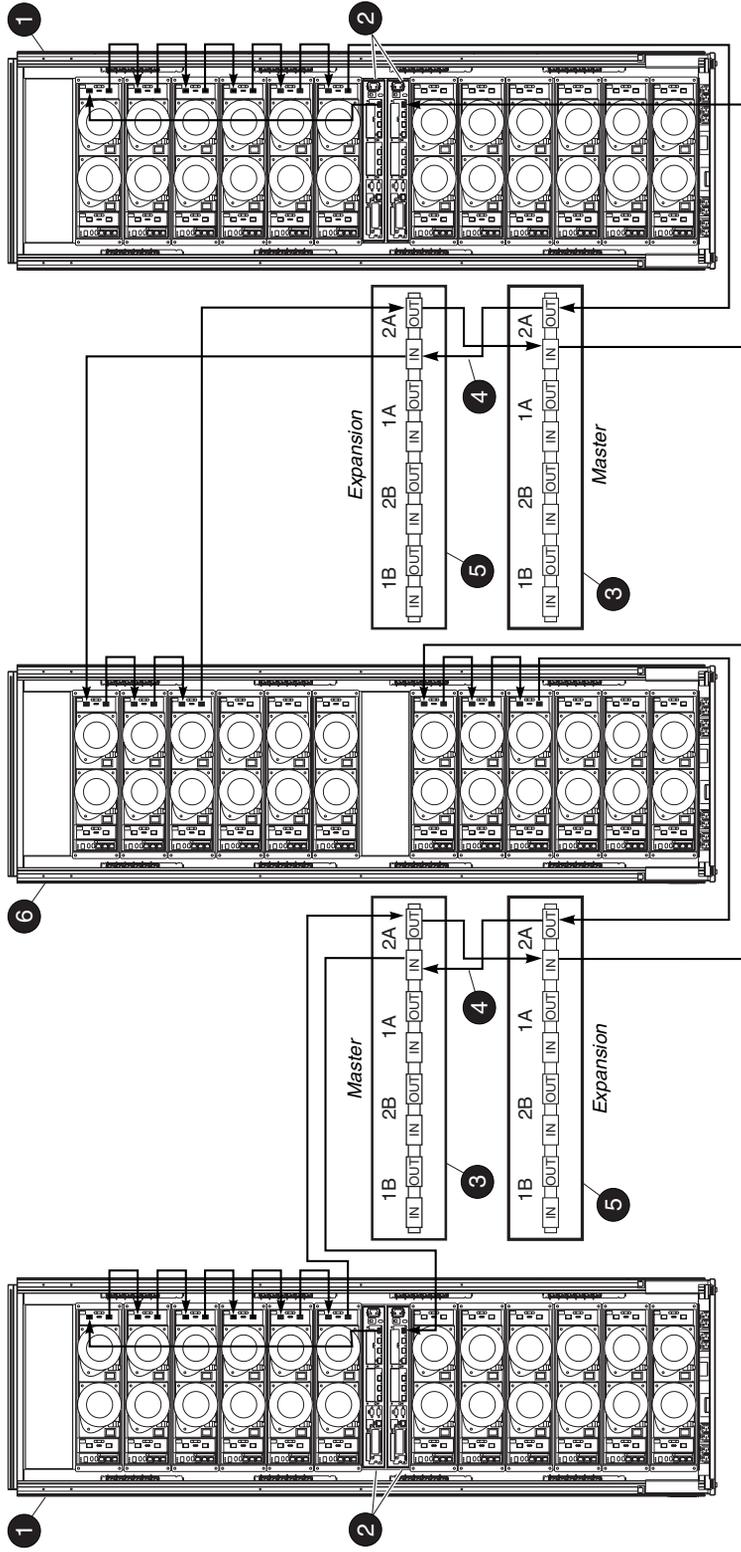


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- 1 Master Rack
- 2 Controller Pair
- 3 Master Rack Expansion Panel
- 4 5-meter Rack-to-Rack Fibre Channel Cables
- 5 Expansion Rack Expansion Panel
- 6 Expansion Rack

Fibre Channel Loop 2A is located on the upper right side of each rack (viewed from the rear). The 2 x 2C12D + 0C12D configuration contains two Loop 2As. The 0C12D rack is divided into an upper and lower half. The upper half of the 0C12D rack connects to the Master Rack on the right, and the lower half of the 0C12D rack connects to the Master Rack on the left. Each Loop 2A connects the M5214 drive enclosures to a controller pair. Figure 1–12 shows Fibre Channel Loop 2A.

Figure 1–12: Configuration 2 x 2C12D + 0C12D—Fibre Channel Loop 2A

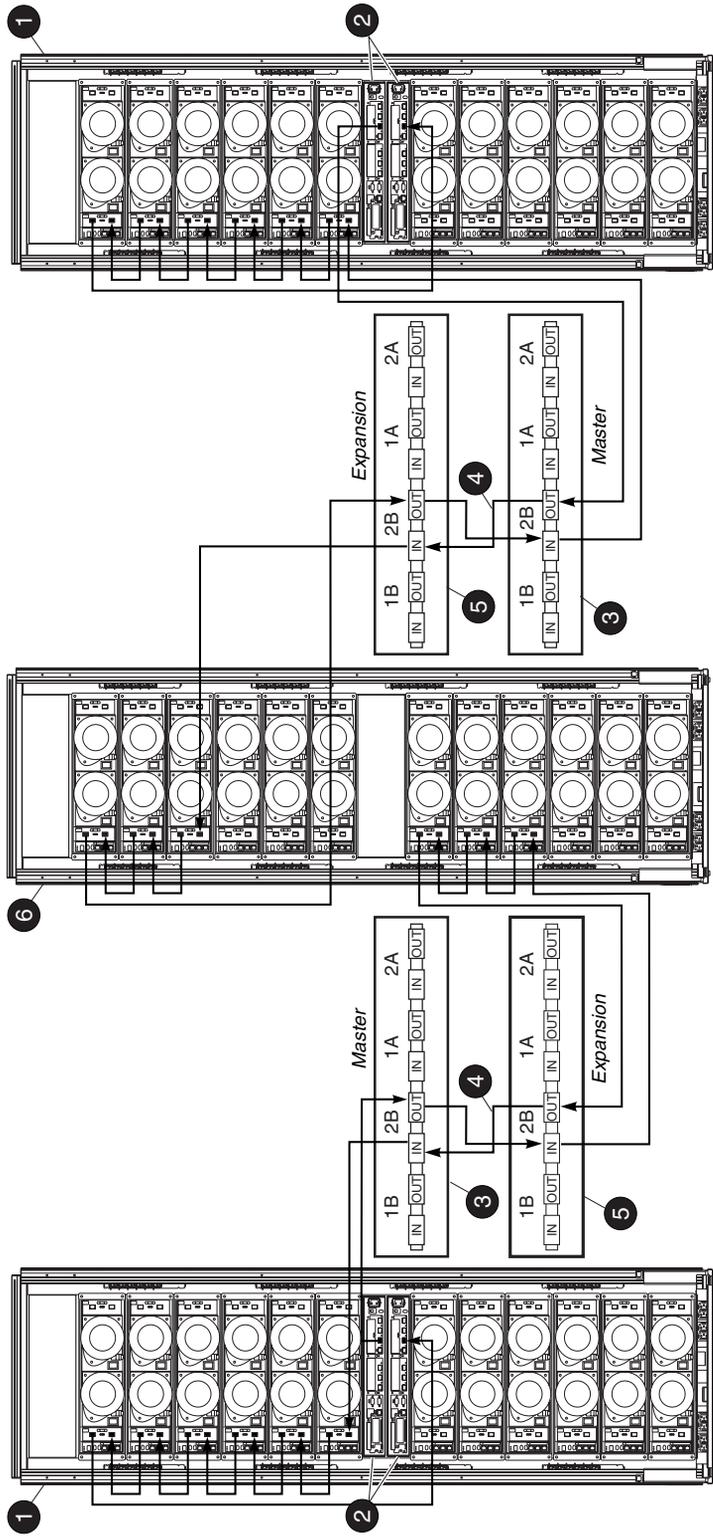


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- ❶ Master Rack
- ❷ Controller Pair
- ❸ Master Rack Expansion Panel
- ❹ 5-meter Rack-to-Rack Fibre Channel Cables
- ❺ Expansion Rack Expansion Panel
- ❻ Expansion Rack

Fibre Channel Loop 2B is located on the upper left side of each rack (viewed from the rear). The 2 x 2C12D + 0C12D configuration contains two Loop 2Bs. The 0C12D rack is divided into an upper and lower half. The upper half of the 0C12D rack connects to the Master Rack on the right, and the lower half of the 0C12D rack connects to the Master Rack on the left. Each Loop 2B connects the M5214 drive enclosures to a controller pair. Figure 1–13 shows Fibre Channel Loop 2B.

Figure 1–13: Configuration 2 x 2C12D + 0C12D—Fibre Channel Loop 2B



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- 1 Master Rack
- 2 Controller Pair
- 3 Master Rack Expansion Panel
- 4 5-meter Rack-to-Rack Fibre Channel Cables
- 5 Expansion Rack Expansion Panel
- 6 Expansion Rack

Expanding a Rack

A Compaq Authorized Service Provider must expand the 2C6D and 0C6D racks by adding M5214 drive enclosures, Expansion Panels, Fibre Channel cables, and enclosure address bus cables to the existing racks. In general, the M5214 drive enclosures are added in pairs.

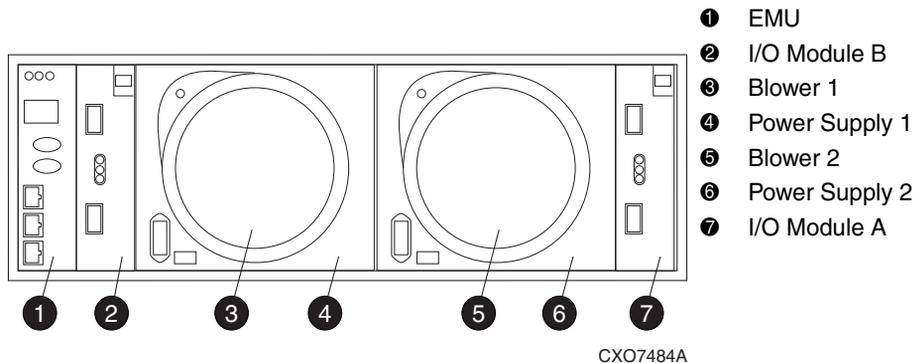
The 2C6D rack can be expanded to the following:

- 2C6D + 2D (expands the 2C6D rack to 112 disks)
- 2C6D + 4D (expands the 2C6D rack to 140 disks)
- 2C6D + 6D (expands the 2C6D rack to 168 disks)

The 0C6D rack can be expanded to the 0C12D rack.

Figure 1-14 shows the M5214 drive enclosure.

Figure 1–14: M5214 Drive Enclosure—Rear View



Adding Drive Enclosures to a Rack

A Compaq Authorized Service Provider can add drive enclosures to a rack while the Enterprise is on or off. Compaq highly recommends that the Enterprise is turned off, while adding drive enclosures to a rack. If the Compaq Authorized Service Provider would like to add a drive enclosure to the rack with the power on, the service provider should take care to disconnect and connect one Fibre Channel loop at a time.

The following steps outline the process for adding drive enclosures to a rack:

IMPORTANT: A Compaq Authorized Service Provider must add the drive enclosures to the rack. Do not attempt to do this without first seeking guidance and assistance from a Compaq Authorized Service Provider.

1. Install the shelf rails. Use the opening directly above the top-most drive enclosure in the rack.
2. Place the M5214 drive enclosures on the rails.

NOTE: The 2C6D rack usually stacks three drive enclosures on the bottom of the rack and three drive enclosures directly above the controller pair. Alternate between the lower and upper portions of the rack as you add drive enclosures to the rack.

Repeat Steps 1 and 2 for each M5214 drive enclosure.

3. Connect the EMU on each M5214 drive enclosure to the enclosure address bus junction box. (It may be necessary to remove the terminator from the enclosure address bus junction box first.)
4. Connect each M5214 drive enclosure to the appropriate power outlets.
5. Add the Expansion Panels to the rack.

For the 0C6D rack, add one Expansion Panel.

For the 2C6D rack, add two Expansion Panels.

6. Connect the FC cables from the controller pair to the Expansion Panel (if necessary).

CAUTION: Because this procedure involves breaking Fibre Channel cable loops, Compaq highly recommends that new drive enclosures be connected to the loops while the power is off.

7. Reconfigure the cables on Loop A to include the new M5214 drive enclosures.

NOTE: For the 0C12D rack, refer to Figure 1–10, Figure 1–11, Figure 1–12, and Figure 1–13 for the FC cabling configuration. For 2C8D, 2D10D, and 2C12D rack expansions refer to Figure 1–5, Figure 1–6, Figure 1–7, and Figure 1–8 for the related FC cabling configuration.

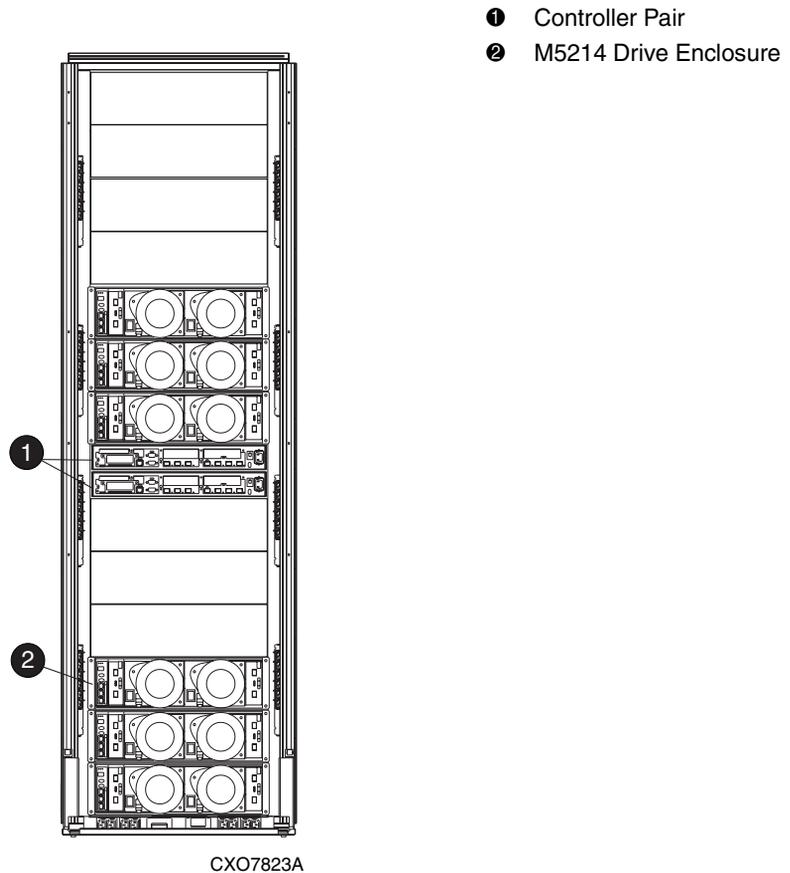
- a. Disconnect the host-to-enclosure FC cable from I/O port 1 (Loop A) on the top drive enclosure in the original stack.
- b. Connect an enclosure-to-enclosure FC cable from I/O port 1 (Loop A) of the lower enclosure to the I/O port 2 (Loop A) of the enclosure directly above it.
- c. Connect the host-to-enclosure FC cable to the I/O port 1 (Loop A) of the top drive enclosure.
- d. Verify that the HSV Element Manager recognizes the new drive enclosures.

8. Reconfigure the cables on Loop B to include the new M5214 drive enclosures.
 - a. Disconnect the host-to-enclosure FC cable from I/O port 1 (Loop B) on the top drive enclosure in the original stack.
 - b. Connect an enclosure-to-enclosure FC cable from I/O port 1 (Loop B) of the lower enclosure to the I/O port 2 (Loop B) of the enclosure directly above it.
 - c. Connect the host-to-enclosure FC cable to the I/O port 1 (Loop B) of the top drive enclosure.
 - d. Verify that the HSV Element Manager recognizes the new drive enclosures.

Enterprise Configuration 2C6D

Configuration 2C6D provides up to six drive enclosures (84 disks). This configuration is shown in Figure 1–15.

Figure 1–15: Configuration 2C6D



Enterprise Expansion Option: Configuration 2C6D + 6D

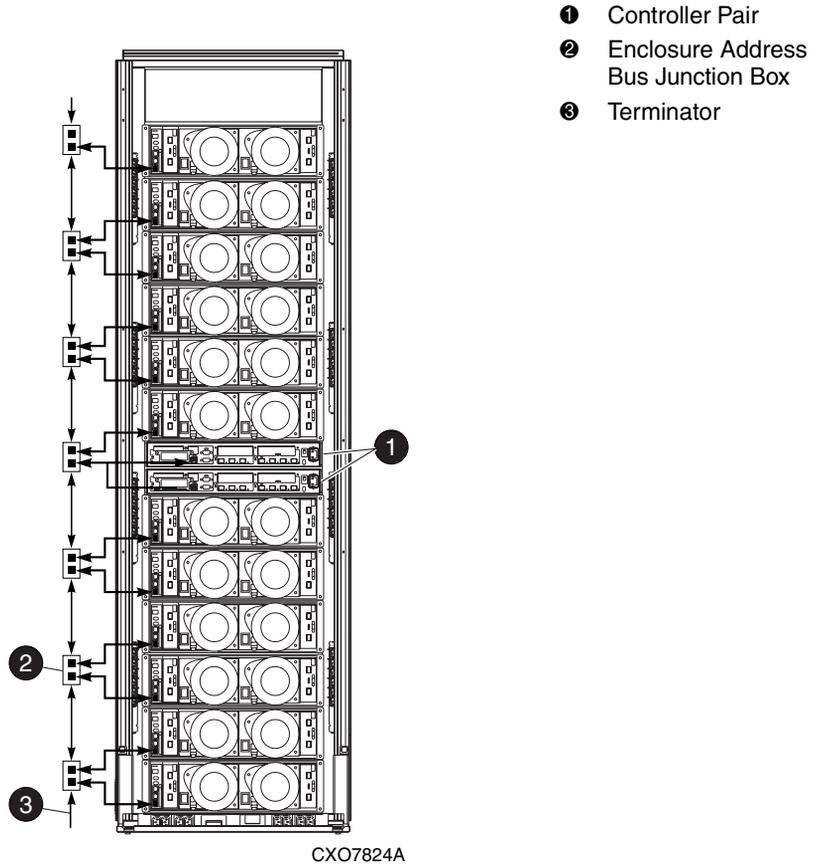
Configuration 2C6D + 6D provides up to twelve drive enclosures (168 disks).

IMPORTANT: This configuration is only available with assistance from a Compaq Authorized Service Provider.

Enclosure Address Bus Configuration

Each M5214 drive enclosure should be connected to an enclosure address bus junction box. The M5214 drive enclosures connect to each enclosure address bus junction box in pairs. The controller pair connects to the enclosure address bus junction box with a Y cable. Figure 1–16 shows the enclosure address bus cable configuration for the 2C6D + 6D configuration.

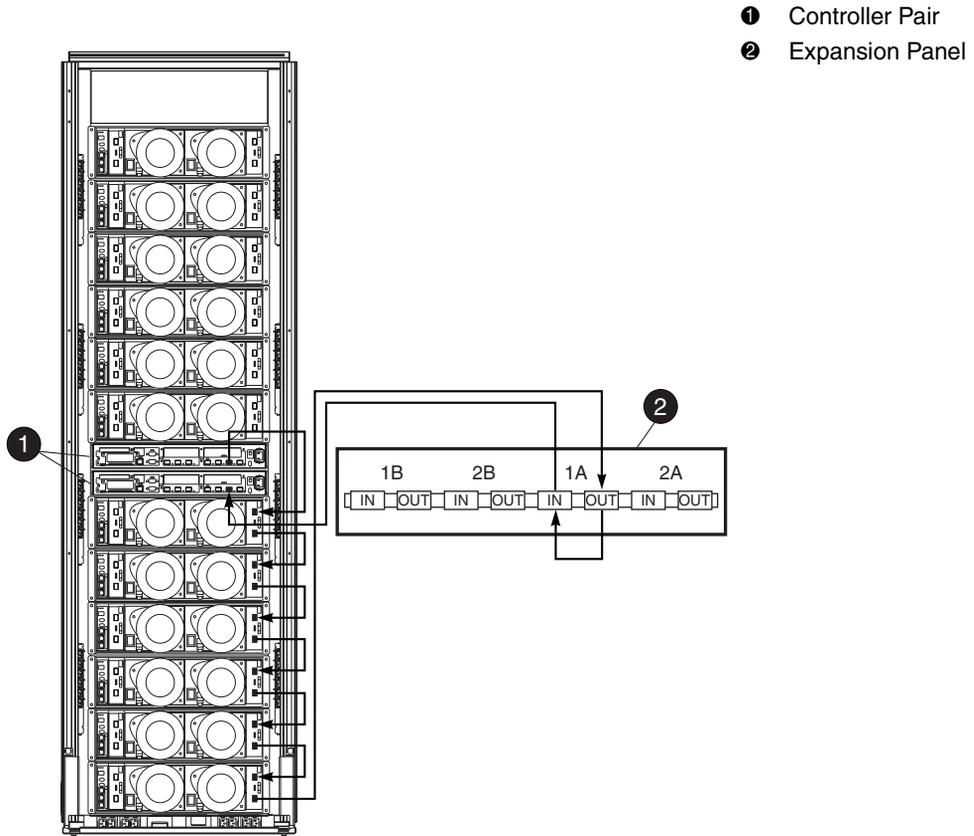
Figure 1–16: Expansion Option: Configuration 2C6D + 6D —Enclosure Address Bus Cable Configuration



Fibre Channel Loop Configurations

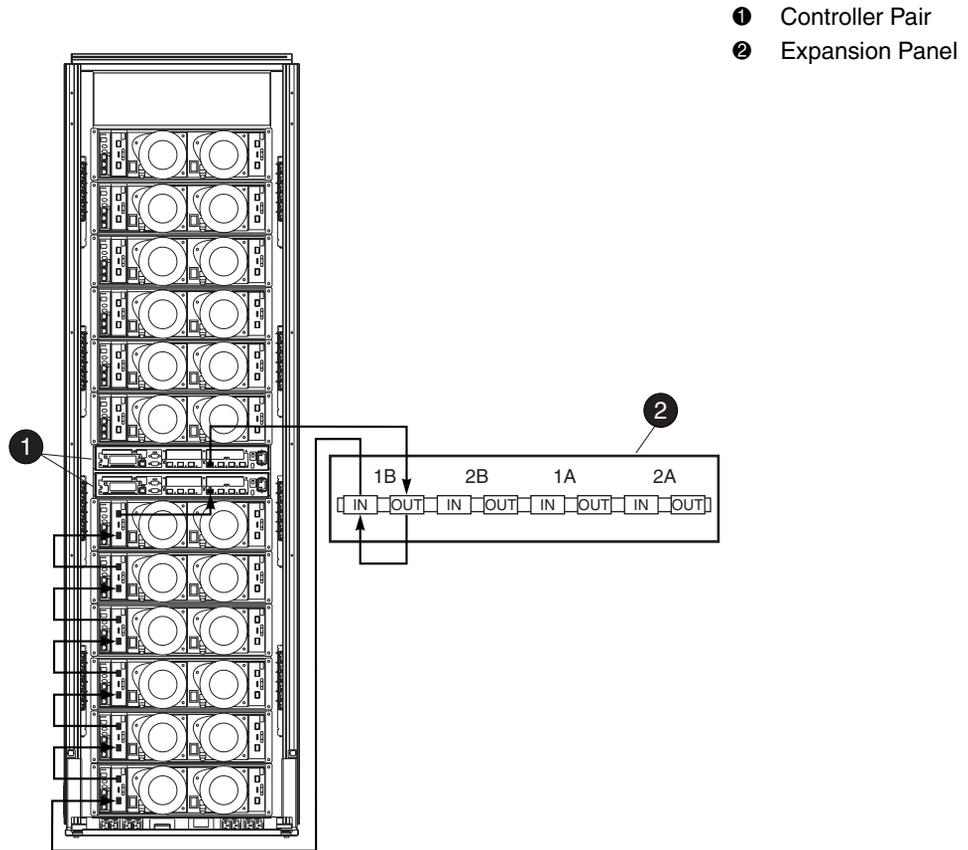
There are four Fibre Channel loops in a rack. Fibre Channel Loop 1A is located on the lower right side of the rack (viewed from the rear). Loop 1A is one continuous loop that connects the M5214 drive enclosures to the controller pair. Figure 1–17 shows Fibre Channel Loop 1A.

Figure 1–17: Expansion Option: Configuration 2C6D + 6D —Fibre Channel Loop 1A



Fibre Channel Loop 1B is located on the lower left side of the rack (viewed from the rear). Loop 1B is one continuous loop that connects the M5214 drive enclosures to the controller pair. Figure 1–18 shows Fibre Channel Loop 1B.

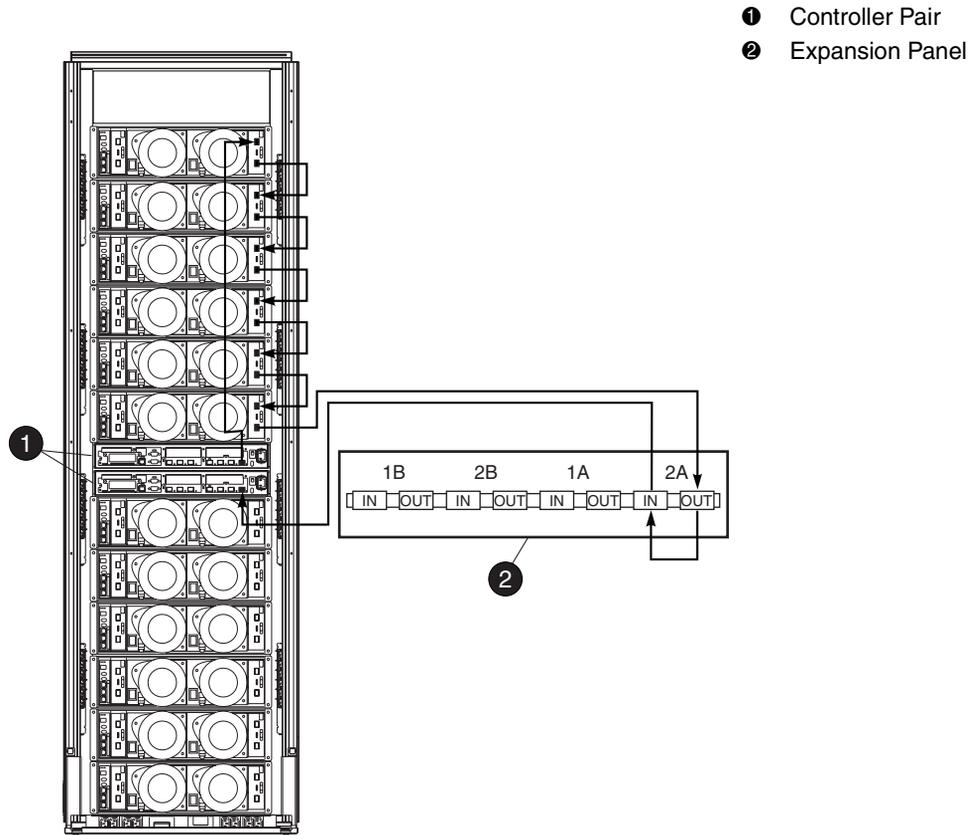
Figure 1–18: Expansion Option: Configuration 2C6D + 6D —Fibre Channel Loop 1B



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Fibre Channel Loop 2A is located on the upper right side of the rack (viewed from the rear). Loop 2A is one continuous loop that connects the M5214 drive enclosures to the controller pair. Figure 1–19 shows Fibre Channel Loop 2A.

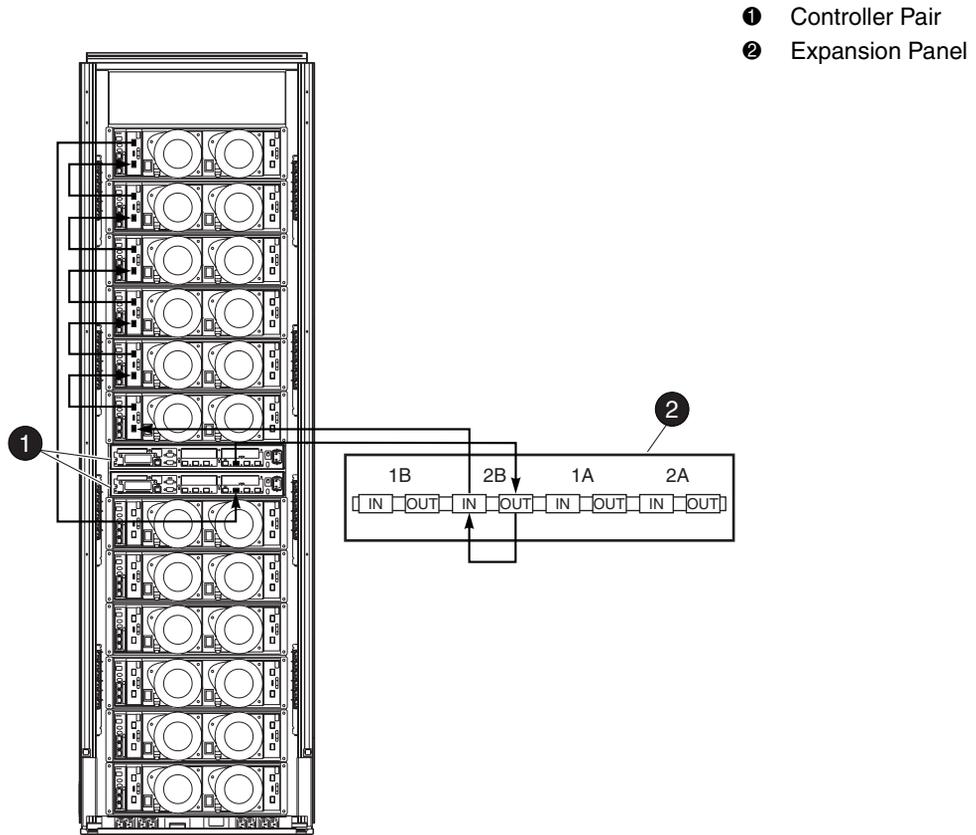
Figure 1–19: Expansion Option: Configuration 2C6D + 6D —Fibre Channel Loop 2A



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Fibre Channel Loop 2B is located on the upper left side of the rack (viewed from the rear). Loop 2B is one continuous loop that connects the M5214 drive enclosures to the controller pair. Figure 1–20 shows Fibre Channel Loop 2B.

Figure 1–20: Expansion Option: Configuration 2C6D + 6D —Fibre Channel Loop 2B



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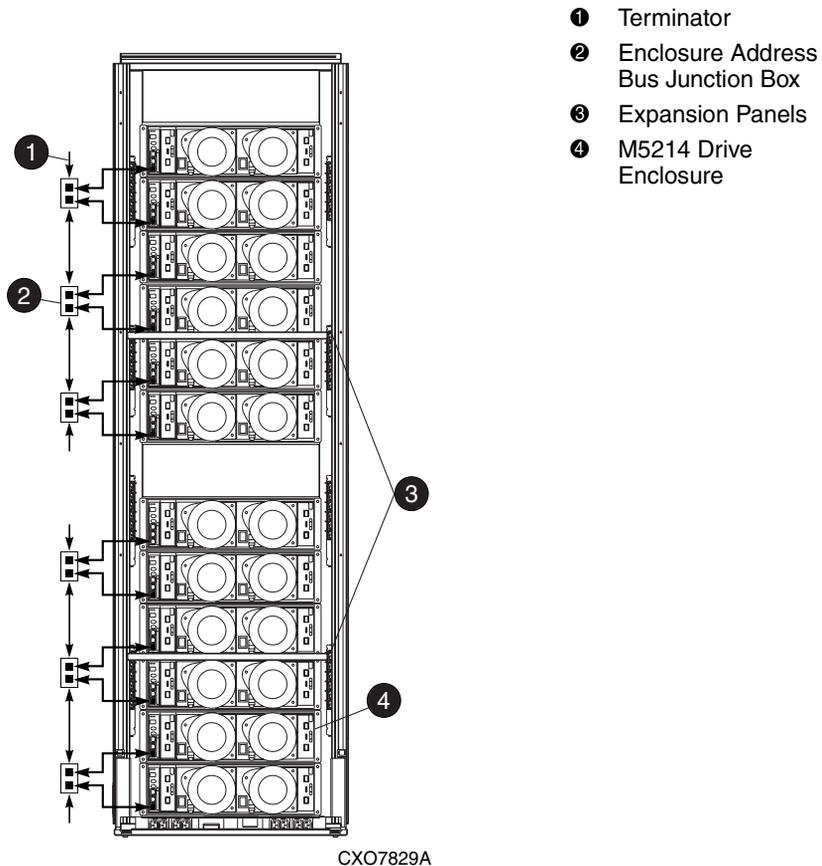
Enterprise Expansion Option: Configuration 0C6D to 0C12D

Configuration 0C6D to 0C12D allows each controller pair to support 240 disks.

Enclosure Address Bus Configuration

Each M5214 drive enclosure should be connected to an enclosure address bus junction box. The M5214 drive enclosures connect to each enclosure address bus junction box in pairs. Figure 1–21 shows the enclosure address bus cable configuration for the 0C6D + 6D configuration.

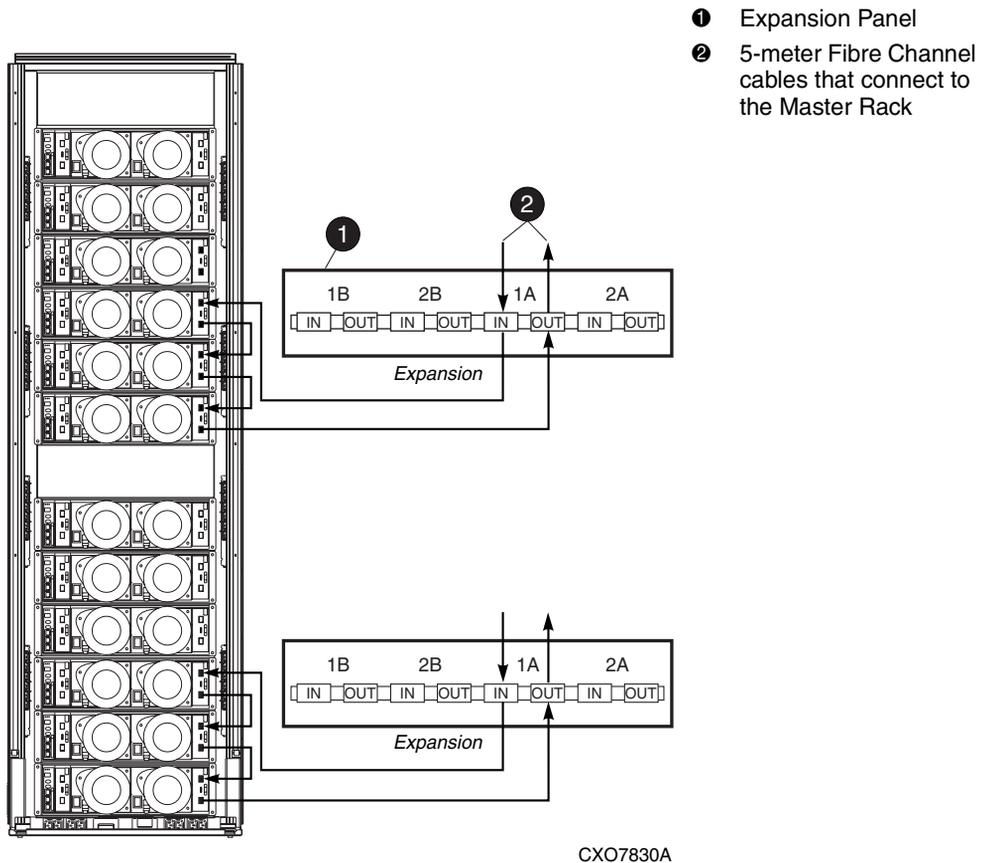
Figure 1–21: Expansion Option: Configuration 0C6D + 6D — Enclosure Address Bus Cable Configuration



Fibre Channel Loop Configurations

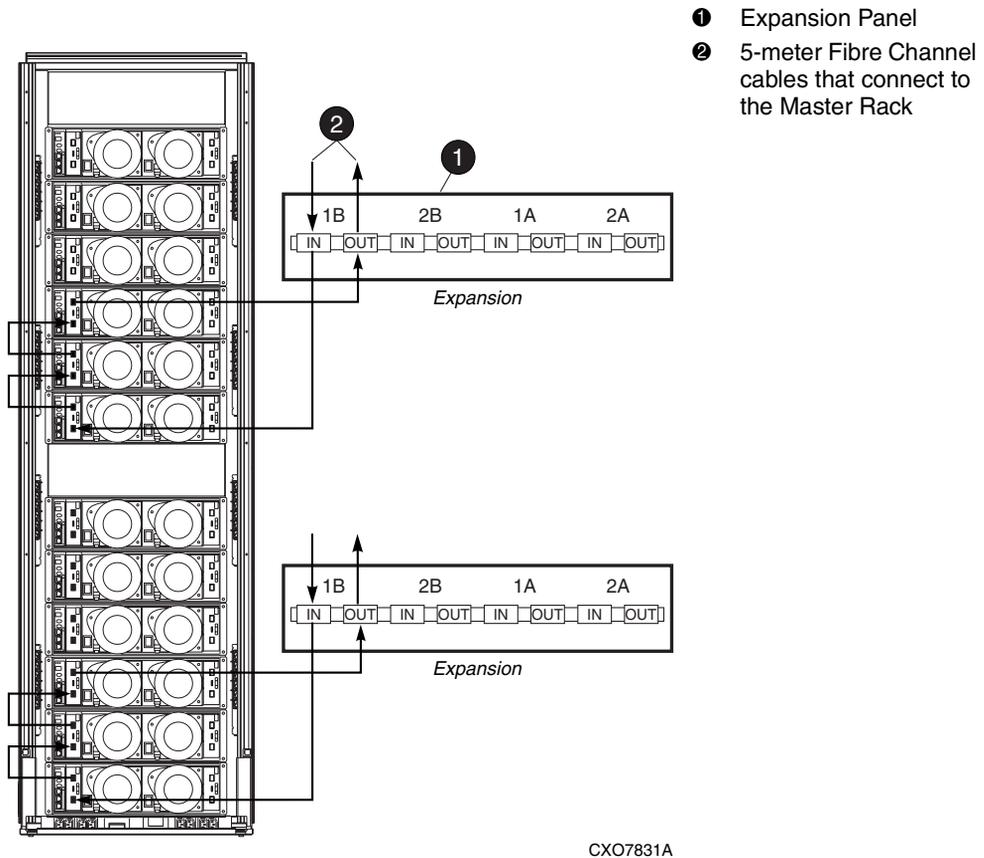
There are eight Fibre Channel loops in the 0C6D + 6D rack. The 0C6D + 6D configuration contains two Loop 1As. The Loop 1As are located on the lower right side and middle-right side of the rack (viewed from the rear). Each Loop 1A connects the M5214 drive enclosures to the upper and lower Expansion Panel, respectively. Figure 1–22 shows Fibre Channel Loop 1A.

Figure 1–22: Expansion Option: Configuration 0C6D + 6D — Fibre Channel Loop 1A



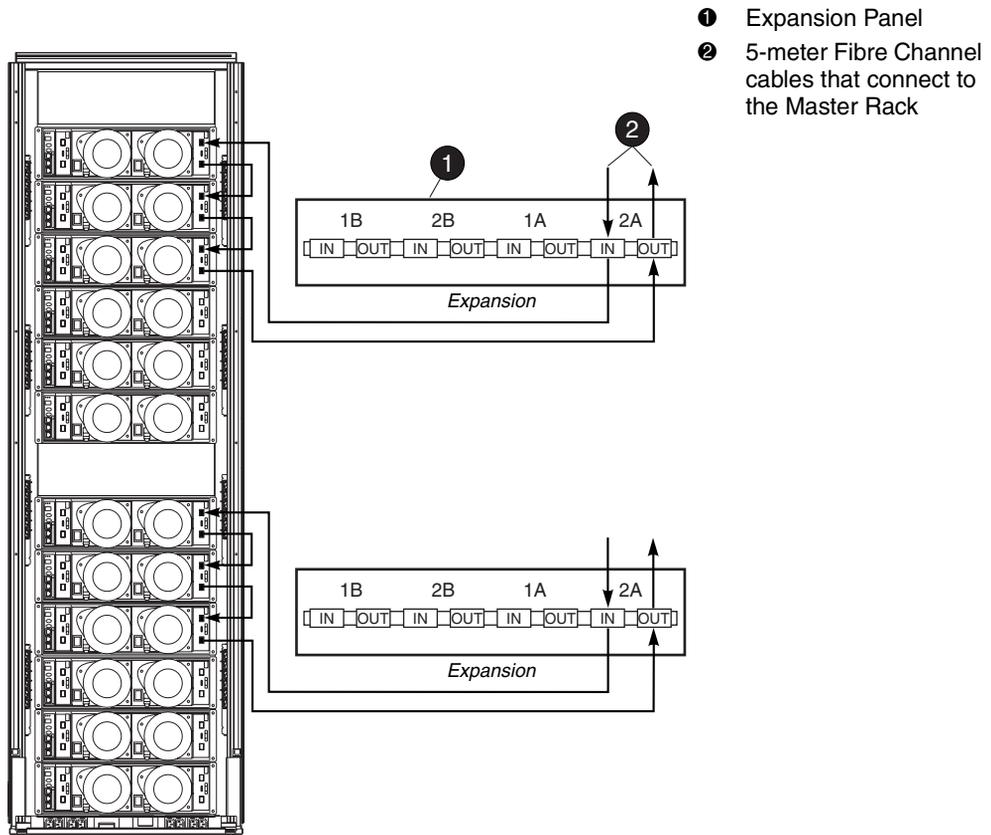
The 0C6D + 6D configuration contains two Loop 1Bs. The Loop 1Bs are located on the lower left side and middle-left side of the rack (viewed from the rear). Each Loop 1B connects the M5214 drive enclosures to the upper and lower Expansion Panel, respectively. Figure 1–23 shows Fibre Channel Loop 1B.

Figure 1–23: Expansion Option: Configuration 0C6D + 6D — Fibre Channel Loop 1B



The 0C6D + 6D configuration contains two Loop 2As. The Loop 2As are located on the upper right side and middle-right side of the rack (viewed from the rear). Each Loop 2A connects the M5214 drive enclosures to the upper and lower Expansion Panel, respectively. Figure 1–24 shows Fibre Channel Loop 2A.

Figure 1–24: Expansion Option: Configuration 0C6D + 6D — Fibre Channel Loop 2A



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The 0C6D + 6D configuration contains two Loop 2Bs. The Loop 2Bs are located on the upper left side and middle-left side of the rack (viewed from the rear). Each Loop 2B connects the M5214 drive enclosures to the upper and lower Expansion Panel, respectively. Figure 1–25 shows Fibre Channel Loop 2B.

Figure 1–25: Expansion Option: Configuration 0C6D + 6D — Fibre Channel Loop 2B

