

# IBM TotalStorage DS4500 Fibre Channel Storage Subsystem Cabling Guide



## Installation overview

Table 1 summarizes the steps required to correctly install, cable, and power on your IBM® TotalStorage® DS4500 Storage Subsystem. Unless otherwise stated, all the following tasks are detailed in the sections referenced in the *IBM TotalStorage DS4500 Installation, User's, and Maintenance Guide*. Review the multilingual *IBM Safety Information* document and read all safety information in the *DS4500 Installation, User's, and Maintenance Guide* before you begin the installation.

**Attention:** Before powering on the DS4500 Storage Subsystem, each attached storage expansion enclosure must be populated with at least two drives. If at least two drives are not installed in each attached storage expansion enclosure, when you power on the DS4500 and its attached storage expansion enclosure(s), your standard storage partition key might be lost and must be regenerated using instructions on the IBM DS4000™ Solutions and Premium Features Web site:

<https://www-912.ibm.com/PremiumFeatures/>

In addition, the resulting insufficient load to the enclosure power supplies might cause them to intermittently appear as failed, falsely indicating the power supplies are bad. All drives in the connected storage expansion enclosure(s) must contain no prior configuration data.

Table 1. Installation Tasks

	Task	Detailed Description
1	Review the DS4500 installation recommendations and requirements.	Chapter 2, "Handling static-sensitive devices"  "Preparing for installation"
2	Fold down and open the sides of the shipping box. Without removing the DS4500 from box, you can remove the DS4500 rack mounting rails and hardware from the box. Install the support rails in the rack cabinet.	Chapter 2, "Installing the support rails"
3	Before removing the DS4500 from the shipping box, remove the components to lighten the unit.	Chapter 2, "Removing the CRUs"
4	Record the serial number, machine type, model number, and RAID controller MAC addresses for your DS4500.	Appendix A, "Records,"
5	Install and secure the DS4500 chassis in the rack cabinet.	Chapter 2, "Installing the DS4500 into a rack on the support rails"
6	Replace the components in the installed DS4500 chassis.	Chapter 2, "Replacing the components"
7	Install in the rack cabinet the DS4000 storage expansion enclosures that you plan to cable to the DS4500.	<i>Installation, User's, and Maintenance Guide</i> for your DS4000 storage expansion enclosure
8	If there is any storage expansion enclosure to be attached to the DS4500, use SFP modules and FC cables to cable the DS4500 to the DS4000 storage expansion enclosure.	Chapter 3, "Connecting storage expansion enclosures to the DS4500"

Table 1. Installation Tasks (continued)

	Task	Detailed Description
9	After you cable the DS4000 storage expansion enclosures, if there are EXP710 storage expansion enclosures in the DS4500 configuration, set their enclosure IDs. If there are EXP810 storage expansion enclosures in the DS4500 configuration, you do not need to set their enclosure IDs because they are set automatically by the controller.	Chapter 3, "Storage expansion enclosure settings"
10	<b>For out-of-band management:</b> Cable the DS4500 Ethernet ports to either the management workstation or to the hosts.	Chapter 3, "Connecting secondary interface cables"
	<b>For in-band management:</b> Cable the DS4500 host channels to the FC HBAs in either the hosts or the FC switch that connects to the host FC HBAs.	Chapter 3, "Connecting hosts to the DS4500"
11	Connect the power cables for the DS4500 and the storage expansion enclosures if needed.	Chapter 3, "Cabling the power supply"
12	Power on the attached storage expansion enclosures and the DS4500 storage subsystem.	Chapter 4, "Turning on the storage subsystem"
13	Review the controller firmware and NVSRAM, drive enclosure firmware, ESM firmware, and Storage Manager software requirements and obtain upgrades if necessary.	Chapter 1, "DS4500 hardware and software compatibility"
14	Install the DS4000 Storage Manager 9.16 host software on the management workstation (for out-of-band management) or on the host (for in-band management). Use the DS4000 Storage Manager software to verify the configuration.	<i>IBM DS4000 Storage Manager 9.16 Installation and Support Guide</i> for your operating system
15	Review and perform the DS4000 Health Check process.	Chapter 4, "Performing the DS4000 Health Check process"

## Installing an SFP module and fibre channel cable



### Statement 3:

**DANGER:** Some laser products contain an embedded Class 3A or Class 3B laser diode. Note the following: Laser radiation when open. Do not stare into the beam, do not view directly with optical instruments, and avoid direct exposure to the beam.

All host and drive cabling connections require you to use Small Form-Factor Pluggable (SFP) modules in the DS4500 host and drive channels used by the cabling connections. The SFP module housing and fibre channel cable have integrated guide keys that prevent you from inserting these devices incorrectly. You must insert SFP modules into ports with minimal pressure so that you do not damage either the SFP module or the port. You can insert an SFP module into an active port without affecting the operational loop performance. You must connect the fibre channel cable to the SFP module after you insert the SFP module into the port.

**Attention:** Remove SFP modules from any unused mini hub ports (both host-side and drive-side) on the DS4500 Storage Subsystem.

- | To avoid damage to fibre-optic cables, follow these guidelines:
- | • Do not route the cable along a folding cable-management arm.
- | • For devices on slide rails, leave enough slack in the cables so they do *not* bend to a diameter of less than 76 mm (3 in.), or a radius less than 38 mm (1.5 in.), when extended or become pinched when retracted.
- | • Route the cable away from places where it can be damaged by other devices in the rack cabinet.
- | • Do not use plastic cable ties in place of the provided cable straps.
- | • Do not overtighten the cable straps or bend the cables to a diameter of less than 76 mm (3 in.), or a radius less than 38 mm (1.5 in.).
- | • When storing excess or unused fiber-optic cables, do not bend the cables to a diameter of less than 76 mm (3 in.), or a radius less than 38 mm (1.5 in.) or wrap them around themselves. See Figure 1 on page 4.
- | • Do not put excess weight on the cable at the connection point. Be sure that the cable is well supported.
- | • The following are the supported maximum cable lengths:
  - | – 1 Gbps: 500 meters 50/125 um fiber, 300 meters 62.5/125 um fiber
  - | – 2 Gbps: 300 meters 50/125 um fiber, 150 meters 62.5/125 um fiber
  - | – 4 Gbps: 150 meters 50/125 um fiber, 70 meters 62.5/125 um fiber

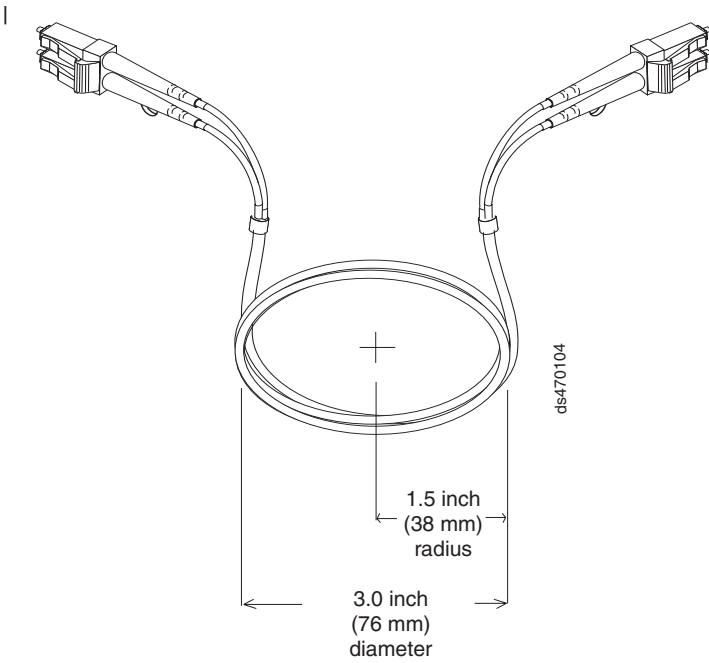


Figure 1. Recommended bending and looping specifications for fiber-optic cables

1. Remove the protective caps from the SFP module and from the fibre channel cable. Do not touch the exposed fibre-optic cable.

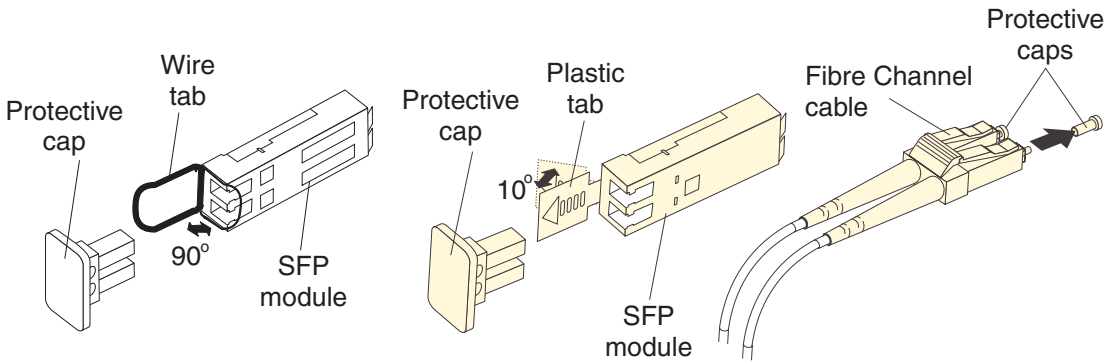


Figure 2. SFP modules and fibre channel cables

2. Insert the SFP module into an SFP module port on an IBM DS4500 mini hub.
3. Connect the fibre channel cable to the SFP module.

### To remove an SFP module and fibre channel cable:

1. Remove the fibre-optic cable from the SFP module; then, replace the protective caps on the cable connector.

**Attention:** Do not grasp the plastic tab that is part of the SFP module while disconnecting the fibre-optic cable. Pulling the SFP module plastic tab while disconnecting the fibre-optic cable might damage the SFP module.

2. For SFPs with plastic tabs, pull the SFP module plastic tab outward at a 10° angle while you remove the SFP module. The plastic tab releases the SFP module latch.
3. For SFPs with wire tabs, pull the SFP module wire tab outward at a 90° angle and remove the SFP module. The wire tab releases the SFP module latch.
4. Replace the protective cap on the SFP module.

## Direct-attached host-side fibre channel cabling

**Attention:** Install the DS4500 Storage Subsystem and all storage expansion enclosures in the rack cabinet before cabling the configuration.

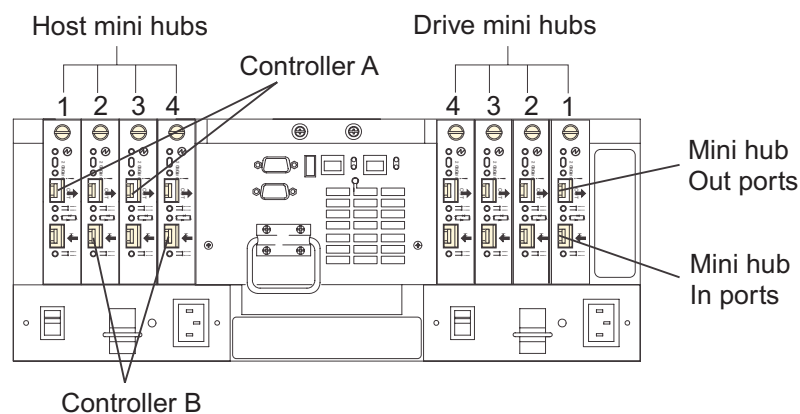


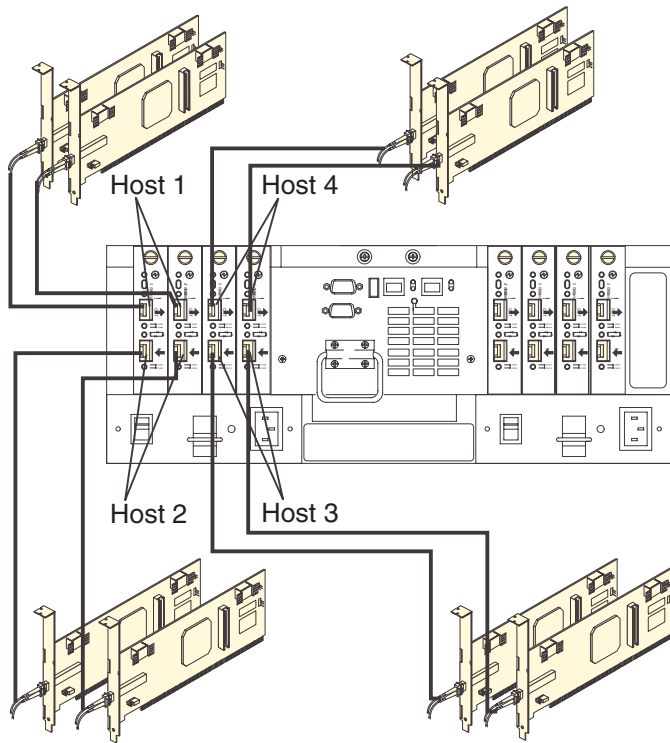
Figure 3. DS4500 Storage Subsystem ports and controllers

1. Connect a host adapter to the Host 1 (top) port on host-side mini hub 1. For redundancy, connect a second host adapter to the Host 1 (top) port on the host-side mini hub 2.

**Note:** To connect devices to each other, follow the procedure on the other side of this document for installing SFP modules and fibre channel cables.

2. For a second redundant host, connect two host adapters to the Host 2 (bottom) ports on host-side mini hubs 1 and 2.
3. For a third redundant host, connect two host adapters to the Host 3 (bottom) ports on host-side mini hubs 3 and 4.
4. For a fourth redundant host, connect two host adapters to the Host 4 (top) ports on host-side mini hubs 3 and 4.

Host 1, Host Adapter 1 and 2      Host 4, Host Adapter 1 and 2



Host 2, Host Adapter 1 and 2      Host 3, Host Adapter 1 and 2

Figure 4. DS4500 Storage Subsystem host adapter connections (direct-attached)

For additional information about host-side cabling, refer to the *IBM TotalStorage DS4500 Fibre Channel Storage Subsystem Installation, User's, and Maintenance Guide*.

## Drive-side fibre-channel cabling

The DS4500 Storage Subsystem supports up to two redundant drive loops. A redundant drive loop consists of one or more storage expansion enclosures connected to a controller using two sets of fibre channel cables. If one data path fails, the controller uses the other data path to maintain the connection to the drive group.

## Drive interface ports

DS4500 Storage Subsystems use only redundant drive-loop configurations. Each drive mini hub connects to Controller A and Controller B and represents a single drive loop. The drive loops must be set up in pairs to support redundant drive loop configurations (two data paths per storage expansion enclosure). See Figure 5 for an illustration of the drive-side mini-hub interface ports.

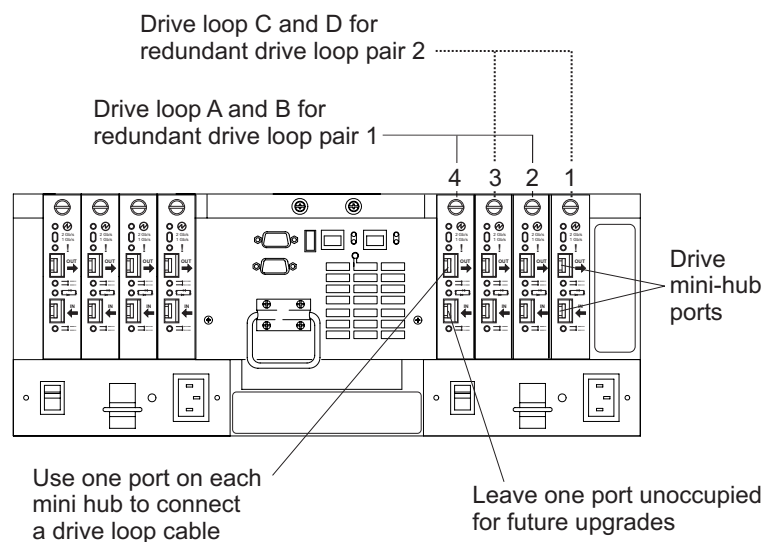


Figure 5. Drive mini-hub ports

The maximum number of storage expansion enclosures that can be connected per pair of redundant drive loops depends on the IBM DS4000 storage expansion enclosure models used. The following DS4000 storage expansion enclosure types are supported by the DS4500 Storage Subsystem:

- FASTt EXP500
- DS4000 EXP700
- DS4000 EXP710
- DS4000 EXP100
- DS4000 EXP810

If the drives are configured using only DS4000 EXP700, EXP710, EXP810, or EXP100 storage expansion enclosures, the DS4500 Storage Subsystem supports a maximum of 224 hard drives.

If the drives are configured using only FASTt EXP500 storage expansion enclosures, the DS4500 Storage Subsystem supports a maximum of 220 hard drives.

**Important:** Ensure that the single digit (x1) of the enclosure ID for every enclosure in a redundant drive loop pair is unique. Refer to the *IBM TotalStorage DS4500 Installation, User's, and Maintenance Guide* for more information on the storage expansion enclosure IDs settings.

To cable two DS4000 10- or 14- drive storage expansion enclosures (EXP500, EXP700, EXP710, or EXP100) to the DS4500, see "Connecting to EXP500/EXP100/EXP700/EXP710 storage expansion enclosures" on page 8. To cable two DS4000 16-drive storage expansion enclosures (EXP810) to the DS4500, see "Connecting to EXP810 storage expansion enclosures" on page 9.

**Attention:** If you need more information about storage expansion enclosure cabling, including how to cable different storage expansion enclosures types and the latest updates, please see the *IBM TotalStorage DS4500 Installation, User's and Maintenance Guide* and the *IBM TotalStorage DS4000 Hard Drive and Storage Expansion Enclosure Installation and Migration Guide*. In addition, you must purchase the FC/SATA Enclosure Intermix premium option to combine DS4000 EXP100s or DS4000 EXP810s with SATA enhanced disk drive modules (E-DDMs) with DS4000 EXP700s, DS4000 EXP710s, or DS4000 EXP810s with fibre channel drives in the same DS4500 Storage Subsystem configuration.

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## Connecting to EXP500/EXP100/EXP700/EXP710 storage expansion enclosures

1. If you are cabling two EXP500/EXP100/EXP700/EXP710 storage expansion enclosures to the DS4500, use a fibre channel cable to connect the In port on the left ESM board of the first enclosure to the Out port on the left ESM board of the second enclosure. Connect the In port on the right ESM board of the first enclosure to the Out port on the right ESM board of the second enclosure.

If you want to connect additional storage expansion enclosures into drive loops A and B, then by starting with the second storage expansion enclosure, connect each additional storage expansion enclosure into drive loops A and B in the same manner. Leave the In port on the right ESM board on the last storage expansion enclosure in the loop unoccupied.

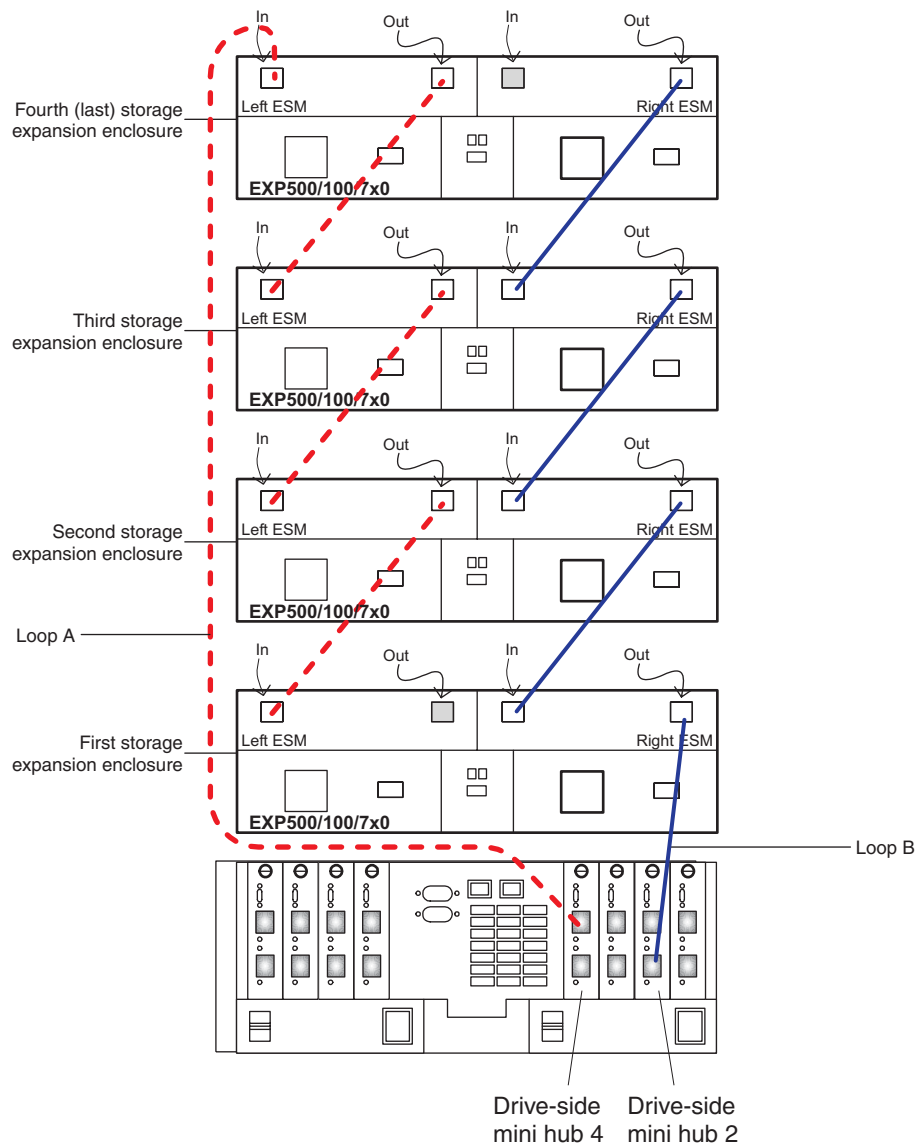
2. Ensure that each storage expansion enclosure has a unique enclosure ID (switch setting).
3. From the second (or last) enclosure, connect the In port on the left ESM board to the Out (upper) port on drive-side mini hub 4 on the DS4500.

Leave the Out port on the left ESM board on the first enclosure and the In (lower) port on the drive-side mini hub 4 unoccupied.

4. From the first enclosure, connect the Out port on the right ESM board to the In (lower) port on drive-side mini hub 2 on the DS4500.

Leave the In port on the right ESM board on the second (or last) enclosure and the Out (upper) port on the drive-side mini hub 2 unoccupied.





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Figure 6. EXP100/700/710 storage enclosure

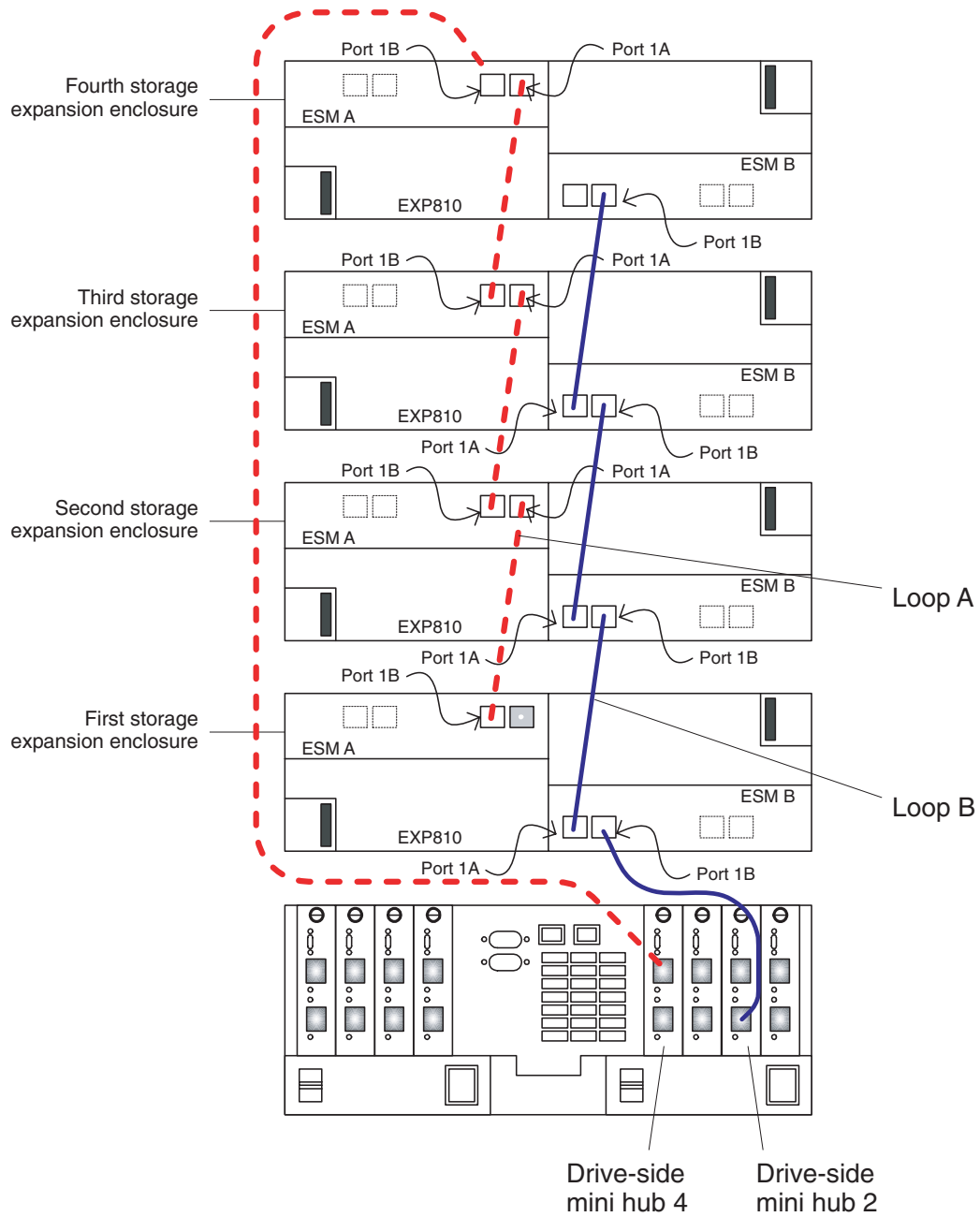
## Connecting to EXP810 storage expansion enclosures

1. Make sure that each EXP810 storage expansion enclosure has the enclosure speed set to 2 Gbps fibre channel speed.
2. If you are cabling two EXP810 storage expansion enclosures to the DS4500, use a fibre channel cable to connect port 1B on the ESM A board of the first enclosure to port 1A on the ESM A board of the second enclosure. Connect port 1A on the ESM B board of the first enclosure to port 1B on the ESM B board of the second enclosure.

If you want to connect additional storage expansion enclosures into drive loops A and B, then by starting with the second storage expansion enclosure, connect each additional storage expansion enclosure into drive loops A and B in the same manner. Leave port 1A on the ESM B board on the last storage expansion enclosure in the loop unoccupied.

3. From the second (or last) enclosure, connect port 1B on the ESM A board to the Out (upper) port on drive-side mini hub 4 on the DS4500.  
Leave port 1A on the ESM A board on the first enclosure and the In (lower) port on the drive-side mini hub 4 unoccupied.
4. From the first enclosure, connect port 1B on the ESM B board to the In (lower) port on drive-side mini hub 2 on the DS4500.  
Leave port 1A on the ESM B board on the second (or last) enclosure and the Out (upper) port on the drive-side mini hub 2 unoccupied.

The EXP810 enclosure IDs will automatically set to give each enclosure in the drive loop a unique enclosure ID.



ds4500\_8107

Figure 7. EXP 810 storage expansion enclosure

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GC26-7813-02

