IBM System Storage
DS4000 Fibre Channel and
Serial ATA Intermix Premium
Feature Installation Overview

Note: For the most current information on the DS4000 Fibre Channel and Serial ATA (FC/SATA) Intermix premium feature, including the latest version of this Installation overview, see the IBM® System Storage® Support Web site:

   www.ibm.com/servers/storage/support/disk/

The DS4000 FC/SATA Intermix premium feature supports the concurrent attachment of Fibre Channel and SATA storage expansion enclosures to a single DS4000 controller configuration.

With this premium feature, you can create and manage distinct arrays or logical drives that are built from either Fibre Channel disks or SATA disks in a DS4000 Storage Subsystem, and allocate the drives to the appropriate applications in the attached host servers.

Note: You must purchase the DS4000 FC/SATA Enclosure Intermix premium feature for each DS4000 Storage Subsystem that will have drive channels/loops intermixing SATA and Fibre Channel technology drives.

Table 1 shows the combinations of DS4000 storage subsystems and storage expansion enclosures that this DS4000 FC/SATA Intermix premium feature currently supports.

Table 1. FC/SATA Intermix premium feature - supported configurations

DS4000 Storage Subsystem Model	**Intermixing with ... (see note 7)**						
	EXP100	**EXP810 with SATA E-DDMs**	**EXP810 with FC and SATA E-DDMs (mixed EXP810)**	**EXP710** *and* **EXP100**	**EXP700** *and* **EXP100**	**[EXP710 and/or EXP810 with FC E-DDMs]***and* **[EXP810 with SATA E-DDMs and/or mixed EXP810]**	**[EXP710 and/or EXP810 with FC E-DDMs]** *and* **[EXP100 and/or EXP810 with SATA E-DDMs and/or mixed EXP810]**
DS4100	DS4100 storage subsystems do not support the Intermix premium feature.						
DS4200 Express	DS4200 Express storage subsystems do not currently support the Intermix premium feature. (See note 11.)						
DS4300 (standard or Turbo dual-controller) without FC drives in internal slots	N/A (See note 8)	N/A (See note 8)	Yes (See note 13)	Yes	Yes	Yes (See notes 4 and 13)	Yes (See notes 4 and 13)
DS4300 (standard or Turbo dual-controller) with FC drives in internal slots	Yes	Yes	Yes (See note 13)	Yes	Yes	Yes (See notes 4 and 13)	Yes (See notes 4 and 13)

Table 1. FC/SATA Intermix premium feature - supported configurations (continued)

DS4000 Storage Subsystem Model	Intermixing with ... (see note 7)						
	EXP100	EXP810 with SATA E-DDMs	EXP810 with FC and SATA E-DDMs (mixed EXP810)	EXP710 *and* EXP100	EXP700 *and* EXP100	[EXP710 and/or EXP810 with FC E-DDMs]*and* [EXP810 with SATA E-DDMs and/or mixed EXP810]	[EXP710 and/or EXP810 with FC E-DDMs] *and* [EXP100 and/or EXP810 with SATA E-DDMs and/or mixed EXP810]
DS4400	N/A (See note 9)	N/A (See note 9)	No	Yes	Yes	No	No
DS4500	N/A (See note 9)	N/A (See note 9)	Yes (See note 13)	Yes	Yes	Yes (See notes 4 and 13)	Yes (See notes 4 and 13)
DS4700 with SATA E-DDMs only, in internal slots	N/A (See note 1)	N/A (See note 10)	Yes (See note 13)	Yes (See note 1)	No (See note 3)	Yes (See notes 5 and 13)	Yes (See notes 1 and 13)
DS4700 with FC E-DDMs in internal slots	Yes (See note 1)	Yes	Yes (See note 13)	Yes (See note 1)	No (See note 3)	Yes (See notes 5 and 13)	Yes (See notes 1 and 13)
DS4800	N/A (See note 9)	N/A (See note 9)	Yes (See note 13)	Yes (See note 2)	No (See note 3)	Yes (See notes 5 and 13)	Yes (See notes 6 and 13)

Notes for Table 1:

1. DS4700s do not support EXP100s with controller firmware 6.16.xx.xx and earlier. Controller firmware version 6.23.xx.xx (or later) is required to support the attachment of EXP100s.
2. Requires DS4800 controller firmware version 6.15.xx.xx or 6.23.xx.xx (or later).
3. DS4700s and DS4800s do not support EXP700s.
4. Requires DS4300 or DS4500 controller firmware version 6.19.xx.xx or later.
5. Requires DS4700 or DS4800 controller firmware version 6.16.88.xx or later.
6. DS4800s require controller firmware version 6.23.xx.xx or later to support intermixing EXP810s and EXP100s.
7. EXP810s cannot be intermixed with EXP700s. You must upgrade your EXP700 to an EXP710 using the DS4000 EXP700 Models 1RU-1RX Switched-ESM Option Upgrade Kit before you can intermix with EXP810s.
8. For a DS4300 subsystem with no drives in its internal drive slots, the FC/SATA Intermix premium feature is not required to connect to a storage expansion enclosure with SATA drives only, such as an EXP100 or an EXP810 (with SATA E-DDMs only). However, a special NVSRAM file must be installed in the DS4300 subsystem to disable its internal drive slots.

   Note: To find the NVSRAM file, look in the following directory of the controller firmware upgrade package:

   ```
   ...\NVSRAM\DS4300_FAStT600_Turbo\For_attachment_of_EXP100–EXP810(SATA)_enclosures_only
   ```
9. The FC/SATA Intermix premium feature is not required to connect a DS4400, DS4500, or DS4800 storage subsystem to a storage expansion enclosure with SATA drives only, such as an EXP100 or an EXP810 (with SATA E-DDMs only).

10. For a DS4700 subsystem with SATA drives in its internal drive slots, the FC/SATA Intermix premium feature is not required to connect to a storage expansion enclosure with SATA drives only, such as an EXP810 (with SATA E-DDMs only).

11. Configurations that are not supported at the time of publication might be supported in the future. For the most current information on the DS4000 Fibre Channel and Serial ATA (FC/SATA) Intermix premium feature, see the IBM System Storage Support Web site:

    www.ibm.com/servers/storage/support/disk/

12. The FC/SATA Intermix premium feature is required to intermix a DS4700 with SATA E-DDMs in its internals slots with Fibre Channel enclosures, such as the EXP710 or the EXP810 with Fibre Channel E-DDMs

13. Intermixing FC and SATA E-DDMs within the same EXP810 is supported **only** at controller firmware version 06.23.xx.xx or later. The following DS4000 storage subsystems are supported at this firmware level: DS4300, DS4500, DS4700, and DS4800.

For information regarding future support for other Fibre Channel/SATA intermix combinations of DS4000 storage subsystems and storage expansion enclosures, contact your IBM reseller or representative or check the DS4000 Interoperability Matrix at the following Web site:

www-1.ibm.com/servers/storage/disk/ds4000/interop-matrix.html

Firmware requirements

The FC/SATA Intermix premium feature requires that you upgrade the DS4000 Storage Manager and controller firmware. See Table 2 for the versions that are applicable to your DS4000 storage subsystem model.

Important: Before you begin the upgrade, see the readme files that are packaged with the DS4000 Storage Manager host software or controller firmware for any prerequisites and for any required updating sequences. You can also refer to the DS4000 Installation, User's, and Maintenance Guides for your specific storage subsystem and disk expansion enclosures for more information.

Table 2. Required DS4000 Storage Manager and subsystem controller firmware levels, by DS4000 subsystem model type

DS4000 Subsystem Model	DS4000 controller firmware version	DS4000 Storage Manager version
DS4300	6.19.xx.xx or later	Storage Manager 9.23 or later
DS4400	6.12.2x.xx	
DS4500	6.19.xx.xx or later	
DS4700	6.23.xx.xx or later	
DS4800	6.23.xx.xx or later	

Note: For the most current version of the DS4000 Storage Manager and storage subsystem controller firmware, see the IBM System Storage Support Web site:

www.ibm.com/servers/storage/support/disk/

FC/SATA Intermix Option installation kit

The FC/SATA Intermix Option installation kit includes the following items:
- *IBM System Storage DS4000 Fibre Channel and Serial ATA Intermix Premium Feature Installation Overview* (this publication)
- The DS4000 FC/SATA Intermix premium feature entitlement document
- The DS4000 FC/SATA Intermix premium feature activation document, which includes the feature activation code and the instructions about how to generate the key file

Installing the FC/SATA Intermix premium feature

Complete the following steps to install the FC/SATA Intermix premium feature upgrade:

1. Purchase an IBM System Storage DS4000 Fibre Channel/SATA Intermix entitlement. Contact your IBM reseller or representative for additional information.
2. Upgrade your DS4000 ESM firmware to the level that is compatible with each particular enclosure type.

    Attention: You should perform any required ESM code upgrades before you perform any other code upgrades. See Table 3 to find the ESM firmware levels that are compatible with each enclosure type.

Table 3. ESM firmware levels by storage expansion enclosure type

Storage expansion enclosure type	ESM firmware level
DS4000 EXP100	9563 or later (9565 is current). See note **a**, below.
DS4000 EXP700	9326 or later (9330 is current). See notes **b** and **c**, below.
DS4000 EXP710	9651 or later
DS4000 EXP810	9891 or later

Notes:

a. If a DS4000 storage subsystem has an EXP100 ESM firmware version earlier than 9554 installed, you must upgrade the firmware to version 9554 before upgrading to version 9563 or 9565. (Please note that the controller firmware version must be version 5.41.1x.xx in order to upgrade the earlier version of ESM firmware to version 9554.)

b. You must upgrade the EXP700 ESM firmware to version 9326 or later before you upgrade the DS4000 storage subsystem controller firmware to version 06.1x.xx.xx.

c. DS4700 and DS4800 storage subsystems do not support DS4000 EXP700 expansion enclosures. Also, DS4300 and DS4500 storage subsystems do not support intermixing EXP700 expansion enclosures with EXP810 expansion enclosures. However, you can remove these restrictions by upgrading the EXP700 to an EXP710 by purchasing and implementing the *DS4000 EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit*.

3. If necessary, upgrade your host software to DS4000 Storage Manager version 9.23 or later. You can download Storage Manager software from the IBM DS4000 Storage Manager Support Web site:

    www.ibm.com/servers/storage/support/disk/

    Refer to the appropriate Storage Manager Installation and Support Guide for your host operating system.

4. Upgrade your DS4000 Storage Subsystem controller firmware to the appropriate version for your storage subsystem model, as indicated in Table 2 on page 3. For more information, see the IBM DS4000 Storage Manager Installation and Support Guide for your host operating system. You can download the latest versions of the DS4000 Storage Subsystem controller firmware and Storage Manager host software from the DS4000 System Storage Support Web site (see link in Step 3).

5. The DS4000 FC/SATA Intermix premium feature is entitled, and therefore it requires the use of a feature key to enable the option. To obtain the feature key identifier, you need a feature activation code, which is printed on the IBM premium feature activation card (included with this DS4000 FC/SATA Intermix premium feature kit). You also need your controller unit IBM serial number, which is printed on the label on the back of your DS4000 storage subsystem.

    Using the instructions in the DS4000 FC/SATA Intermix premium feature activation card, generate the FC/SATA Intermix premium feature key to enable FC/SATA Intermix functionality.

    Attention: Before activating the FC/SATA Intermix premium feature, be sure to check the controller firmware readme files for the most up-to-date information. The readme files might include updated code prerequisites, specific Intermix cabling requirements, or other important information that you might need. Failure to check the readme files for this information can cause undesired results.

    Note: Save the premium feature enable key file in a safe location.

FC/SATA Intermix restrictions and recommendations

Please note the following restrictions and recommendations when configuring and cabling your subsystem in an FC/SATA Intermix configuration:
- "Restrictions"
- "Recommendations" on page 14

Restrictions

Important: When you add drive expansion enclosures of different types, the grouping of the enclosure types might force the new enclosures to be cabled in the middle of the drive loop. In this case, it is strongly recommended that you power down the configuration or schedule your installations during offpeak I/O periods. You can use the performance monitor function in the DS4000 Storage Manager Subsystem Management window to determine offpeak I/O periods.

If you cannot power down the configuration to install a new enclosure in the middle of the loop, you must use DS4000 Storage Manager to verify that the interrupted drive loop is in `Optimal` state before you modify the other drive loop. This minimizes the possibility that arrays might fail as a result of cabling errors.

Therefore, it is also important to plan for additions to the configuration prior to your initial installation. It is also best practice to take these same precautions when you add new enclosures to either end of the redundant drive loop.

For more information, see the *IBM System Storage DS4000 Hard Drive and Storage Expansion Enclosure Installation and Migration Guide.*

Compatible storage subsystems

Only the following DS4000 Storage Subsystems support the FC/SATA Intermix premium feature:
- DS4300 Standard/Base or Turbo
- DS4400
- DS4500
- DS4700
- DS4800

Limitations:

- DS4400 storage subsystems do not currently support EXP810 expansion enclosures.
- You cannot attach more than four EXP810s to one drive port that is part of a two-ported drive channel (for example, DS4700 and DS4800 subsystems have a two-port drive channel).

   Note: This restriction does not apply when you are connecting enclosures to DS4300 and DS4500 drive ports.

For information regarding future DS4000 FC/SATA Intermix interoperability, contact your IBM reseller or representative or check the DS4000 Interoperability Matrix at the following Web site:

www-1.ibm.com/servers/storage/disk/ds4000/interop-matrix.html

Table 4 lists the drive types and their corresponding DS4000 storage subsystems and storage expansion enclosures.

Table 4. Drive types and their corresponding DS4000 storage subsystems and storage expansion enclosures

Drive type (see note 1)	Storage subsystem type	Storage expansion enclosure type
SATA	DS4100 DS4700 (see note 2)	DS4000 EXP100 DS4000 EXP810 (see note 2)
Fibre Channel	DS4300 Standard/Base or Turbo DS4400 DS4500 DS4700 (see note 3) DS4800	DS4000 EXP700 DS4000 EXP710 DS4000 EXP810 (see note 3)
Mixed SATA and Fibre Channel	DS4700 (see note 4)	DS4000 EXP810 (see note 4)

Notes:

1. The drive trays for the DS4700/EXP810 Fibre Channel drives and SATA E-DDMs are the same. However, this is not true of the DS4100/EXP100 SATA DDMs and the DS4300/EXP710/700 Fibre Channel DDMs, which have different drive trays from each other and from the DS4700/EXP810 Fibre Channel or SATA E-DDMs.
2. These devices are considered to be SATA drive types when populated with SATA E-DDMs.
3. These devices are considered to be Fibre Channel drive types when populated with Fibre Channel E-DDMs.
4. Intermixing FC and SATA E-DDMs in the same DS4700 or EXP810 device is supported only with controller firmware version 6.23.xx.xx or later.

Setting Enclosure IDs with unique single digit values

Ensure that the single digit (x1) of the enclosure ID for every enclosure in a redundant drive loop pair is unique. (In addition to expansion enclosures, this includes any storage subsystem that has drives installed.)

Enclosure IDs (sometimes known as tray IDs, or server IDs) consist of two digits: x10 and x1. In 14-drive expansion enclosures (EXP100/EXP700/EXP710), you can set the enclosure ID manually. In 16-drive expansion enclosures (EXP810), the enclosure ID is set automatically by the EXP810 ESM and the controller firmware. (Please refer to the appropriate Installation, User's, and Maintenance Guides for your enclosures for information on how to manually set the switches.)

If you do not set the enclosure IDs to be unique among enclosures, then drive loop errors might be randomly posted in the DS4000 subsystem Major Event Log (MEL) when you intermix different types of storage expansion enclosures in a redundant drive loop pair (such as an EXP100 with an EXP810). For example, with four enclosures attached to a DS4500 in a redundant drive loop pair, the correct enclosure

ID settings should be x1, x2, x3, and x4 (where x can be any digits that can be set). Examples of incorrect settings would be 11, 21, 31, 41; or 12, 22, 32 62. These examples are incorrect because the x1 digits are the same in all enclosure IDs (either 1 or 2).

If the enclosure IDs in your DS4000 subsystem configuration are not currently set to have unique single digit values for the enclosures in the same redundant drive loop pair, make the changes to the enclosure IDs in the next maintenance schedule. This will prevent unnecessary downtime when you add enclosures of different type (especially EXP810s) to the existing enclosures in the redundant drive loop pair.

Grouping DS4000 storage expansion enclosures in a redundant drive loop

> **Attention:**
> Configurations that do not follow this DS4000 storage expansion enclosures grouping restriction are not supported.

When mixing enclosures with Fibre Channel and SATA drives in a drive loop (DS4300/DS4400/DS4500) or behind a drive channel port (DS4700/DS4800), always group them by enclosure type. Table 1 on page 1 shows three different types of enclosures.

Note: For enclosures such as EXP710s and EXP810s, which are considered to be the same switch-ESM enclosure type even though they have different machine type, model and physical characteristic, group them next to each other by model type. See "Recommendations" on page 14 for recommended cabling diagrams.

Figure 1 shows a correct way and an incorrect way to group expansion enclosures that are attached to a DS4300, DS4400 or DS4500 storage subsystem:
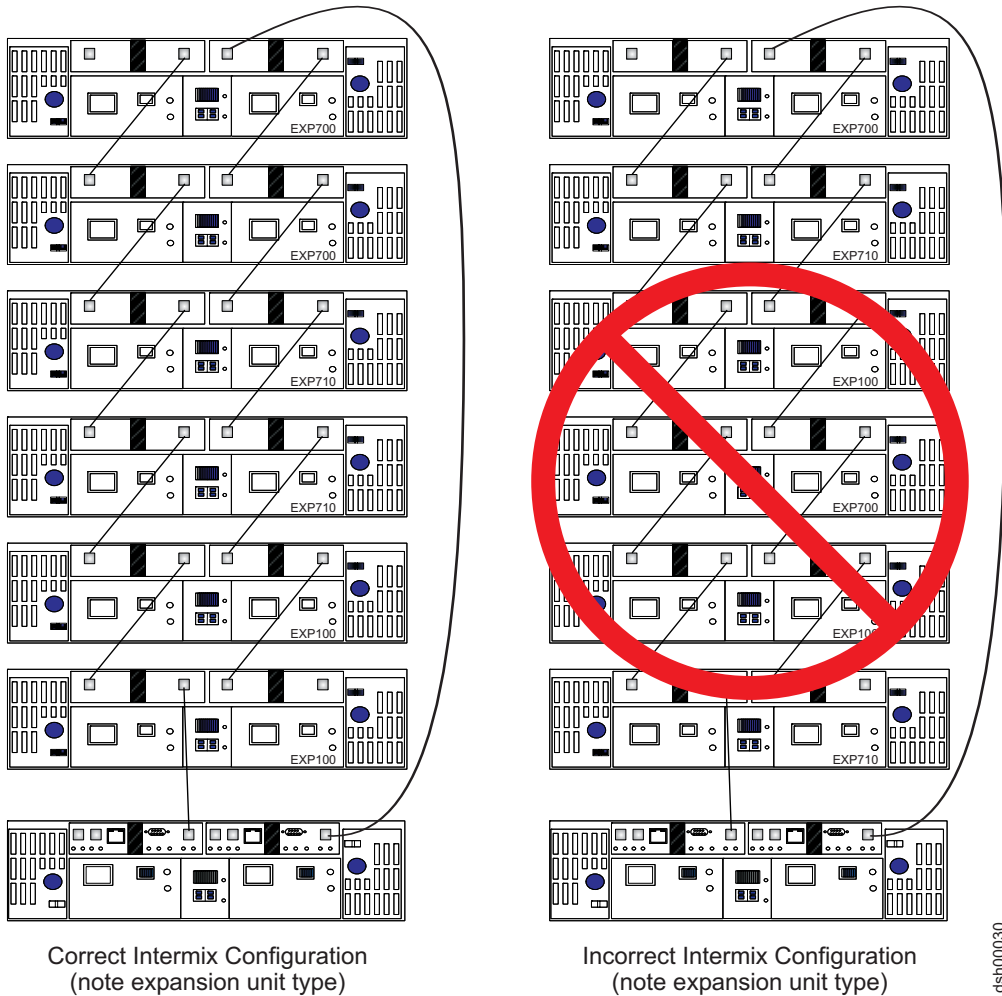

Correct Intermix Configuration
(note expansion unit type)

Incorrect Intermix Configuration
(note expansion unit type)

Figure 1. Correct and incorrect ways to group expansion enclosures in a redundant drive loop (DS4300 and DS4500 storage subsystems)

You must group enclosure model types together, as the configuration on the left shows. In the configuration on the left, the EXP700s are grouped together at the top of the loop, followed by the EXP710s, which are grouped together at the middle of the loop, followed by the EXP100s, which are grouped together closest to the controller.

Note: The storage expansion enclosure model type is indicated in the lower right corner of each enclosure.

In the configuration on the right, the enclosures are cabled in a random order and are not grouped by type. IBM does not support DS4000 Storage Subsystem Fibre Channel/SATA intermix configurations when they are cabled in this way.

Figure 2 on page 10 shows another incorrect way to group the expansion enclosures. In this case, the configuration is incorrect because the EXP100s are cabled between the EXP710s and the EXP810s.

Notes:

1. These figures are for illustrative purpose only. The representations of the DS4000 storage subsystems and expansion enclosures might not accurately reflect the rear view of the DS4000 products. (The cabling diagrams are correct.)

2. The controller firmware considers EXP810s and EXP710s to be the same enclosure type – a switched storage expansion unit type, which has an ESM with an embedded Fibre Channel loop switch – even though they are different models. Therefore, you must group these two enclosure models next to each other if they are contained within a drive loop or drive channel. However, you still need to group all of the EXP710s together, and group all of the EXP810s together, in the drive loop/channel.
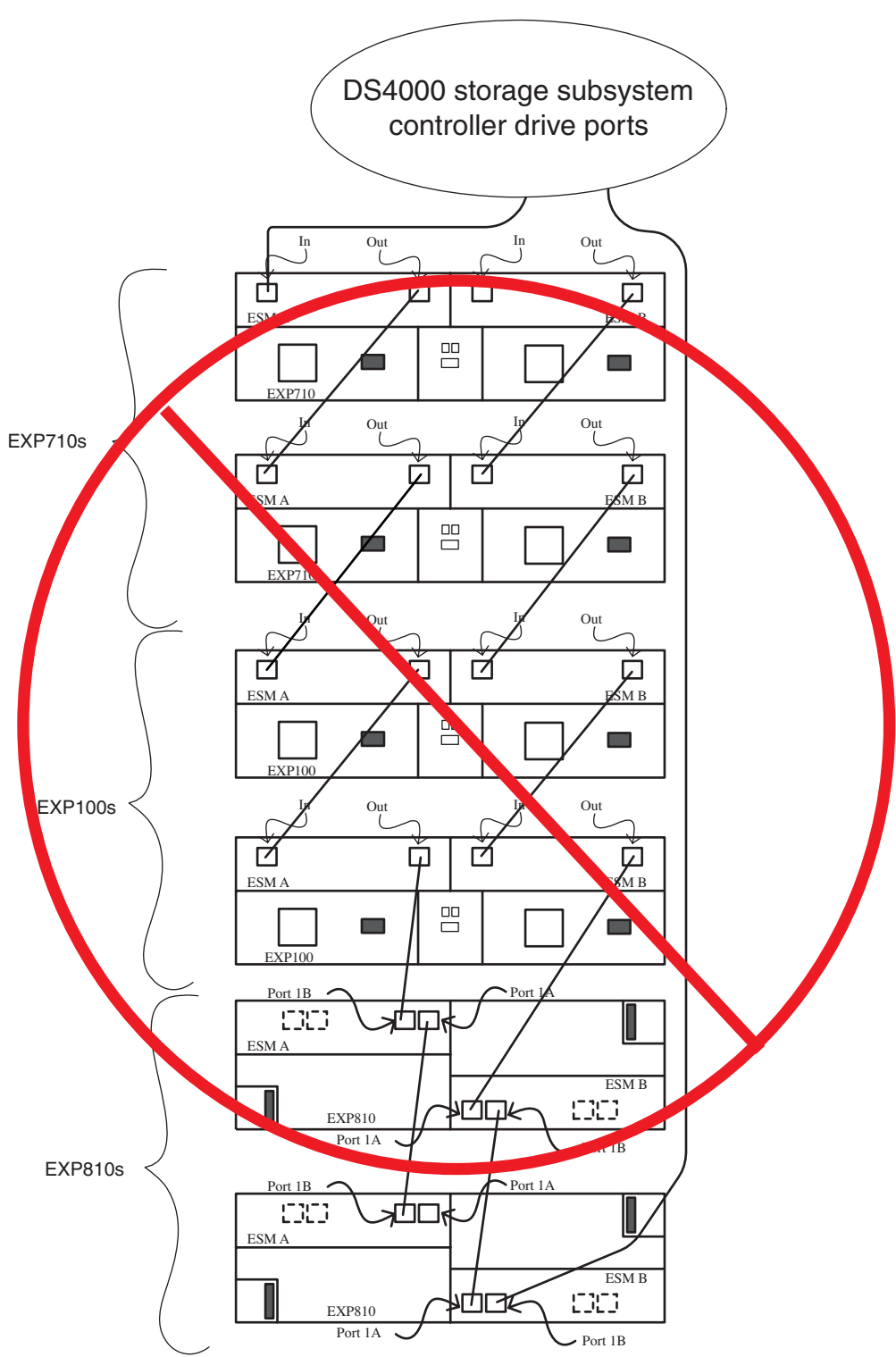
Figure 2. Second example of incorrect expansion enclosure grouping

> **Attention:**
>
> For the purposes of the storage expansion enclosure grouping restriction, note the following considerations:
>
> - All models of the EXP100 are considered to be the same from a grouping perspective. For example, the EXP100 1710-10X, 1710-10U, and the 1724-1XP are considered like enclosure types and must be grouped together.
> - All models of the EXP700 are considered to be the same from a grouping perspective. For example, the EXP700 1740-1RU, and the 1740-1RX are considered like enclosure types and must be grouped together.
> - After the EXP700 has been upgraded with the *DS4000 EXP700 Models 1RU/1RX Switched-ESM Option Upgrade Kit*, it is considered an EXP710, regardless of the machine type and model (as labeled in the EXP700 chassis).
> - The controller firmware considers EXP810s and EXP710s to be the same enclosure type – a switched storage expansion unit type, which has an ESM with an embedded Fibre Channel loop switch – even though they are different models. Therefore, you must group these two enclosure models next to each other if they are contained within a drive loop or drive channel. However, you still need to group all of the EXP710s together, and group all of the EXP810s together, in the drive loop/channel.

For more information, see the *IBM System Storage DS4000 Hard Drive and Storage Expansion Enclosure Installation and Migration Guide*.

Cannot mix drive types

Arrays must consist exclusively of either Fibre Channel or SATA drives. You cannot mix drive types in an array.

Cannot intermix drive types for hot spares

SATA drives can function as hot spares for SATA drives only.

Fibre Channel drives can function as hot spares for Fibre Channel drives only.

DS4300 Standard/Base or Turbo Intermix configuration restrictions

In DS4300 Intermix configurations, with the FC/SATA Intermix premium feature enabled and the correct NVSRAM file installed, the maximum number of expansion enclosures in a drive loop is limited to seven. This is true whether or not there are drives in the DS4300 storage subsystem drive slots.

Intermixing EXP100s with EXP710s and EXP810s in a DS4700 or DS4800 configuration

When intermixing EXP100s, EXP710s, and EXP810s in a DS4700 or DS4800 storage subsystem configuration, if it is not possible to cable each group of enclosures by model type (EXP100s, EXP710s, and EXP810s) in a separate redundant drive loop pair or behind each port of the dual-ported redundant drive channel pair, group them so that EXP810s are between EXP100s and EXP710s.

In addition, when an EXP100 is the first storage expansion enclosure cabled directly to the storage subsystem's controller drive port, follow these rules:

- Cable from the storage subsystem controller drive port to the OUT port on the left ESM (ESM A) of the EXP100.

Note: This is a change from previous cabling recommendations where you cabled from the controller drive port to the IN port on the left ESM (ESM A) of the EXP100.

- If an EXP100 follows the initial EXP100, cable from the IN port on the left ESM (ESM A) of the first EXP100 to the OUT port on the left ESM of the next EXP100. Continue this cabling pattern until you encounter an EXP710 or EXP810, then cable from the IN port on the left ESM (ESM A) of the EXP100 to the IN port of the EXP710 or EXP810.

- If an EXP710 or EXP810 follows the initial EXP100, cable from the IN port on the left ESM (ESM A) of the EXP100 to the IN port of the EXP710 or EXP810. To cable to the next storage expansion enclosure in the chain, cable from the OUT port of the left ESM of the EXP710 or EXP810 to the IN port of the next storage expansion enclosure.

- Continue the left ESM (ESM A) cabling pattern by cabling from the OUT port to the IN port on subsequent storage expansion enclosures until you complete the chain.

Figure 3 shows an acceptable EXP710, EXP810 and EXP100 intermix configuration in a DS4700 or DS4800 environment. The cabling is acceptable because it follows the cabling recommendations.
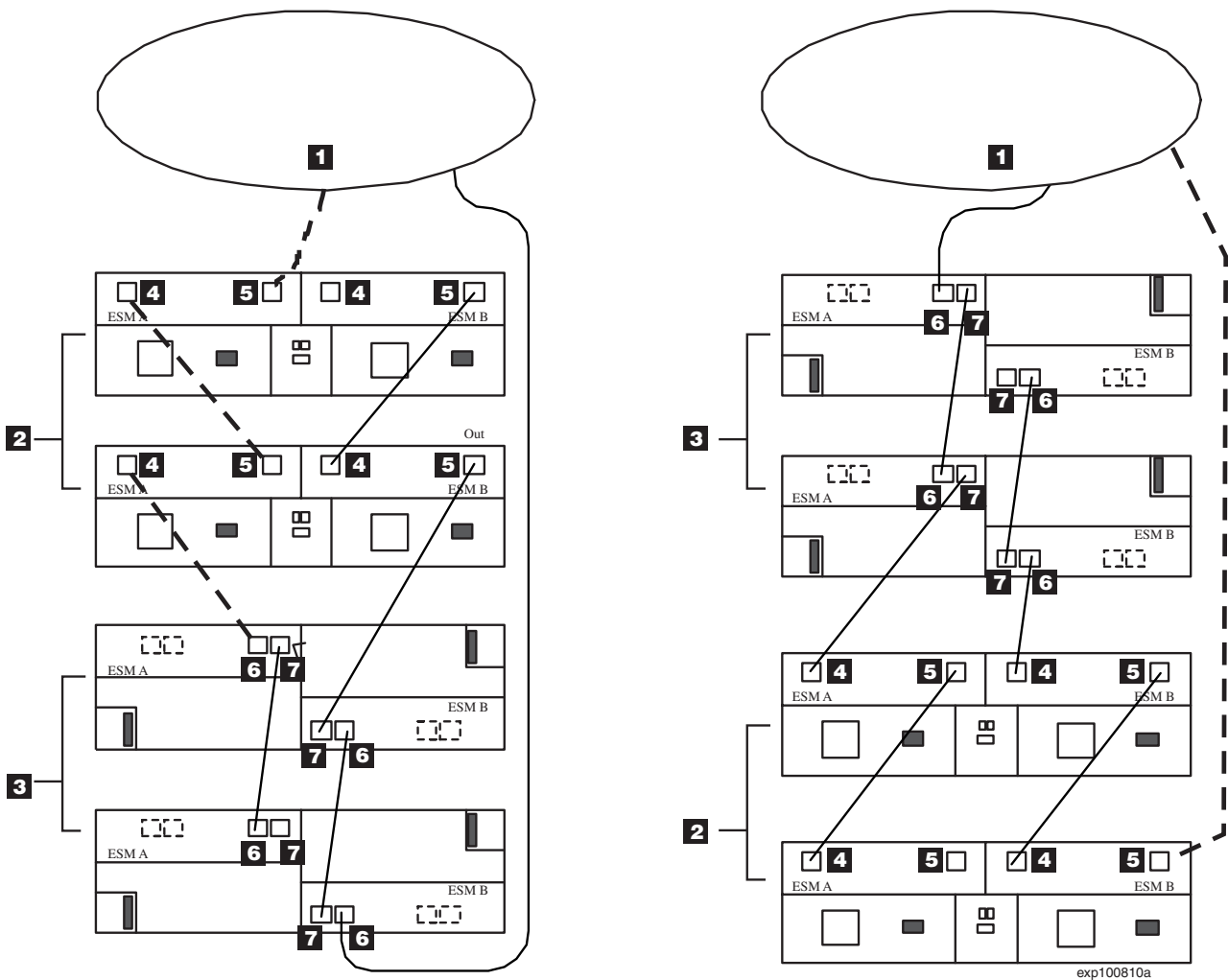

exp100810a

Figure 3. Acceptable EXP710, EXP810 and EXP100 intermix configuration in a DS4700 or DS4800 environment

Table 5. Description of Figure 3

Number	Description
1	DS4700 or DS4800 storage subsystem

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Table 5. Description of Figure 3 on page 12 (continued)

Number	Description
2	EXP100
3	EXP810
4	IN port
5	OUT port
6	Port 1B
7	Port 1A

Figure 4 shows an unacceptable EXP710, EXP810, and EXP100 intermix configuration in a DS4700 or DS4800 environment. The cabling is unacceptable because storage subsystem controller is cabled to the IN port on the left ESM of the first EXP100.
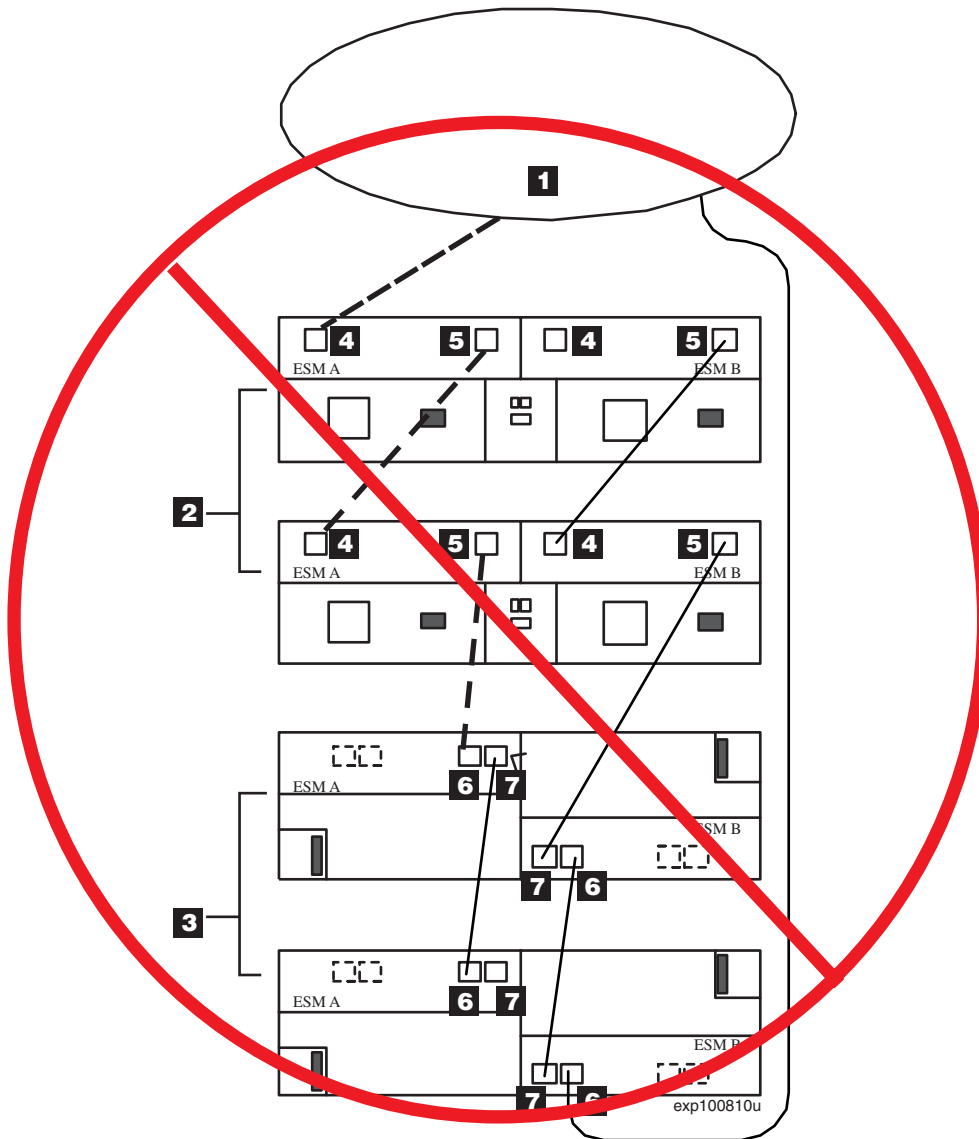

Figure 4. Unacceptable EXP710, EXP810 and EXP100 intermix configuration in a DS4700 or DS4800 environment

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Number	Description
1	DS4700 or DS4800 storage subsystem
2	EXP100
3	EXP810
4	IN port
5	OUT port
6	Port 1B
7	Port 1A

Figure 5 shows cabling variations when intermixing EXP100, EXP710, and EXP810 storage expansion enclosures behind a DS4800 Storage Subsystem.
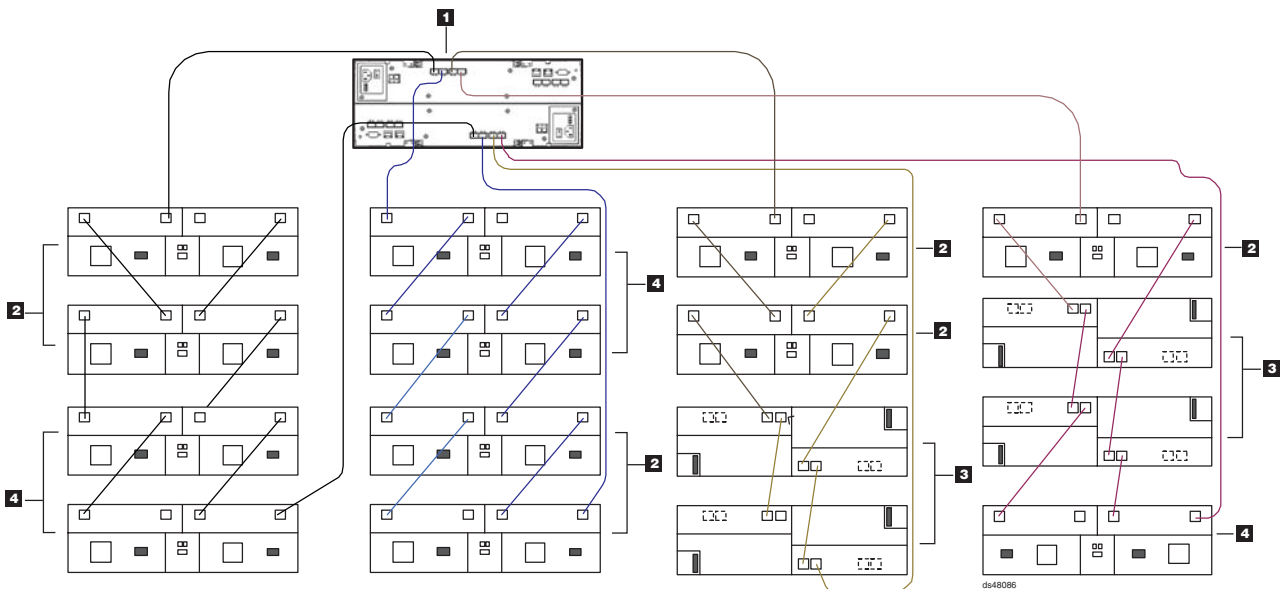
Figure 5. Cabling variations when intermixing EXP100, EXP710, and EXP810 storage expansion enclosures behind a DS4800 Storage Subsystem

Table 7. Description of Figure 5

Number	Description
1	DS4800 Storage Subsystem
2	EXP100
3	EXP810
4	EXP710

Recommendations

Please note the following recommendations when you cable your DS4000 storage subsystem configuration:

Connect only one type of expansion enclosure behind each controller drive port of the dual-ported drive channel or the drive loop

Connect only one type of expansion enclosure behind each DS4000 controller drive port.

Figure 6 shows four EXP100s, four EXP710s, four EXP810s with Fibre-Channel drives, and four EXP810s with SATA drives. The four different expansion unit types are *not* mixed together behind the same drive port of a DS4800 drive channel.
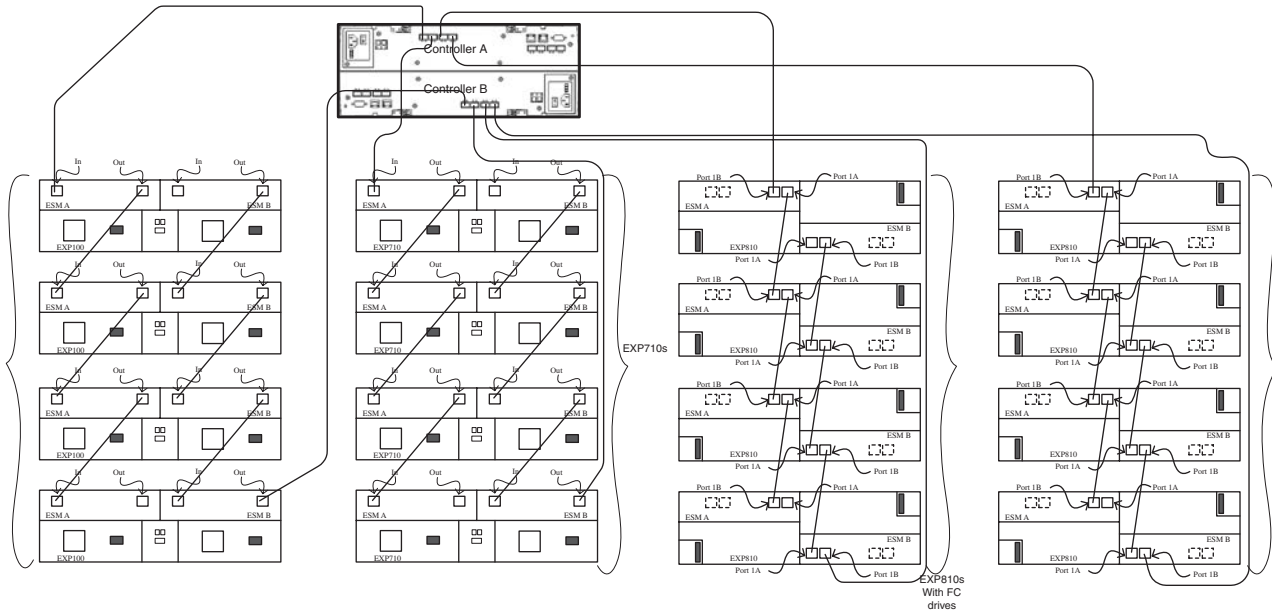

Figure 6. Example of connecting only one type of expansion enclosure (EXP100, EXP710, EXP810) behind a DS4800 controller drive port

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Figure 7 shows three EXP100s and three EXP810s. The two different expansion unit types are *not* mixed together behind the same drive port of a DS4700 drive channel.
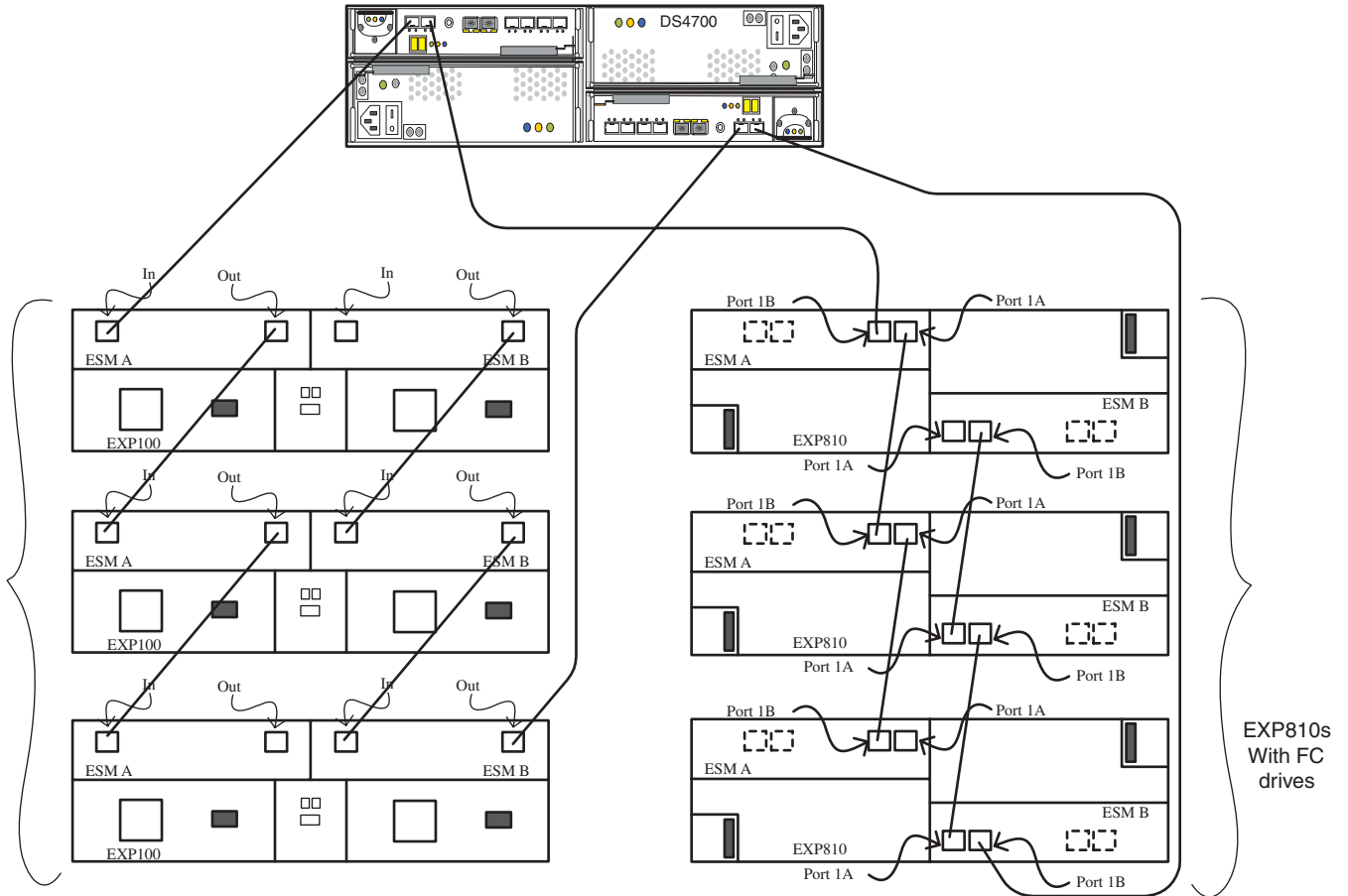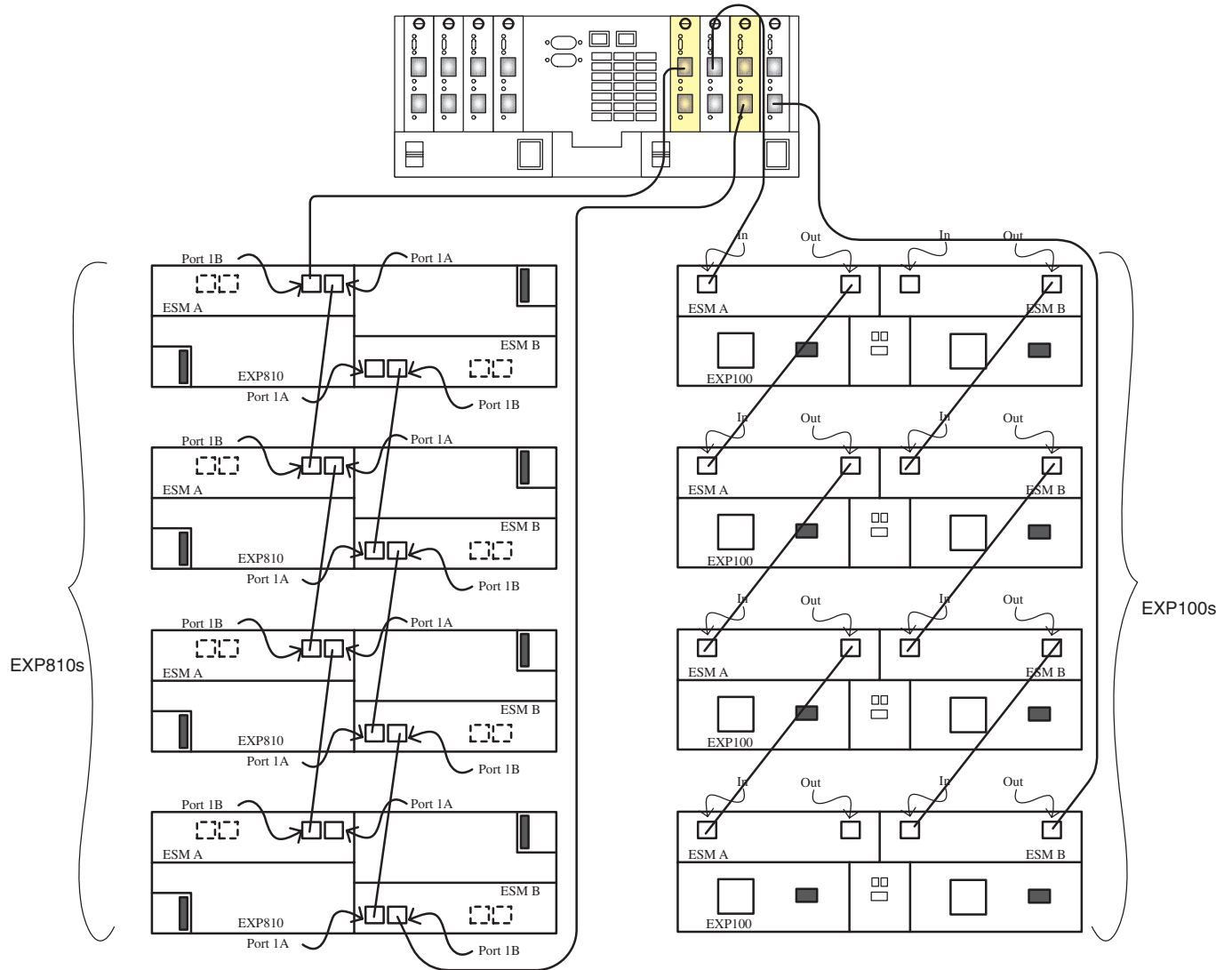

Figure 7. Example of connecting only one type of expansion enclosure (EXP100 or EXP810) behind a DS4700 controller drive port

Figure 8 shows four EXP810s and four EXP100s. The two different expansion unit types of are *not* mixed together behind the same drive port of a DS4500 drive loop.

Figure 8. Example of connecting only one type of expansion enclosure (EXP810 or EXP100) behind a DS4500 controller drive port

Group EXP710 and EXP810s by model type behind each controller drive port

If it is not possible to separate EXP810 and other expansion enclosures behind different controller drive ports, group the expansion enclosures by model type behind each controller drive port. Figure 9 shows EXP710 and EXP810 enclosures that are mixed together behind a drive port, grouped together by model type. In addition, the three EXP810s with the SATA drive option are connected to a different drive channel than the EXP810 and EXP710 with the Fibre Channel drive option.
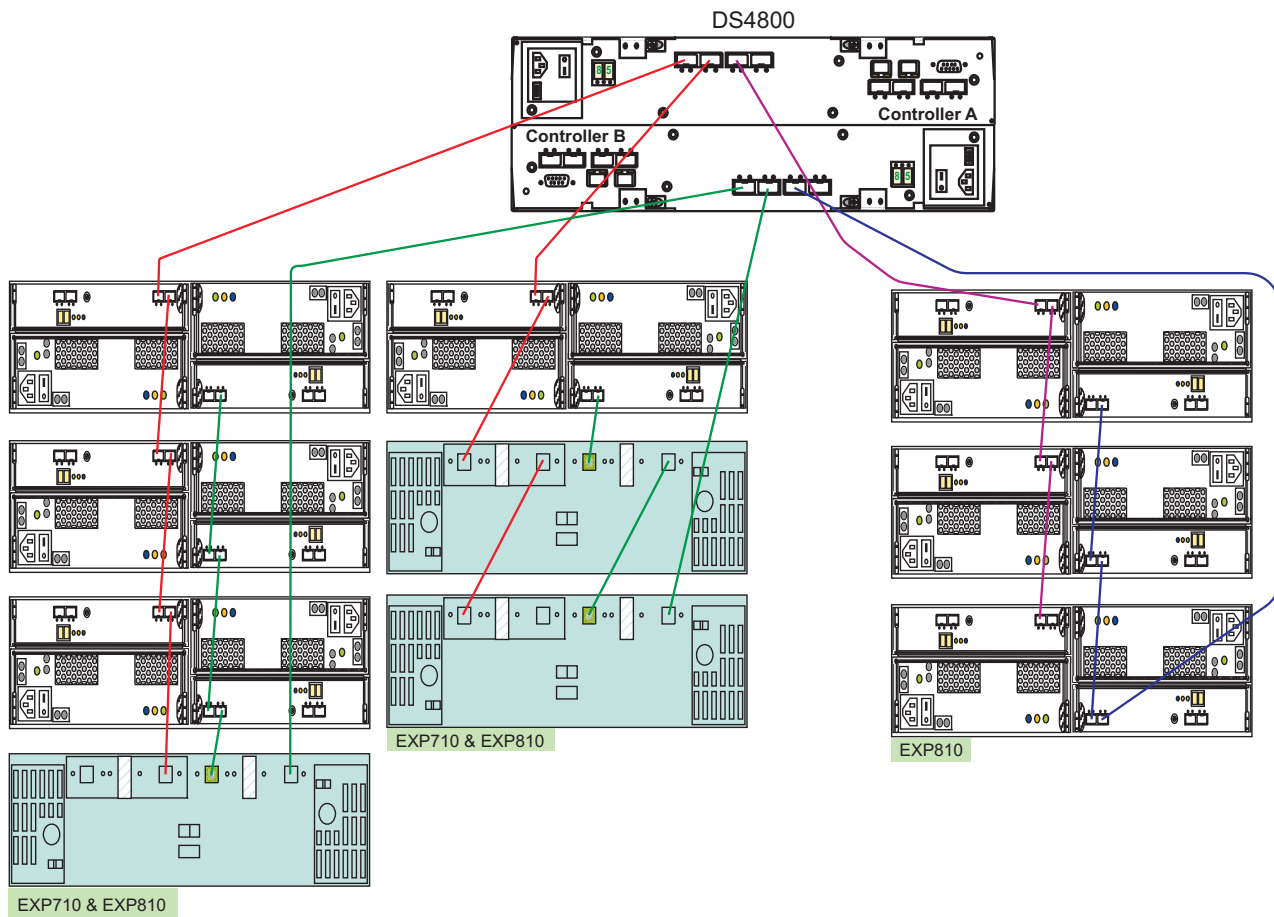

Figure 9. Example of grouping EXP810 and EXP710 model types together behind a DS4800 controller drive port

Group EXP100s and EXP810s by model type behind each DS4000 controller drive port

When intermixing the EXP100s and EXP810s behind a DS4000 storage subsystem, you might not be able to cable the EXP100s in a separate redundant drive loop pair from the EXP810s because of hardware limitations. For example, in the DS4300 only one redundant drive loop is available; or in the DS4500, one redundant drive loop might be full with other storage expansion enclosures. In this case, it is recommended that you group the enclosures by type in the redundant drive loop pair. As shown in Figure 10, cable the group of EXP100s followed by the group of EXP810s, and EXP810s followed by EXP100s.
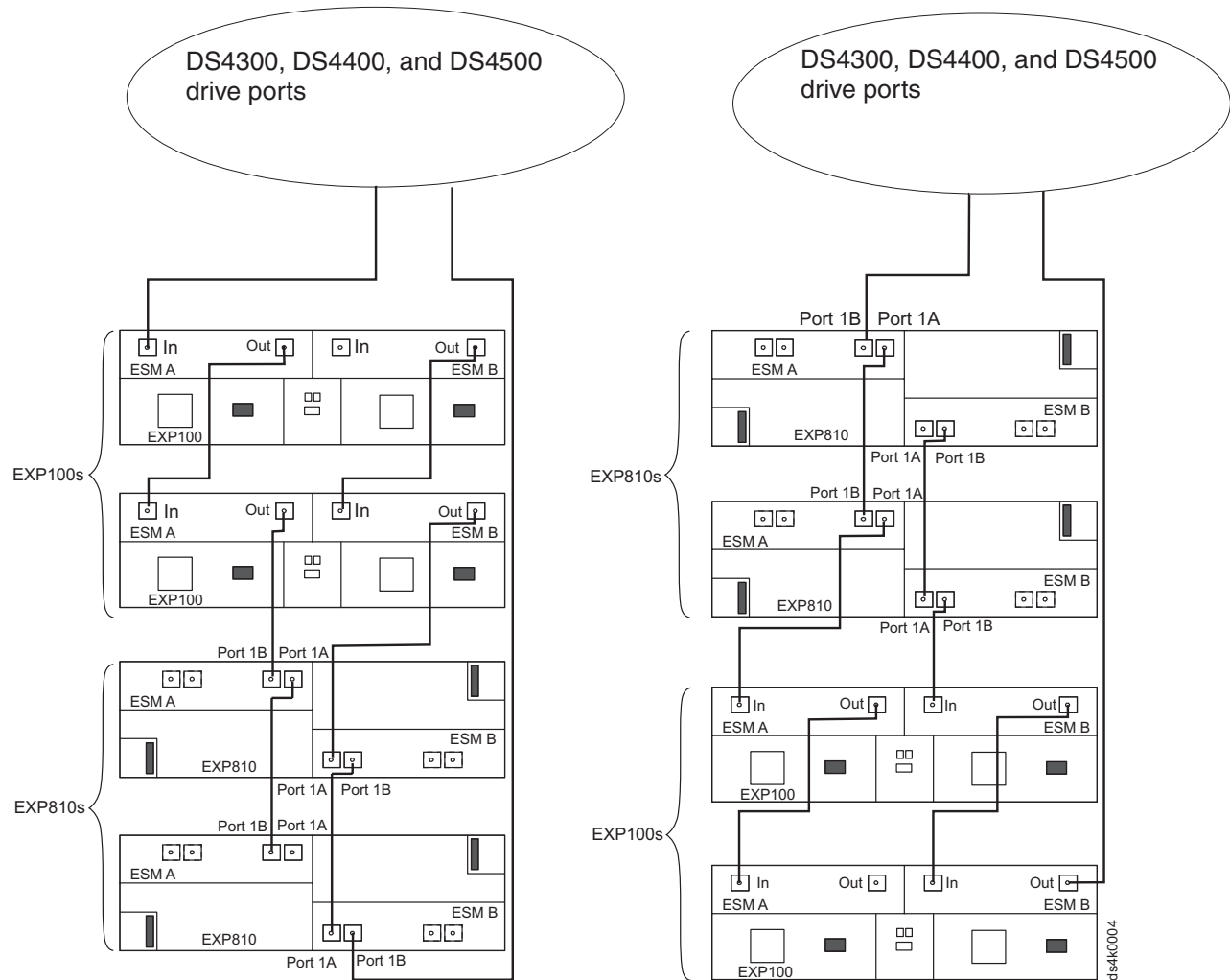

Figure 10. Example of grouping EXP810s and EXP100 model types behind a DS4000 controller drive port

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Group EXP100s, EXP710s, and EXP810s behind a DS4500 or DS4800 controller drive port

When intermixing the EXP100s, EXP710s, and EXP810s behind a DS4500 or DS4800 storage subsystem, it is recommended that you cable the EXP100s in a separate redundant drive loop pair from the EXP810s and EXP710s, if possible. In Figure 11, the redundant drive loop pair on the left has EXP810s and EXP710s intermixed; the redundant drive loop pair on the right has only EXP100s.
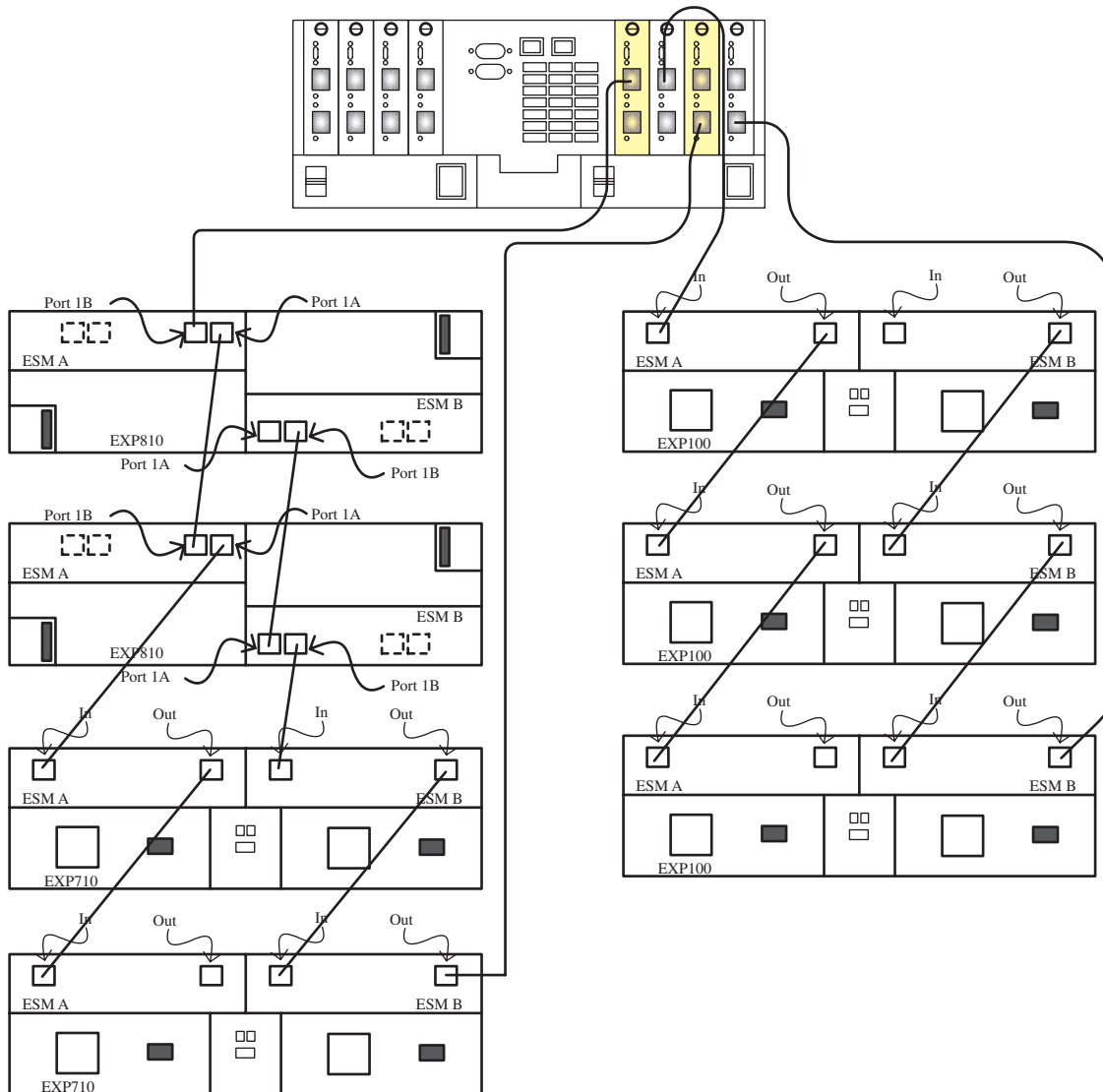

Figure 11. Example of grouping EXP100s, EXP710s, and EXP810s behind a DS4500 controller drive port

In Figure 12, the redundant drive channel on the left has EXP100s only, and the drive channel on the right has EXP810s and EXP710s intermixed.
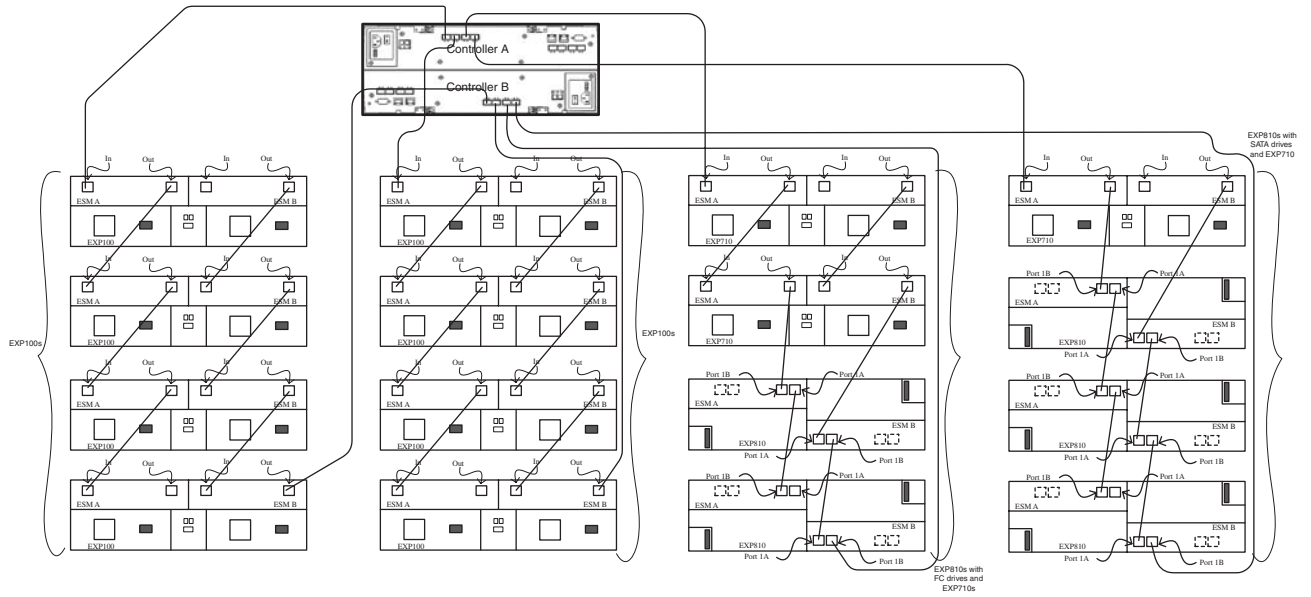

Figure 12. Example of grouping EXP100s, EXP710s, and EXP810s behind a DS4800 controller drive port

Group EXP100s, EXP710s, and EXP810s behind a DS4000 controller drive port

When intermixing EXP100s, EXP710s, and EXP810s behind a DS4000 storage subsystem, if it is not possible to cable the EXP100s in a separate redundant drive loop pair (or separate drive port of the redundant dual-ported drive channel pair) from the EXP810s and EXP710s, it is recommended that you group the enclosures in such a way that the EXP810s are placed between the EXP100s and EXP710s, as shown in Figure 13 on page 23 and Figure 14 on page 24.

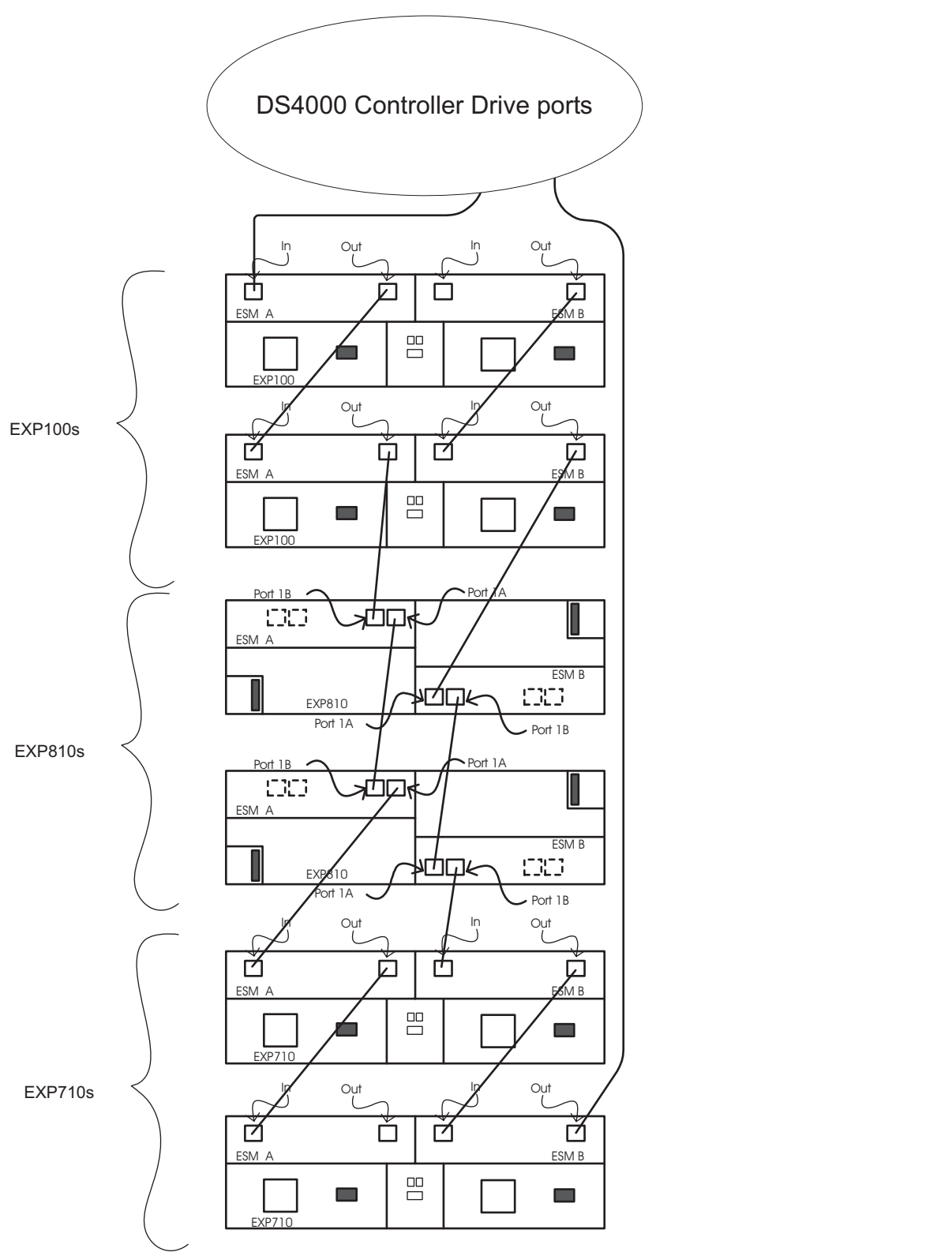**Requirement:** For the DS4300, this is currently a requirement.

DS4000 Controller Drive ports

In   Out   In   Out
ESM A   ESM B
EXP100

In   Out   In   Out
ESM A   ESM B
EXP100

EXP100s

Port 1B   Port 1A
ESM A
                 ESM B
EXP810
Port 1A   Port 1B

Port 1B   Port 1A
ESM A
                 ESM B
EXP810
Port 1A   Port 1B

EXP810s

In   Out   In   Out
ESM A   ESM B
EXP710

In   Out   In   Out
ESM A   ESM B
EXP710

EXP710s

Figure 13. First example of grouping EXP100s, EXP710s, and EXP810s behind a DS4000 controller drive port

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DS4000 Controller Drive ports

In   Out   In   Out

ESM A   ESM B

EXP710

EXP710s

In   Out   In   Out

ESM A   ESM B

EXP710

Port 1B   Port 1A

ESM A

ESM B

EXP810
Port 1A   Port 1B

EXP810s

Port 1B   Port 1A

ESM A

ESM B

EXP810
Port 1A   Port 1B

In   Out   In   Out

ESM A   ESM B

EXP100

EXP100s

In   Out   In   Out

ESM A   ESM B
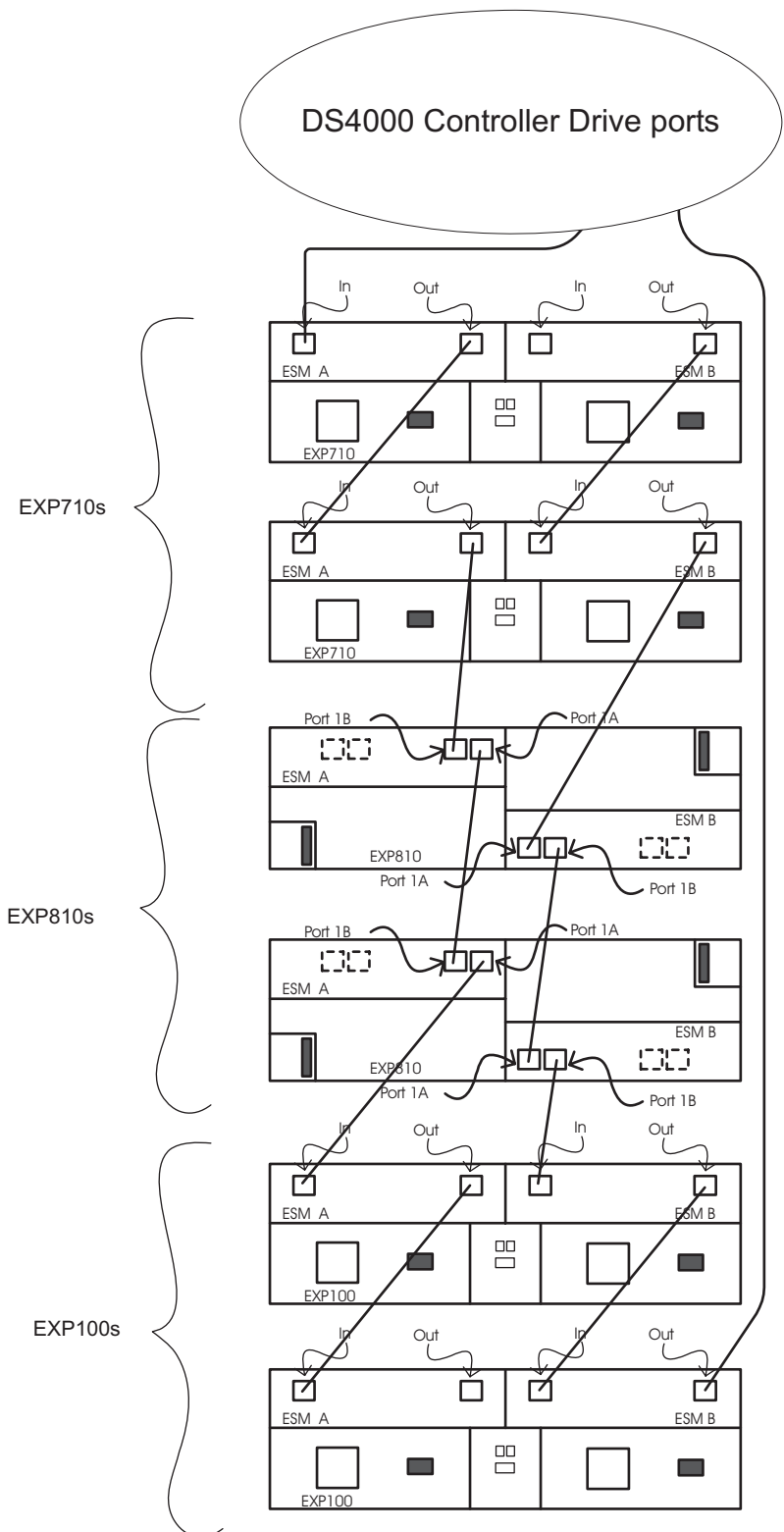
EXP100

Figure 14. Second example of grouping EXP100s, EXP710s, and EXP810s behind a DS4000 controller drive port

GC26-7907-02