Infortrend

Expansion Enclosure Guide

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Abstract:
This guide contains instructions and system limitations for adding expansion enclosures to Infortrend storage system without affecting its existing storage operations.

Contents

Introduction

Infortrend storage systems are made of high quality and durable components based on a high-scalable hardware design, providing support in terms of scalability and upgradeability. You also have the option to expand your storage system's capacity with Infortrend's expansion enclosures in different form factors, allowing you more storage and provide quicker and more efficient storage services without downtime.

The sections in this chapter list the expansion rules that you must follow when configuring the expansion enclosures with SAS 12 Gb/s drive-side models.

Overview of Maximum Drives

Infortrend provides various form factors that you can select for storage systems and expansion enclosures. The maximum number of drives can be calculated based on the different models. Infortrend always uses SAS expansion technology to implement massive drive scalability. Most of the products have onboard SAS ports to connect expansion enclosures and some models support SAS expansion board to connect more expansion systems.

Take a look at the table below for Infortrend's products, the maximum number of drives, and their supported interfaces:

Hybrid SAS Interface	Storage System Drives	On-board SAS Ports	SAS Expansion Board	Maximum Drives
EonStor DS Family (SAS 12Gb/s)	448 within 15 mixed expansion enclosures		N/A	448
EonStor GS 1000 Gen2 EonStor GSe 1000 Gen2	448 within 15 mixed expansion enclosures		N/A	448
EonStor GS 2000/3000/4000 EonStor GSe 2000/3000 EonStor GSc 2000/3000	448 within 15 mixed expansion enclosures		448 within 15 mixed expansion enclosures	896 (448 + 448)
EonStor GS 3000/4000 Gen2	448 within 15 x (JB3012/JB3016/JB3060/JB3060L/JB3025BA)		448 within 15 x (JB3012/JB3016/JB3060/JB3060L/JB3025BA)	896 (448 + 448)
EonStor GSe 3000/4000 Gen2	448 within 15 x (JB 3016/JB3060/JB3060L)		448 within 15 x (JB 3016/JB3060/JB3060L)	896 (448 + 448)
EonStor GS 5000 EonStor GSc 5000	N/A	N/A	[896 within 15 mixed expansion enclosures] x 2 expansion boards	1792 (896 + 896)
Hybrid SATA Interface	Storage System Drives	On-board SAS Ports	SAS Expansion Board	Maximum Drives
EonStor GSe Pro 100/200	5 bay, 8 bay	N/A	32 with 4 expansion enclosures	37 (5+32), 40 (8+32)
EonStor GSe Pro 1000	4 bay, 8 bay	N/A	N/A	8
EonStor GSe Pro 3000	8 bay, 12 bay, 16 bay	N/A	448 within 15 mixed expansion enclosures	448
All Flash SAS Interface	Storage System Drives	On-board SAS Ports	SAS Expansion Board	Maximum Drives
EonStor GSa 2000	24 bay	360 with 15 x JB3024B	360 with 15 x JB3024B	744 (24 + 360 + 360)
EonStor GSa 3000	25 bay	375 with 15 x JB3025B	375 with 15 x JB3025B	775 (25 + 375 + 375)
EonStor GSa 3000/4000 Gen2	448 within 15 x (JB3012/JB3016/JB3060/JB3060L/JB3025BA)		448 within 15 x (JB3012/JB3016/JB3060/JB3060L/JB3025BA)	896 (448 + 448)
EonStor GSa 5000	N/A	N/A	[375 with 15 x JB3025B]x 2 expansion boards	750 (375 + 375)
AI Appliance	Storage System Drives	On-board SAS Ports	SAS Expansion Board	Maximum Drives
EonStor GSi 3016	16 bay	224 with 14 x JB 3016 or 300 with 5 x JB 3060	N/A	316 (16 + 300)
EonStor GSi 5016	16 bay	224 with 14 x JB 3016 or 420 with 7 x JB 3060	N/A	436 (16 + 420)
Storage Server	Storage System Drives	On-board SAS Ports	SAS Expansion Board	Maximum Drives
EonServ 4012	12 bay	N/A	168 with 14 x JB 312 or 300 with 5 x JB 360	312 (12 + 300)
EonServ 4016	16 bay	N/A	224 with 14 x JB 316 or 300 with 5 x JB 360	316 (16 + 300)
EonServ 5012 Gen 1/Gen2	12 bay	168 with 14 x JB 312 or 300 with 5 x JB 360	N/A	312 (12 + 300)
EonServ 5016 Gen 1/ Gen2	16 bay	224 with 14 x JB 316 or 300 with 5 x JB 360	N/A	316 (16 + 300)
EonServ 7012	12 bay	168 with 14 x JB 312 or 420 with 7 x JB 360	N/A	432 (12 + 420)
EonServ 7016	16 bay	224 with 14 x JB 316 or 420 with 7 x JB 360	N/A	436 (16 + 420)

Table 1: Maximum Drives of Current Models

Hybrid Expansion Enclosures

Infortrend allows some models to support hybrid expansion enclosure connections. The onboard SAS expansion port (either dual or single port) supports up to **448** drives for each expansion chain, which is limited by the SAS chip used. Infortrend also offers SAS 12 Gb/s expansion board for some models, which uses the same SAS chip as the onboard expansion ports. You can use twice the supported number of drives of up to **896** (**1792** for EonStor GS/GSc 5000) by cascading the second expansion chain via the expansion host boards. Do note that not every model supports hybrid expansion enclosures configuration.

For the supported number of drives, see section **Overview of Maximum Drives**.

Systems that support hybrid expansion enclosures:

- EonStor DS/GS/GSe family (12 Gb/s SAS drive-side models)
- EonStor GSc family
- EonStor GSe Pro 3000 series

Systems that do not support hybrid expansion enclosures:

- EonStor DS/GS/GSe family (6 Gb/s SAS drive-side models)
- EonStor GSa family
- EonStor GSi family
- EonServ family
- EonStor GSe Pro 100/200/1000 series

Expansion Enclosure Number

Before setting up an extra expansion enclosure to an existing configuration, you must set the rotary ID switch using a flat-blade screwdriver. Do note that each expansion enclosure must have a unique ID within an expansion chain. Currently, the expansion enclosure's rotary ID switch is numbered from 1 to 15, which means you can only connect up to 15 expansion enclosures per expansion chain.

IMPORTANT!
To prevent any ID conflicts, ensure that you set a unique ID to each expansion enclosure when connecting in a multi-array environment.

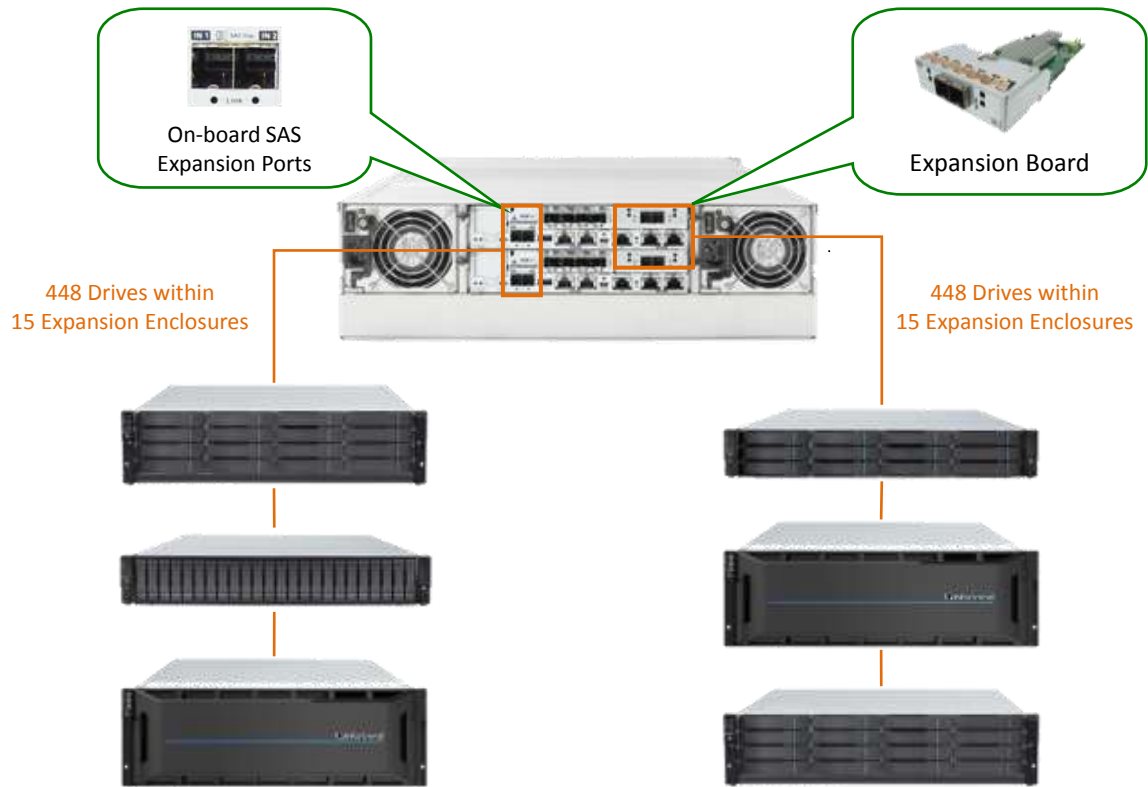

Figure 1: Expansion Enclosures ID switch

On-board SAS
Expansion Ports

Expansion Board

448 Drives within
15 Expansion Enclosures

448 Drives within
15 Expansion Enclosures

Figure 2: Hybrid Expansion Enclosures

Expansion Board

896 Drives within
15 Expansion Enclosures
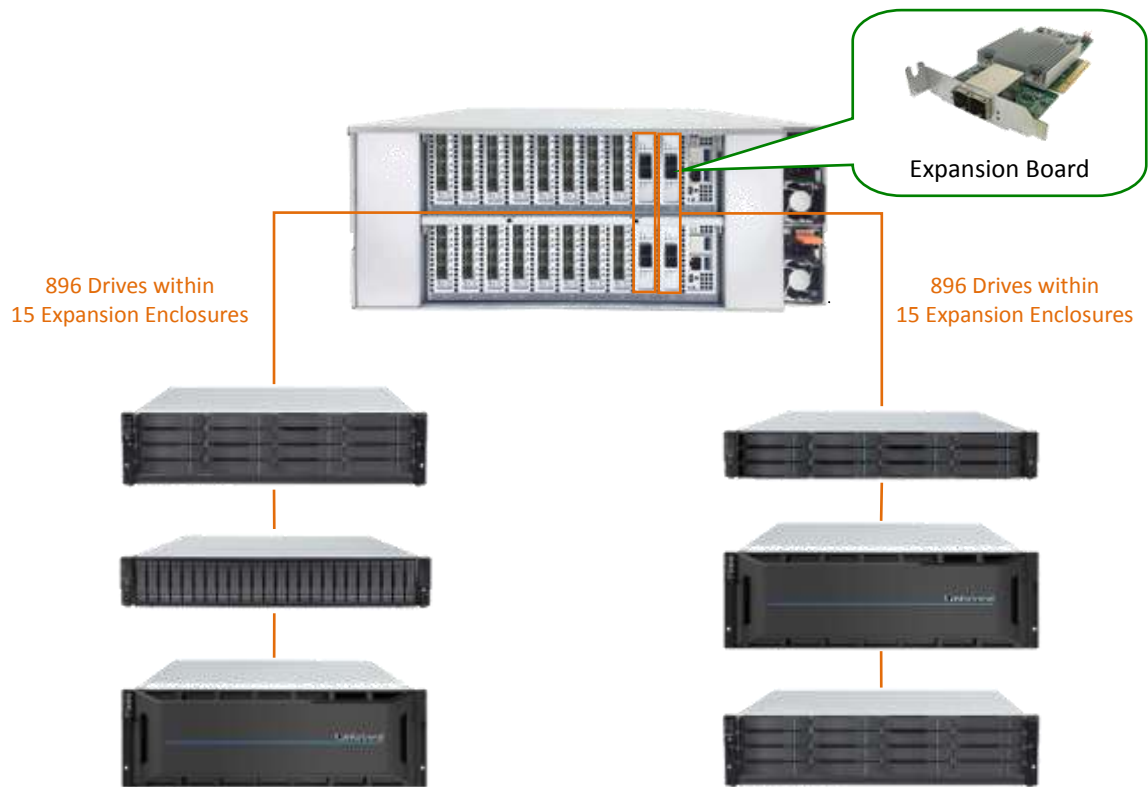
896 Drives within
15 Expansion Enclosures

Figure 3: Hybrid Expansion Enclosures of EonStor GS/GSc 5000

Expansion Enclosure Connections

The sections in this chapter discuss the connections between expansions and storage systems with SAS 6 Gb/s and SAS 12 Gb/s technologies. Since the SAS drive-side protocol technology has been upgraded from SAS 6 Gb/s to SAS 12 Gb/s, the operating storage system can use different SAS protocol for expansion.

SAS 12 Gb/s Storage System

For Infortrend storage systems with SAS 12 Gb/s drive-side, the onboard SAS expansion ports are marked as **IN**.
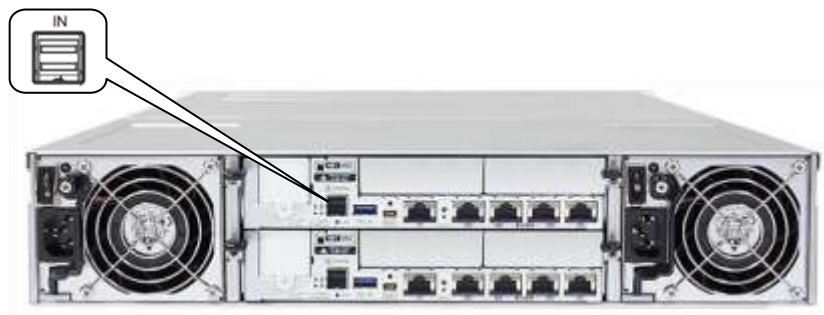

Figure 4: SAS 12 Gb/s Storage System Onboard Expansion Port

For any type of expansion enclosure, connect a SAS cable (blue) from the primary controller's SAS expansion port of the storage system to the primary controller's **OUT** SAS port of the first expansion enclosure.

To configure the redundant paths in two daisy-chain topology, connect a SAS cable (orange) from the second controller's SAS expansion port of the storage system to the second controller's SAS **OUT** port of the last expansion enclosure. Basic connection rule when connecting systems in this connection type is **IN to OUT**, from the last expansion enclosure to the first expansion enclosure.
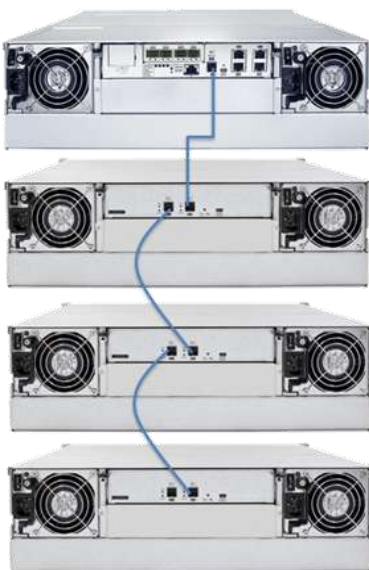

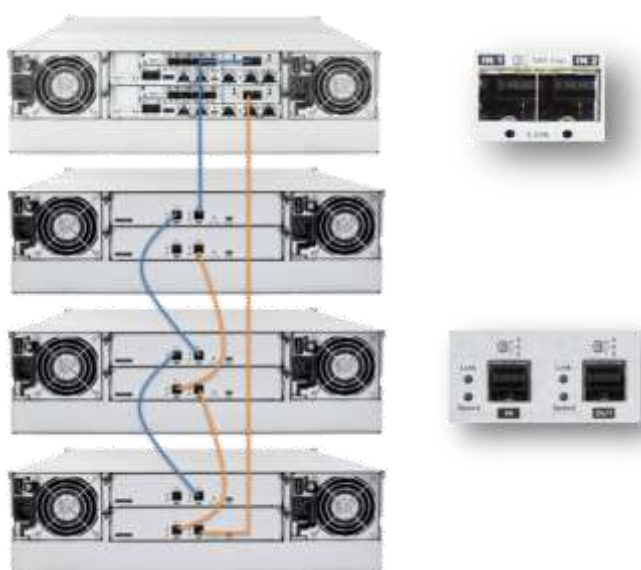*Figure 5: Connecting single-controller expansions using the onboard SAS 12 Gb/s expansion ports .*

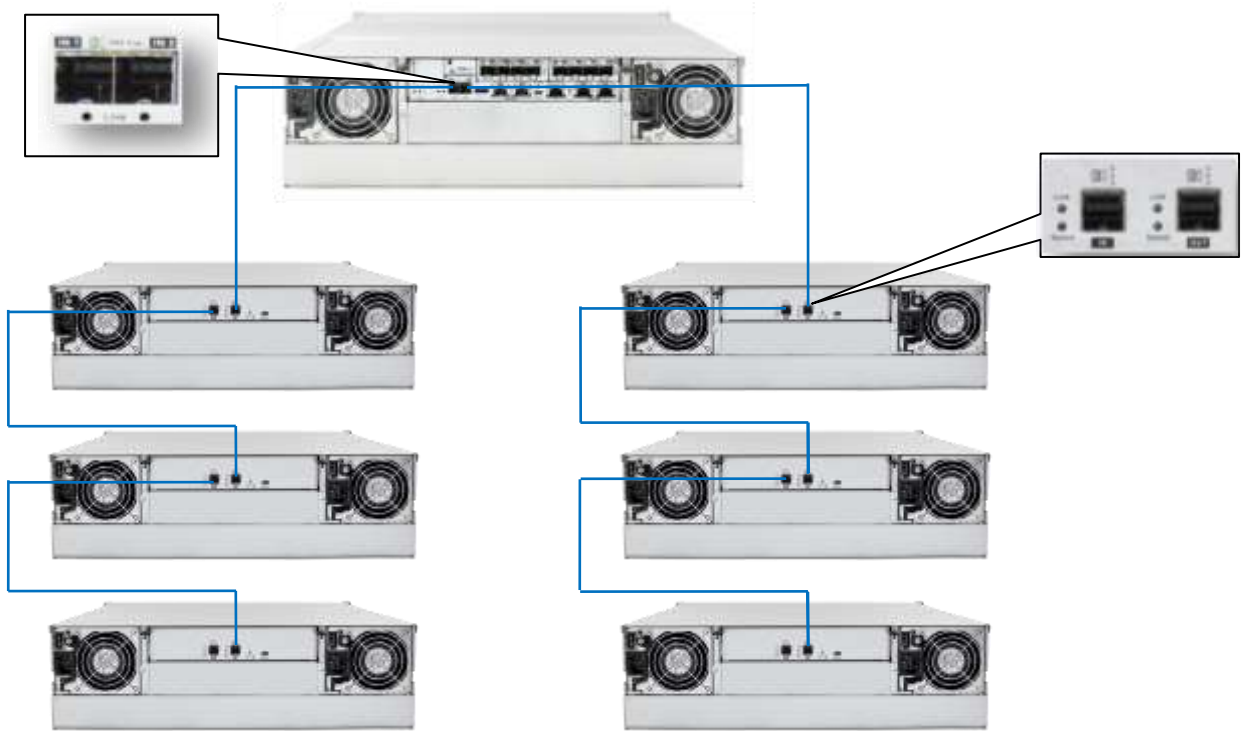*Figure 6: Connecting dual-controller expansions using host board's SAS 12Gb/s expansion ports.*

Figure 7: Connecting single-controller expansions using the onboard SAS 12Gb/s expansion ports
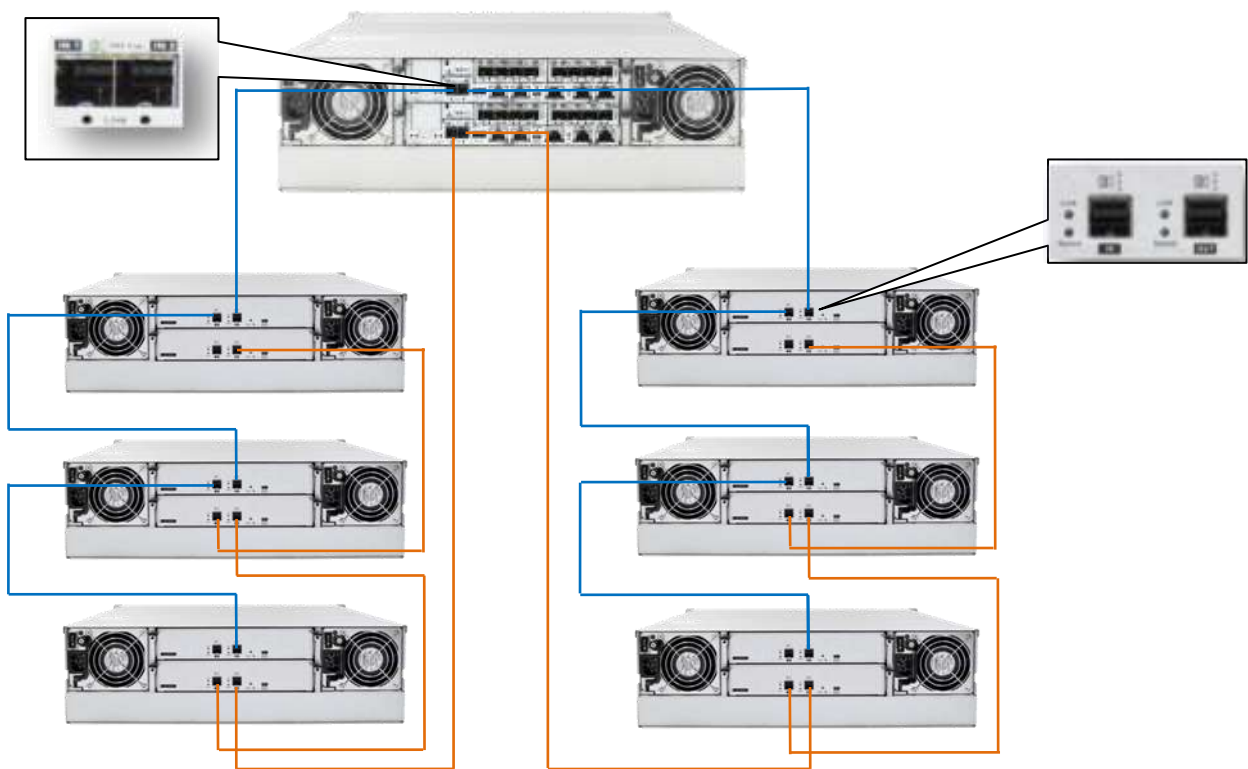

Figure 8: Connecting dual-controller expansions using the onboard SAS 12Gb/s expansion ports

SAS 6 Gb/s Storage System

For SAS 6 Gb/s drive-side storage system, the SAS expansion ports are marked as **OUT**.
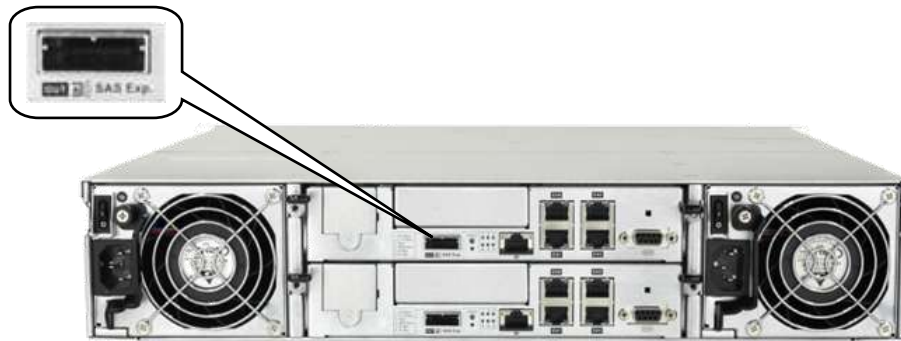

Figure 9: SAS 6 Gb/s Storage System Onboard Expansion Port

For any type of expansion enclosure, attach a SAS cable (blue) from the primary controller's SAS OUT port of the storage system to the primary controller's **IN** SAS port of the expansion enclosure.

To ensure redundancy in two daisy-chain topology, connect a SAS cable (orange) from the second controller's SAS expansion port of the storage system to the second controller's **IN** SAS port of the last expansion enclosure. Basic connection rule when connecting systems in this connection type is **OUT to IN**, from the last expansion enclosure to the first expansion enclosure.
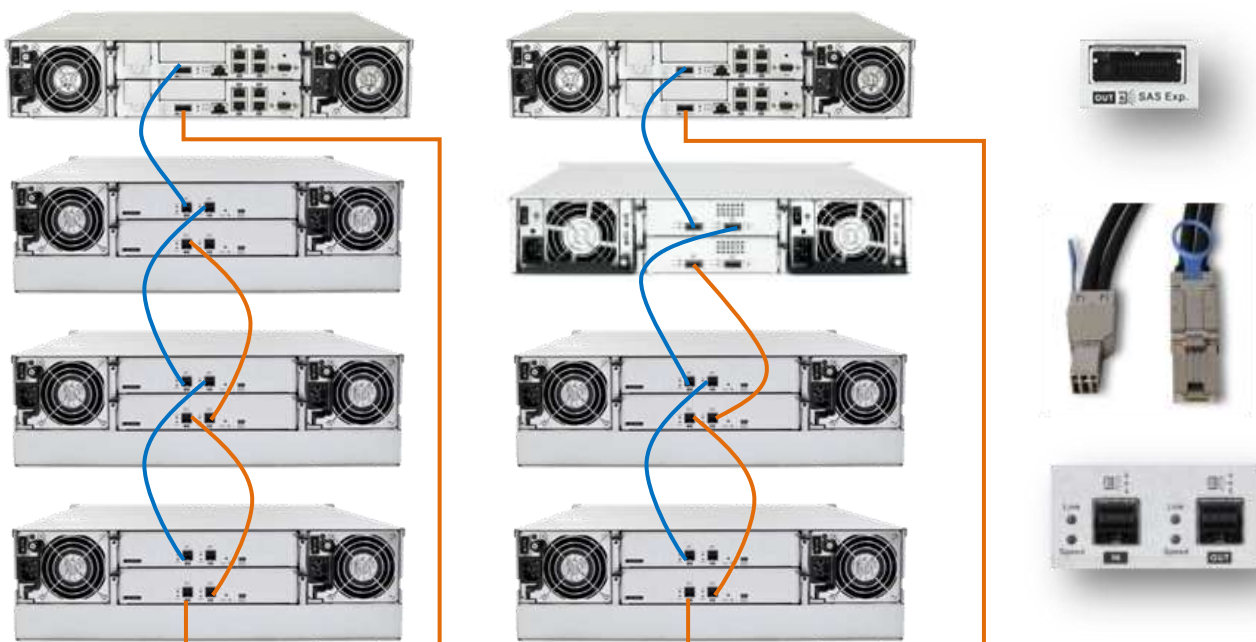

Figure 10: SAS 6 Gb/s Storage System Expansion Connection

NOTE:

1. SAS 6 Gb/s to 12 Gb/s cables are required for SAS 12 Gb/s expansion enclosure connection.
2. Currently this configuration is only supported by the model that is newer than EonStor DS 1000. For G6 and G7/G7i models, please refer to **Previous G7/G7i Model Expansion Table** and **Previous G6 Model Expansion Table**.

Model Classification (Single and Redundant)

Infortrend products, especially the high-availability models, are also classified by the number of controllers: **single** and **redundant**. Redundant storage models are expandable via the redundant expansion enclosure. Single storage models, on the other hand, are expandable via the single expansion enclosures. All single models of storage and expansion enclosures are indentified by two letters: **S** and **G**. **G** models are not upgradeable to redundant (**R**) models, while **S** models are upgradeable to redundant (**R**) models by installing a second **S** model controller. Take note that not every product supports **S** model.

For more information, refer to the table below:

| High Availability Models		Single Model	Redundant Model	Upgradable
EonStor DS 1000/2000		G Model	R Model	No
EonStor DS 3000	DS 3024/3024B	S Model	R Model	Yes
	DS 3012/3016	G Model	R Model	No
EonStor DS 4000	DS 4024/4024B	S Model	R Model	Yes
	DS 4016	S & G Model	R Model	Yes (No for G Model)
EonStor GS 2000/3000/4000 EonStor GS 1000/3000/4000 Gen2 EonStor GSc 2000/3000 EonStor GSa 2000/3000 *(Except 4U60 form factor)*		S Model	R Model	Yes
EonStor GS 3060 EonStor GSc 3060		G Model	R Model	No
EonStor GS 5000 EonStor GSc 5000 EonStor GSa 5000		N/A	R Model	N/A
JB 3000 *(Except 4U60 form factor)*		S Model	R Model	Yes
JB 3060		G Model	R Model	No
Single Models		Single Model	Redundant Model	Upgradable
EonStor GSe Family		G Model	N/A	N/A
EonStor GSe Pro Family		G Model	N/A	N/A
EonStor GSi Family		G Model	N/A	N/A
EonServ Family		G Model	N/A	N/A
JB Pro 200		G Model	N/A	N/A
JB 300		G Model	N/A	N/A

Table 2: Single and Redundant Models
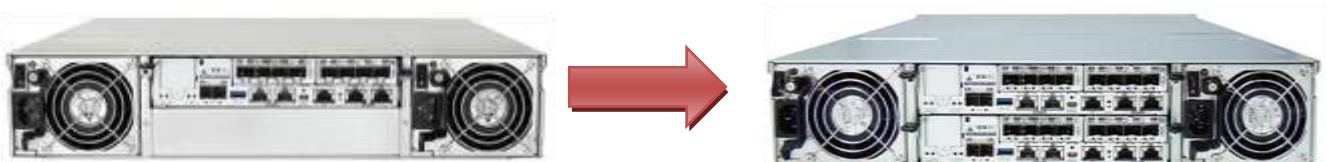
Figure 11: Upgrade from S Model to R Model

Expansion Enclosure On-line Expanding

This chapter details the steps of adding expansion enclosures to an already present storage system setup.
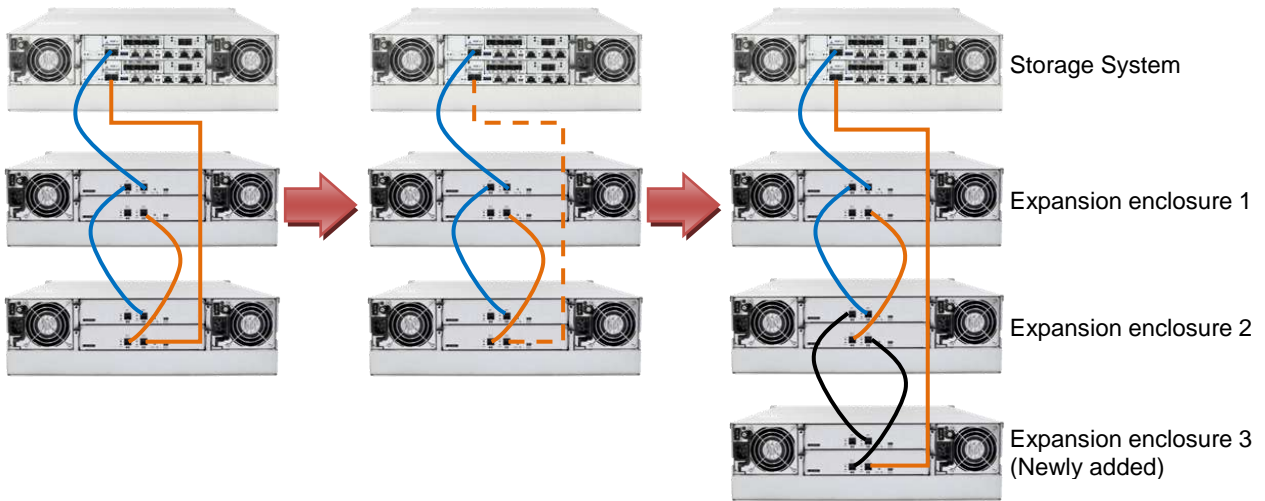

Figure 12: Adding an expansion enclosure

1. Setting the expansion enclosure ID

The expansion enclosure ID is located at the front panel of the expansion enclosure. When setting expansion IDs, always set them in order: Set the first expansion to 1, the second expansion ID in 2, and so on. The newly-added expansion enclosures must be connected after the current setup's last expansion enclosure. Do take note that the enclosure IDs must be different from each other.

Figure 13: Expansion enclosure ID

2. Installing the newly-added expansion enclosure

Due to the expansion enclosure's heavy weight, we recommend you to install the hard drives to the expansion enclosure after the enclosure is already installed to the rack. After the ID assignment and installation of the expansion enclosures to the rack, you can now connect the added expansion enclosures to the current system assembly via SAS cables.

In connecting the newly-added enclosures, ensure that the SAS cables are long enough to reach between SAS ports. The longest cable is used to connect the storage system and the last expansion enclosure. In some cases, the expansion enclosures are not directly installed on top or bottom of the storage system, so the cabling routes may vary. In most cases, at least one long SAS cable is required.

3. Reconnecting the redundant SAS path (for redundant models only)

Unplug the SAS cable from the current last expansion controller (see dotted orange connection in Figure 9), then connect it to the SAS port of newly-added last expansion's second controller (see longest orange cable connection in Figure 9). A longer SAS cable may be required.

This step involves disconnecting one of the SAS cables, so critical events on storage system such as reports of drive-side redundant path failure are expected. You will get notification events from the management GUI, LCD panel, LEDs, and other means of notification alerts.
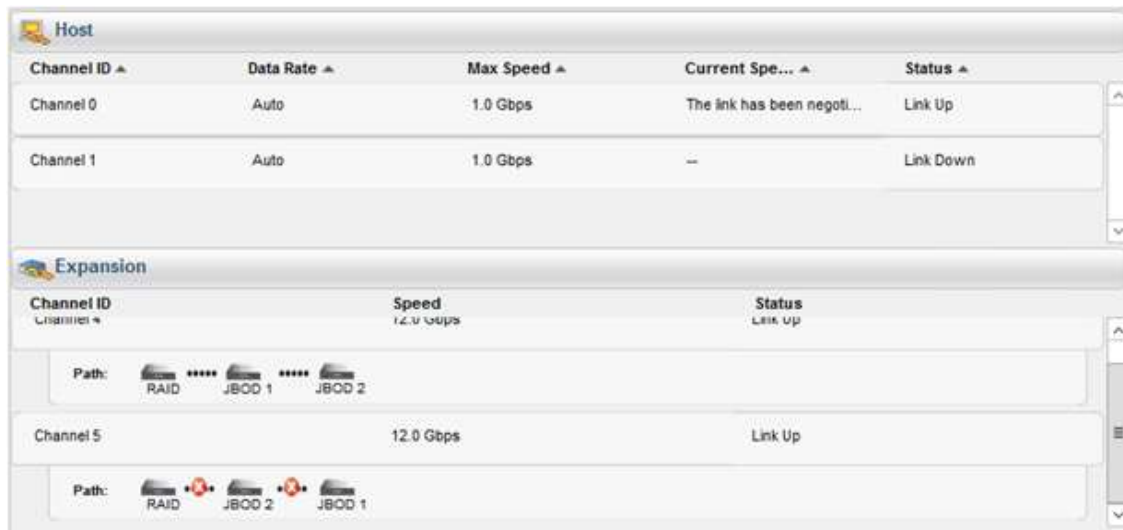

Figure 14: Redundant path failure of expansion enclosures in SANWatch

4. Connecting new SAS cable

Connect new SAS cables (see **black** connection) from the current last expansion to the newly-added expansion enclosure. Ensure to follow the SAS connection's **IN to OUT** rule described in Expansion Enclosure Connections.

> **NOTE:**
> The sample diagram is only for SAS 12 Gb/s storage system.

5. Turning on the newly-added expansion enclosure

Press the power button to turn on the expansion enclosure, then wait for the storage management GUI to display the additional expansion enclosure. Once the added subsystem is successfully working with the system assembly, the storage system's status on the management, GUI, LCD panel, LED panel, and other status features are back to normal.

Do take note that adding a newly-added expansion enclosure also sets the Hot-Add feature, which may cause delay or pause for about 10-20 seconds on the host I/O. The delay/pause time may vary depending on the operating system, drivers, and other factors.

6. Installing the newly added drives

We recommend you to install the drives into the newly-added expansion enclosure after the enclosure is successfully recognized by the storage system. After installing the drives to the enclosure, check the drives' status in the storage management GUI. Once the drives appeared on the GUI, you can already use them in storage provisioning. For more details, refer to the software manual.

IMPORTANT!

If SANWatch or Embedded RAIDWatch is used as a management tool for DS family, you must reload the mentioned management tool after connecting the new expansion enclosure. If the management tool does not display the newly-added enclosures, click **Data Reload** from the upper-right corner of the GUI to refresh the screen.

Figure 15: Data Reload button on Embedded RAIDWatch

EonStor DS 1000/2000/3000 & GS/GSe 1000

SAS 6Gb/s Model Expansion Table

Model Name	Expansion Enclosure
DS1012 (SAS 6Gb/s) DS2012 (SAS 6Gb/s) DS3012 (SAS 6Gb/s)	14 x JB 2012 / JB 3012 5 x JB 2048 5 x JB 2060(L) / JB 3060(L)
DS1016 (SAS 6Gb/s) DS2016 (SAS 6Gb/s) DS3016 (SAS 6Gb/s)	14 x JB 2016 / JB 3016 5 x JB 2048 5 x JB 2060(L) / JB 3060(L)
DS1024 (SAS 6Gb/s) DS2024 (SAS 6Gb/s) DS3024 (SAS 6Gb/s)	14 x JB 2016 / JB 3016 5 x JB 2048 5 x JB 2060(L) / JB 3060(L)
DS1024B (SAS 6Gb/s) DS2024B (SAS 6Gb/s) DS3024B (SAS 6Gb/s)	14 x JB 2024B / JB 3024B 5 x JB 2048 5 x JB 2060(L) / JB 3060(L)
DS1036B (SAS 6Gb/s)	13 x JB 2024B / JB 3024B 9 x JB 2036B 5 x JB 2060(L) / JB 3060(L)
DS3048 (SAS 6Gb/s)	5 x JB 2048 5 x JB 3060(L)
DS3060 (SAS 6Gb/s)	5 x JB 2060(L) / JB 3060(L)
GS1012 (SAS 6Gb/s) GSe1012 (SAS 6Gb/s)	14 x JB 2012 / JB 3012 5 x JB 2060(L) / JB 3060(L)
GS1016 (SAS 6Gb/s) GSe1016 (SAS 6Gb/s)	14 x JB 2016 / JB 3016 5 x JB 2060(L) / JB 3060(L)
GS1024 (SAS 6Gb/s)	14 x JB 2016 / JB 3016 5 x JB 2060(L) / JB 3060(L)
GS1024B (SAS 6Gb/s)	14 x JB 2024B / JB 3024B 5 x JB 2060(L) / JB 3060(L)

Previous G7/G7i Model Expansion Table

ESDS Model Name	Expansion Enclosure	Mixed Expansion Enclosure
B24F-R2852-6 B24F-R2652-4	9 x ESDS B24S-J2000-R (3U)	
B24F-G2852-6 B24F-G2652-4	9 x ESDS B24S-J2000-G (3U)	
S12F-R2651 S12F-R2851 S12E-R2251	8 x ESDS S12S-J2000-R/ JB 2012R (2U) 6 x ESDS B24S-J2000-R (3U) 4 x ESDS S48S-J2000-R (4U)	5 x ESDS S12S-J2000-R/ JB 2012R + 3 x ESDS S48S-J2000-R 2 x ESDS S12S-J2000-R/ JB 2012R + 4 x ESDS S48S-J2000-R
S12F-G2651 S12F-G2851 S12E-G2251	8 x ESDS S12S-J2000-G/ JB 2012S (2U) 6 x ESDS B24S-J2000-G (3U) 4 x ESDS S48S-J2000-G (4U)	5 x ESDS S12S-J2000-G/ JB 2012S + 3 x ESDS S48S-J2000-G 2 x ESDS S12S-J2000-G/ JB 2012S + 4 x ESDS S48S-J2000-G
S16F-R2652-4 S16F-R2651 S16F-R2852-6 S16F-R2851 S16E-R2251 S16E-R2152-6 S16S-R2250	8 x ESDS S16S-J2000-R/ JB 2016R (3U) 6 x ESDS B24S-J2000-R (2U) 4 x ESDS S48S-J2000-R (4U)	5 x ESDS S16S-J2000-R/ JB 2016R + 3 x ESDS S48S-J2000-R 2 x ESDS S16S-J2000-R/ JB 2016R + 4 x ESDS S48S-J2000-R
S16F-G2652-4 S16F-G2651 S16F-G2852-6 S16FG2851 S16E-G2251 S16E-G2152-6 S16S-G2250	8 x ESDS S16S-J2000-S/ JB 2016S (3U) 6 x ESDS B24S-J2000-G (2U) 4 x ESDS S48S-J2000-G (4U)	5 x ESDS S16S-J2000-S/ JB 2016S + 3 x ESDS S48S-J2000-G 2 x ESDS S16S-J2000-S/ JB 2016S + 4 x ESDS S48S-J2000-G
S24F-R2651 S24F-R2851	8 x ESDS S16S-J2000-R/ JB 2016R (3U) 6 x ESDS B24S-J2000-R (2U) 4 x ESDS S48S-J2000-R (4U)	5 x ESDS S16S-J2000-R/ JB 2016R + 2 x ESDS S48S-J2000-R 1 x ESDS S16S-J2000-R/ JB 2016R + 4 x ESDS S48S-J2000-R
S24F-G2651 S24F-G2851	8 x ESDS S16S-J2000-S/ JB 2016S (3U) 6 x ESDS B24S-J2000-G (2U) 4 x ESDS S48S-J2000-G (4U)	5 x ESDS S16S-J2000-S/ JB 2016S + 2 x ESDS S48S-J2000-G 1 x ESDS S16S-J2000-S/ JB 2016S + 4 x ESDS S48S-J2000-G
S48F-R2852-6 S48F-R2652-4	4 x ESDS S48S-J2000-R	
S48F-G2852-6 S48F-G2652-4	4 x ESDS S48S-J2000-G	

Previous G6 Model Expansion Table

ESDS Model Name	Expansion Enclosure
B12F-G2840-4 B12E-G2140-4 B12S-G2240	6 x ESDS B12S-J2000-G (1U) 6 x ESDS S12S-J2000-G/ JB 2012S (2U) 6 x ESDS S16S-J2000-S/ JB 2016S
B12F-R2840-4 B12E-R2140-4 B12S-R2240	6 x ESDS B12S-J2000-R (1U) 6 x ESDS S12S-J2000-R/ JB 2012R (2U) 6 x ESDS S16S-J2000-R/ JB 2016R
B24F-G2840-4 B24F-G2842-6 B24E-G2142-6 B24S-G2242-4 B24S-G2240	5 x ESDS B24S-J2000-S (2U) 5 x ESDS S12S-J2000-G/ JB 2012S (2U) 5 x ESDS S16S-J2000-S/ JB 2016S JB 3012/JB 3016[*1*2]
B24F-R2840-4 B24F-R2842-6 B24E-R2142-6 B24S-R2242-4 B24S-R2240	5 x ESDS B24S-J2000-R (2U) 5 x ESDS S12S-J2000-R/ JB 2012R (2U) 5 x ESDS S16S-J2000-R/ JB 2016R JB 3012/JB 3016[*1*2]
S12F-S2840N	6 x ESDS S12S-J2000-SN (2U)
S12F-R2840N	6 x ESDS S12S-J2000-RN (2U)
S12F-G2840-4 S12E-G2140-4 S12S-G2240-4 S12S-G2240	6 x ESDS S12S-J2000-G/ JB 2012S (2U) JB 3012[*1*2]
S12F-R2840-4 S12E-R2140-4 S12S-R2240-4 S12S-R2240	6 x ESDS S12S-J2000-R/ JB 2012R (2U) JB 3012[*1*2]
S16F-G2840-4 S16F-G2842-6 S16E-G2142-6 S16E-G2240 S16S-G2242-4 S16S-G2240-4 S16S-G2240	6 x ESDS S16S-J2000-S/ JB 2016S JB 3016[*1*2]
S16F-R2840-4 S16F-R2842-6 S16E-R2142-6 S16E-R2240 S16S-R2242-4 S16S-R2240-4 S16S-R2240	6 x ESDS S16S-J2000-R/ JB 2016R JB 3016[*1*2]
S24F-G2840-4 S24E-G2142-6 S24S-G2240-4 S24S-G2240	5 x ESDS S16S-J2000-S/ JB 2016S JB 3016[*1*2]
S24F-R2840-4	5 x ESDS S16S-J2000-R/ JB 2016R JB 3016[*1*2]
S48F-G2842-6	4 x ESDS S48S-J2000-G (4U)
S48F-R2842-6	4 x ESDS S48S-J2000-R (4U)

*1) This JBOD is only compatible with the RAID controller firmware v. 3.89J02 and SANWatch 3.0.e.100 or above.

*2) Tested only in a 1 RAID with 1 JBOD environment