

SAS JBOD Connection Guide

Best Practice

May 2026

ANNOUNCEMENT

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PREFACE

Technical Support

Do you have any questions or need help trouble-shooting a problem? Please contact QSAN Support, we will reply to you as soon as possible.

- Via the Web: https://www.qsan.com/technical_support
- Via Telephone: +886-2-77206355
- (Service hours: 09:30 - 18:00, Monday - Friday, UTC+8)
- Via Skype Chat, Teams / Skype ID: qsan.support
- (Service hours: 09:30 - 02:00, Monday - Friday, UTC+8, Summer time: 09:30 - 01:00)
- Via Email: support@qsan.com

Information, Tip, and Caution

This document uses the following symbols to draw attention to important safety and operational information.



INFORMATION

INFORMATION provides useful knowledge, definition, or terminology for reference.



TIP

TIP provides helpful suggestions for performing tasks more effectively.



CAUTION

CAUTION indicates that failure to take a specified action could result in damage to the system.

1. OVERVIEW

This document provides technical instructions for connecting expansion units with QSAN storage.

1.1. Introduction to SAS JBOD

QSAN XD5 series is a cost-effective DAS (Direct Attached Storage) or SAS JBOD (Just a Bunch Of Disks) expansion chassis designed for server expansion and is fully compatible with QSAN’s entire storage product line. XD5 series supports several standard form factors:

- LFF (Large Form Factor): 24-bay 19” rack mount 4U chassis, 16-bay 19” rack mount 3U chassis, 12-bay 19” rack mount 2U chassis, and 78-bay 19” rack mount 4U chassis.
- SFF (Small Form Factor): 26-bay 19” rack mount 2U chassis.

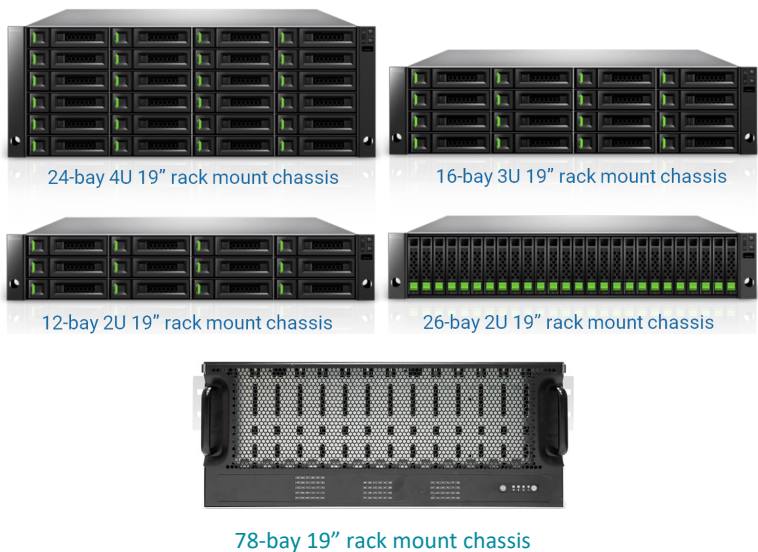


Figure 1-1 XD5 Series Form Factors

The following tables provide detailed information about all XD5 series models arranged by form factors.

Table 1-1 XD5 Series Models

MODEL NAME	CONTROLLER TYPE	FORM FACTOR, BAY COUNT, RACK UNIT
XD5324D	Dual Controller	LFF 24-bay 4U Chassis
XD5324S	Single Controller	LFF 24-bay 4U Chassis
XD5316D	Dual Controller	LFF 16-bay 3U Chassis
XS5316S	Single Controller	LFF 16-bay 3U Chassis
XS5312D	Dual Controller	LFF 12-bay 2U Chassis
XS5312S	Single Controller	LFF 12-bay 2U Chassis
XS5326D	Dual Controller	SFF 26-bay 2U Chassis
XS5326S	Single Controller	SFF 26-bay 2U Chassis
XS5378D	Dual Controller	LFF 78-bay 4U Chassis



INFORMATION

The XD5378D is only available in a dual-controller model.

1.2. Apply Models

The XD5 series can be used as an expansion unit for the following models.

Block Storage

- **XF5 Series:** XF5226D-12C, XF5226S-12C
- **XF4 Series:** XF4226D-8C, XF4226S-8C, XF4226D-4C, XF4226S-4C

- **XCubeSAN 5300 Series:** XS5326D, XS5326S, XS5324D, XS5324S, XS5316D, XS5316S, XS5312D, XS5312S
- **XCubeSAN 3300 Series:** XS3326D, XS3326S, XS3324D, XS3324S, XS3316D, XS3316S, XS3312D, XS3312S

Unified Storage

- **XN5 Series:** XN5226D-12C, XN5226S-12C
- **XN4 Series:** XN4226D-8C, XN4226S-8C, XN4226D-4C, XN4226S-4C
- **XN2 Series:** XN2216-8C, XN2216-4C, XN2212-8C, XN2212-4C, XN2216-2C, XN2212-2C, XN2204-4C, XN2202-2C
- **XCubeNXT 8100 Series:** XN8126D, XN8126S, XN8124D, XN8124S, XN8116D, XN8116S, XN8112D, XN8112S
- **XCubeNXT 5100 Series:** XN5126D, XN5126S, XN5124D, XN5124S, XN5116D, XN5116S, XN5112D, XN5112S



INFORMATION

The XF3 series and XN3 series do not support connecting SAS expansion units.

1.3. List of Available Cable

The following table shows available SAS cables. For host connections, it is recommended to use SAS cables shorter than 3 meters to ensure optimal performance and signal integrity. To enable the Wake-on-SAS feature for expansion enclosures, you must use QSAN genuine SAS cables with sideband support.

Table 1-2 The List of Available Cable

MODEL NAME	PICTURE	DESCRIPTION
CBL-12SH150		SAS 12G Expansion Cable, SFF-8644 to SFF-8644, 1.5 Meters
CBL-12SW150		SAS 12G Expansion Cable with Wake-on-SAS, SFF-8644 to SFF-8644, 1.5 Meters (This cable is not suitable for connecting HBA or RAID card)

2. DEPLOYMENT TYPES AND CABLING

This chapter describes the deployment options and cabling configurations for QSAN storage connecting to expansion units. The storage system can be deployed to host servers using either Fibre Channel or Ethernet connections to build a high-performance storage environment. For capacity expansion, the system supports connection to XD5 series expansion enclosures.

2.1. Deployment Types

The expansion unit supports following deployment types.

Single Path

The following figure shows a single-controller storage system connected to an expansion unit; the second figure shows a dual-controller storage system connected to an expansion unit but experiencing failure.

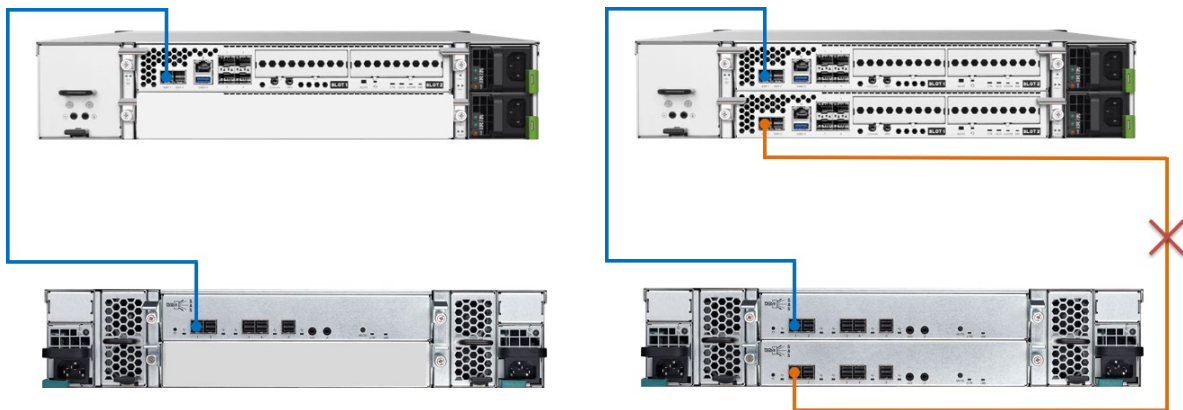


Figure 2-1 Single-Path Deployment Type

Step details are described below.

1. Connect the SAS cable from QSAN CTRL 1 EXP1 to JBOD CTRL 1 port 1.

In a single-path deployment, one path connects from the storage head to the expansion unit. In this deployment, only one controller in the enclosure is used. In dual-controller storage, single-channel degradation is provided, and data can be accessed.

Two Paths

The following figure illustrates the connections of a dual-controller storage system and expansion units. MPIO (Multipath Input/Output) configuration is designed to provide HA (High Availability) data connections to ensure data consistency in the event of a single path host connection failure.

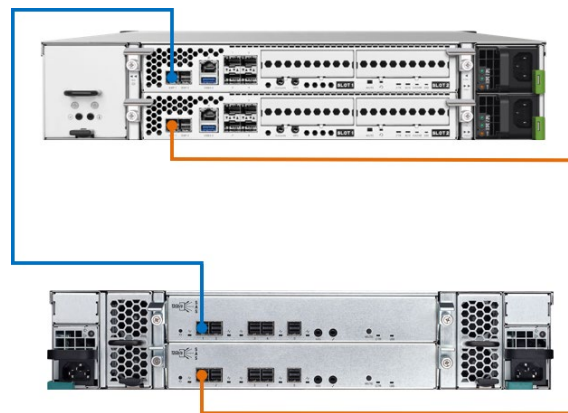


Figure 2-2 Two-Path Deployment Type

Step details are described below.

1. Connect the SAS cable from QSAN CTRL 1 EXP1 to JBOD CTRL 1 port 1.
2. Connect the SAS cable from QSAN CTRL 2 EXP1 to JBOD CTRL 2 port 1.

In a dual-path deployment, two paths connect from the storage head to the expansion unit. In this deployment, both controllers in the system are used. Basic dual-domain fault tolerance is provided, and the disk drives must support dual-path I/O (SAS or dual-port NVMe interface).

Four Path

The following diagram shows the connection of a dual-controller storage system and expansion units. The double-protected data connection ensures data consistency in the event of a single-path host connection failure.

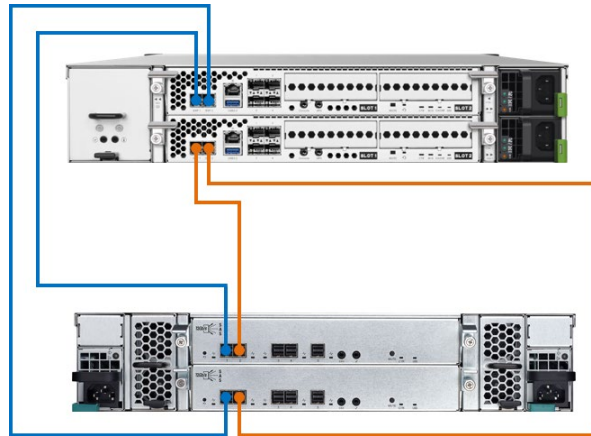


Figure 2-3 Four-Path Deployment Type

Step details are described below.

1. Connect the SAS cable from QSAN CTRL 1 EXP1 to JBOD CTRL 1 port 1.
2. Connect the SAS cable from QSAN CTRL 1 EXP2 to JBOD CTRL 2 port 1.
3. Connect the SAS cable from QSAN CTRL 2 EXP1 to JBOD CTRL 1 port 2.
4. Connect the SAS cable from QSAN CTRL 2 EXP2 to JBOD CTRL 2 port 2.

In a four-path deployment, in addition to the two paths from the storage heads to the expansion units, there are two additional paths for cross-connection redundancy between the controllers. In this deployment, a high-performance and fully redundant structure is provided. The conditions for the disk drive are the same as dual-path deployment.

The following describes the situation of the QSAN storage system.

Table 2-1 Storage Status Connected to the Expansion Unit

ITEM	TWO CABLES	ONLY ONE CABLE LEFT	FOUR CABLES
Connection Context	One per controller, corresponding to JBOD CTRL1 and CTRL2	Single controller or one line failure	Head CTRL1 and CTRL2 have two cables each, cross-connected to JBOD CTRL1 and CTRL2
XF5 / XF4 Series	Basic dual-path redundant configuration: two connections provide fault tolerance and load sharing.	Degraded mode: Loss of redundancy, but still accessible. JBOD performance slightly degraded, and the Event log displays "Path Degraded".	High-performance configuration: Dual controllers with dual-channel cross-connection provide higher I/O bandwidth and stability.
XN5 / XN4 Series			
XCubeSAN Series	Standard dual-controller architecture: Dual-path fault-tolerant design ensures continued operation even if any path fails.	Degraded but operational: The system enters Degraded state, but the Pool and Disk is still fully accessible.	High-performance configuration: It improves performance and load balancing.
XCubeNXT Series			

System Behavior Summary

- Two Cables Deployment:** Under normal circumstances, both paths are available, and I/O traffic is distributed using the MPIO /NMP (Network Multipathing) Round-Robin mechanism. If either path is disconnected, the system automatically fails over, ensuring uninterrupted operation.
- Only One Cable Left:** The JBOD will not be offline; MPIO will automatically switch to a single path. It is recommended to repair it as soon as possible to restore full fault tolerance.
- Four Cables:** For XF5, XF4, XN5, and XN4 series, this ensures full JBOD fault tolerance and zero-disruption operation. For XCubeSAN and XCubeNXT series, it improves performance and load balancing.

2.2. Expansion Configuration Rules

The diagram below shows the connection of the XCubeSAN and XCubeNXT series with the most expansion units.

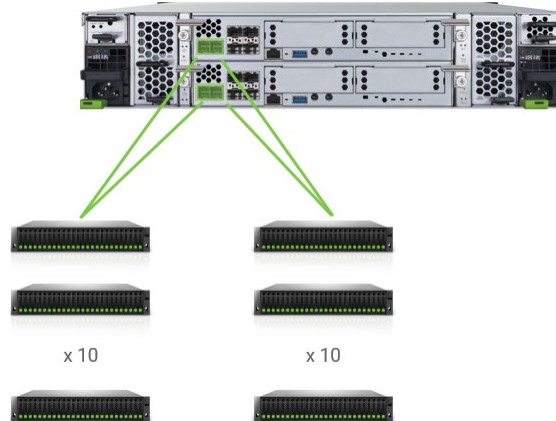


Figure 2-4 Connection of XCubeSAN and XCubeNXT Series

The following table lists the configuration rules for the storage system and expansion enclosures. Before deploying your system, you can refer to the table below to understand the maximum number of expansion cabinets and hard drives.

Table 2-2 2U 12-bay Expansion Configuration Rules

STORAGE MODELS	EXPANSION UNIT	MAX. NUMBER OF EXPANSION UNIT	MAX. NUMBER OF DISK DRIVE	MAX. RAW CAPACITY (SAS HDD 26 TB, SAS SSD 30.72 TB)
XS5312 / XS3312 XN8112 / XN5112 (2U 12-bay, LFF)	XD5312 (2U 12-bay, LFF)	20 (SAS JBOD)	12 (SAS HDD) + 20 x 12 (SAS HDD) = 252	6,552 TB
	XD5316 (2U 16-bay, LFF)	20 (SAS JBOD)	12 (SAS HDD) + 20 x 16 (SAS HDD) = 332	8,632 TB
	XD5324 (2U 24-bay, LFF)	20 (SAS JBOD)	12 (SAS HDD) + 20 x 24 (SAS HDD) = 492	12,792 TB
	XD5326 (2U 26-bay, SFF)	20 (SAS JBOD)	12 (SAS HDD) + 20 x 26 (SAS SSD) = 532	16,286 TB

	XD5378 (4U 78-bay, LFF)	4 (SAS JBOD)	12 (SAS HDD) + 4 x 78 (SAS HDD) = 324	8,424 TB
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Table 2-3 3U 16-bay Expansion Configuration Rules

STORAGE MODELS	EXPANSION UNIT	MAX. NUMBER OF EXPANSION UNIT	MAX. NUMBER OF DISK DRIVE	MAX. RAW CAPACITY (SAS HDD 26 TB, SAS SSD 30.72 TB)
XS5316 / XS3316 XN8116 / XN5116 (3U 16-bay, LFF)	XD5312 (2U 12-bay, LFF)	20 (SAS JBOD)	16 (SAS HDD) + 20 x 12 (SAS HDD) = 256	6,656 TB
	XD5316 (2U 16-bay, LFF)	20 (SAS JBOD)	16 (SAS HDD) + 20 x 16 (SAS HDD) = 336	8,736 TB
	XD5324 (2U 24-bay, LFF)	20 (SAS JBOD)	16 (SAS HDD) + 20 x 24 (SAS HDD) = 496	12,896 TB
	XD5326 (2U 26-bay, SFF)	20 (SAS JBOD)	16 (SAS HDD) + 20 x 26 (SAS SSD) = 536	16,390 TB
	XD5378 (4U 78-bay, LFF)	4 (SAS JBOD)	16 (SAS HDD) + 4 x 78 (SAS HDD) = 328	8,528 TB

Table 2-4 4U 24-bay Expansion Configuration Rules

STORAGE MODELS	EXPANSION UNIT	MAX. NUMBER OF EXPANSION UNIT	MAX. NUMBER OF DISK DRIVE	MAX. RAW CAPACITY (SAS HDD 26 TB, SAS SSD 30.72 TB)
XS5324 / XS3324 XN8124 / XN5124 (4U 24-bay, LFF)	XD5312 (2U 12-bay, LFF)	20 (SAS JBOD)	24 (SAS HDD) + 20 x 12 (SAS HDD) = 264	6,864 TB
	XD5316 (2U 16-bay, LFF)	20 (SAS JBOD)	24 (SAS HDD) + 20 x 16 (SAS HDD) = 344	8,944 TB
	XD5324 (2U 24-bay, LFF)	20 (SAS JBOD)	24 (SAS HDD) + 20 x 24 (SAS HDD) = 504	13,104 TB

	XD5326 (2U 26-bay, SFF)	20 (SAS JBOD)	24 (SAS HDD) + 20 x 26 (SAS SSD) = 544	16,598 TB
	XD5378 (4U 78-bay, LFF)	4 (SAS JBOD)	24 (SAS HDD) + 4 x 78 (SAS HDD) = 336	8,736 TB

Table 2-5 2U 26-bay Expansion Configuration Rules

STORAGE MODELS	EXPANSION UNIT	MAX. NUMBER OF EXPANSION UNIT	MAX. NUMBER OF DISK DRIVE	MAX. RAW CAPACITY
				(SAS HDD 26 TB, SAS SSD 30.72 TB)
XS5326 / XS3326 XN8126 / XN5126 2U 26-bay, SFF	XD5312 (2U 12-bay, LFF)	20 (SAS JBOD)	26 (SAS SSD) + 20 x 12 (SAS HDD) = 266	7,038 TB
	XD5316 (2U 16-bay, LFF)	20 (SAS JBOD)	26 (SAS SSD) + 20 x 16 (SAS HDD) = 346	9,118 TB
	XD5324 (2U 24-bay, LFF)	20 (SAS JBOD)	26 (SAS SSD) + 20 x 24 (SAS HDD) = 506	13,278 TB
	XD5326 (2U 26-bay, SFF)	20 (SAS JBOD)	26 (SAS SSD) + 20 x 26 (SAS SSD) = 546	16,773 TB
	XD5378 (4U 78-bay, LFF)	4 (SAS JBOD)	26 (SAS SSD) + 4 x 78 (SAS HDD) = 338	8,910 TB



INFORMATION

The maximum number of connecting to XD5378 expansion units is 4.

3. CONCLUSION

When expanding your storage environment, connecting XD5 series expansion enclosures allows for seamless scalability, enhancing storage capacity while maintaining high performance. By adhering to these best practices for cabling and configuration, users can effectively expand their storage environment, providing additional storage space without compromising on system reliability or performance.

4. APPENDIX

4.1. Apply To

Please refer to Chapter 1.2, [Apply Models](#) section for supported models.

XEVO 2 firmware 2.2.0 and later

XEVO 3 firmware 3.2.0 and later

QSM 4 firmware 4.2.0 and later

4.2. Reference

Product Page

- Block Storage
 - [XF5 Series](#)
 - [XF4 Series](#)
 - [XCubeSAN 5300 Series](#)
 - [XCubeSAN 3300 Series](#)
- Unified Storage
 - [XN5 Series](#)
 - [XN4 Series](#)
 - [XN2 Series](#)
 - [XCubeNXT 8100 Series](#)
 - [XCubeNXT 5100 Series](#)
 - [QSM Storage Manager](#)

Document

- [Hardware Manual](#)
- [XEVO 2 Software Manual](#)

- [XEVO 3 Software Manual](#)
- [QSM 4 Software Manual](#)
- [NVMe-oF JBOF Connection Guide](#)