

STORAGE DEVELOPER CONFERENCE



BY Developers FOR Developers

Virtual Conference
September 28-29, 2021

How to Connect A SAS System

An Overview of STA's SAS Integrator's Guide

Presented by Alex Haser

Introduction to the Serial Attached SCSI (SAS) Integrator's Guide

- Provides a quick reference to the menu of standard components required to assemble a SAS system
 - Includes connections from the SAS drive (a hard drive or a solid state drive (SSD)) out to the enclosure level, including the associated box-to-box cabling
 - The standard cables shown assume that system boards, adapter cards, backplanes, etc. are pinned out per the SAS-4.1 standard

Speaker
Photo Will
Be Placed
Here

Disclaimers:

Speaker
Photo Will
Be Placed
Here

- Information in SAS Integrator's Guide is specific to SAS-4.1 ([INCITS 567](#)). At the time of publication of the SAS Integrator's Guide, SAS-4.1 has not been finalized. However, no technical changes are anticipated before its release.
- Refer to SAS-4.1 for detailed information on connectors, cable assemblies, pinouts, sideband wiring, etc.
- There are multiple applications for these cables assemblies that involve interfaces other than SAS.
 - For compatibility of SIDEBAND signals, the recommended SIDEBAND signal pin assignment is provided in SFF-8448
 - SFF-9402 provides a reference for signal assignments of SAS and PCIe for specific cable assemblies defined in SAS-4.1

Obsolete Connectors & Cables

- With the introduction of SAS-4.1, some connectors & cable assemblies were removed due to lack of support for signal speeds
- These unsupported connectors & cable assemblies include:
 - SAS High Density Drive
 - SAS (4i)
 - Mini SAS (4i & 4x)

Speaker
Photo Will
Be Placed
Here

SAS Connectors

Internal & external connectors

SAS Connectors

- Mechanical definitions of SAS connectors are documented in SFF specifications

	Connector	Documentation
Internal Connectors	SAS Drive	SFF-8482 (SFF-8223, SFF-8323, SFF-8523)
	SAS Multilink Drive	SFF-8630
	Multifunction 6X Unshielded	SFF-8639
	Micro SAS	SFF-8486 (SFF-8147)
	Mini SAS HD (4i, 8i, & 16i)	SFF-8643
	SlimSAS (4i & 8i)	SFF-8654
	SAS MiniLink (4i & 8i)	SFF-8611 & SFF-8612
External Connectors	Mini SAS HD (4x, 8x, & 16x)	SFF-8644
	QSFP	SFF-8662 & SFF-8672

- Refer to Section 5.4.3 in SAS-4.1 for more information

Speaker
Photo Will
Be Placed
Here

SAS Cable Assemblies

Internal Drive, Internal Symmetric, Internal Fanout,
& External Cable Assemblies

Internal Drive Cable Assemblies

■ Basic Requirements:

- The following signal connections are vendor specific:
 - Power
 - READY LED
 - POWER DISABLE
- The SAS initiator device uses a SATA host plug connector for connection to a SAS Drive cable assembly
- The signal assignment for the SAS initiator or expander device with this connector is the same as that defined for a SATA host

■ Sideband Requirements:

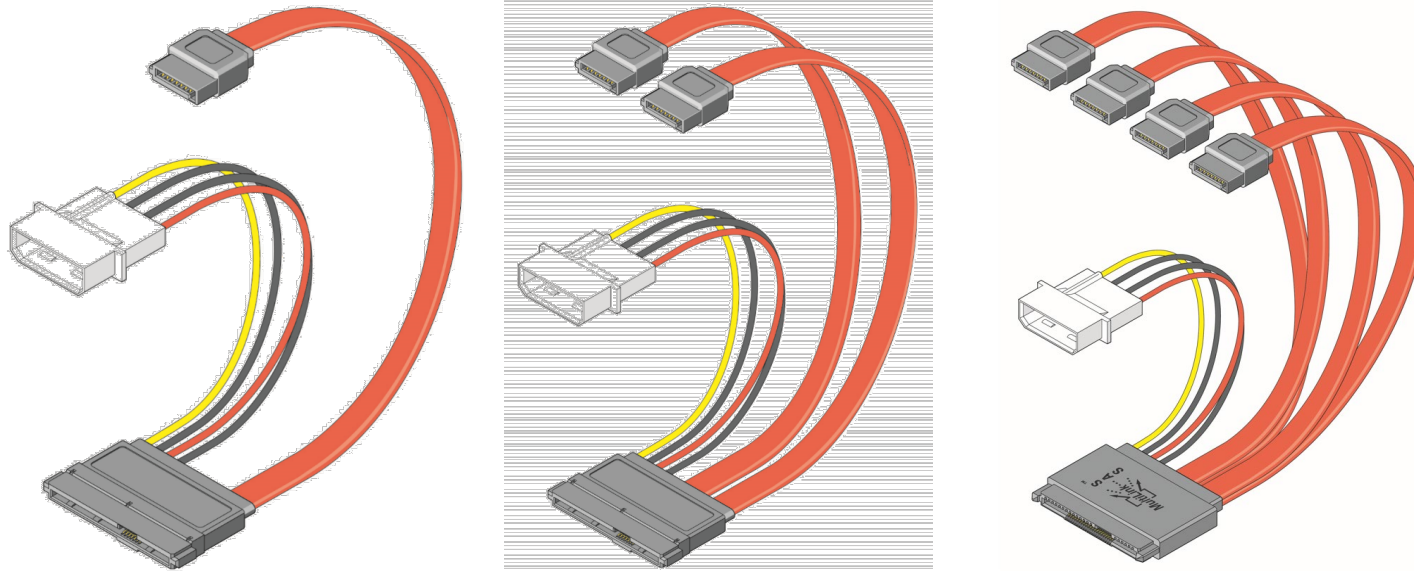
- Sideband signals are not used for drive cables

Speaker
Photo Will
Be Placed
Here

Internal Drive Cable Assembly Types

Speaker
Photo Will
Be Placed
Here

Connector that connects to the SAS target device	Connects to the SAS initiator device or expander device
Single-port Drive cable connector	SATA signal cable connector
Dual-port Drive cable connector	2 SATA signal cable connectors
SAS MultiLink Drive cable connector	4 SATA signal cable connectors



Figures

Left: Single-Port Drive Cable Connector to SATA Signal Cable Connector
Center: Dual-Port Drive Cable Connector to 2 SATA Signal Cable Connectors
Right: MultiLink Drive Cable Connector to 4 SATA Signal Cable Connector

SAS Internal Symmetric Cable Assemblies

Speaker
Photo Will
Be Placed
Here

- Symmetric cables: One connector at either end of a cable

Connector

Connector

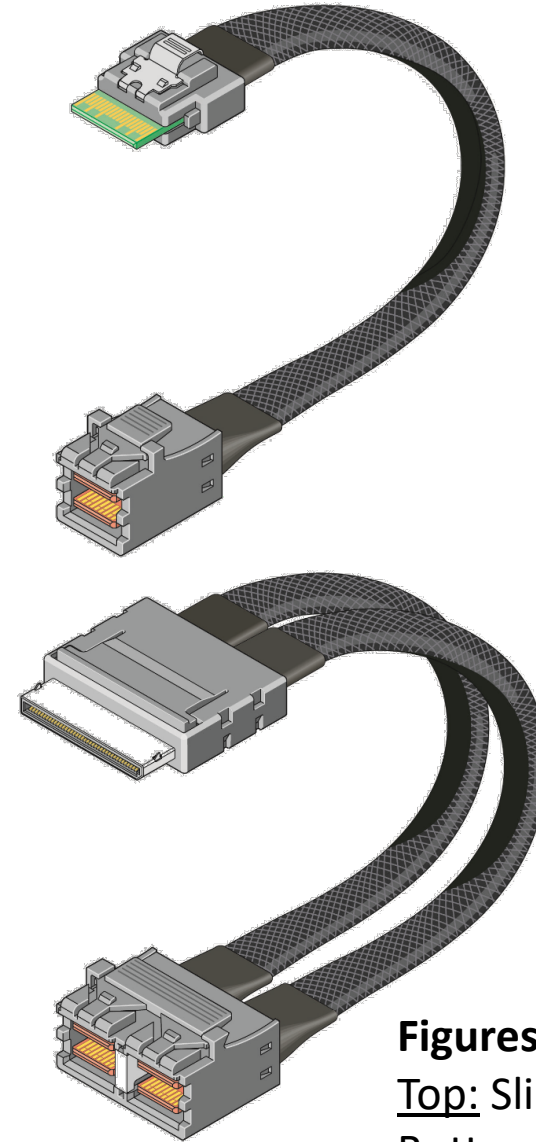
- Basic Requirements:

- TX signals on one end of the cable connect to RX signals on the other end (e.g., TX+ connects to RX+)
- Should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, or 4X on each connector's housing)
- One or more of the signal returns (ground signals) may be connected together (commoned) in cable assemblies

- Sideband Requirements: Refer to Integrator's Guide for details

SAS Internal Symmetric Cable Assembly Types

- Mini SAS HD 4i to Mini SAS HD 4i
- Mini SAS HD 8i to Mini SAS HD 8i
- SlimSAS 4i to SlimSAS 4i
- SlimSAS 4i to Mini SAS HD 4i
- SlimSAS 8i to SlimSAS 8i
- SlimSAS 8i to Mini SAS HD 8i
- SAS MiniLink 4i to SAS MiniLink 4i
- SAS MiniLink 4i to Mini SAS HD 4i
- SAS MiniLink 8i to SAS MiniLink 8i
- SAS MiniLink 8i to Mini SAS HD 8i



Speaker
Photo Will
Be Placed
Here

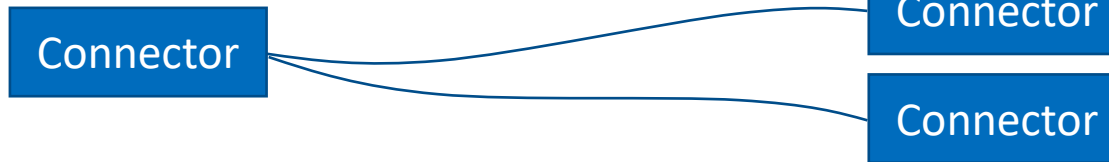
Figures

Top: SlimSAS 4i to Mini SAS HD 4i

Bottom: MiniLink 8i to Mini SAS HD 8i

SAS Internal Fanout Cable Assembly Types

- Fanout cables: Single connector on one end of the cable & multiple connectors on the other end



Speaker
Photo Will
Be Placed
Here

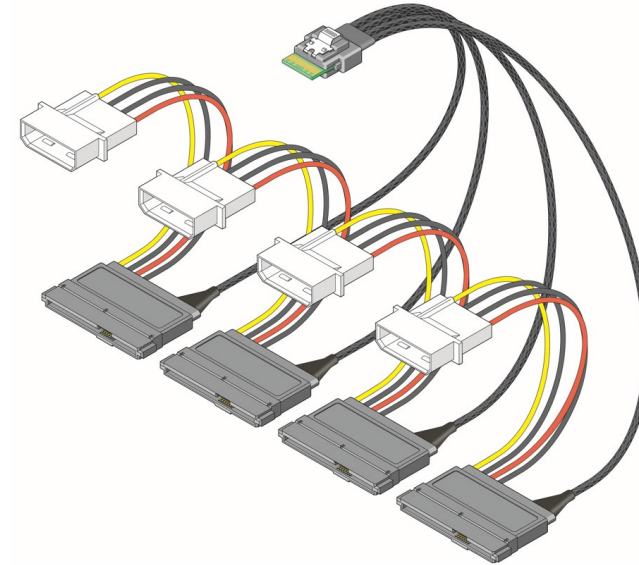
- Basic Requirements:

- TX signals on one end of the cable connect to RX signals on the other end (e.g., TX+ connects to RX+)
- Each signal return on one end of the cable assembly is connected to at least one signal return on the other end of the cable assembly
- One or more of the signal returns (ground signals) may be connected together (commoned) in cable assemblies

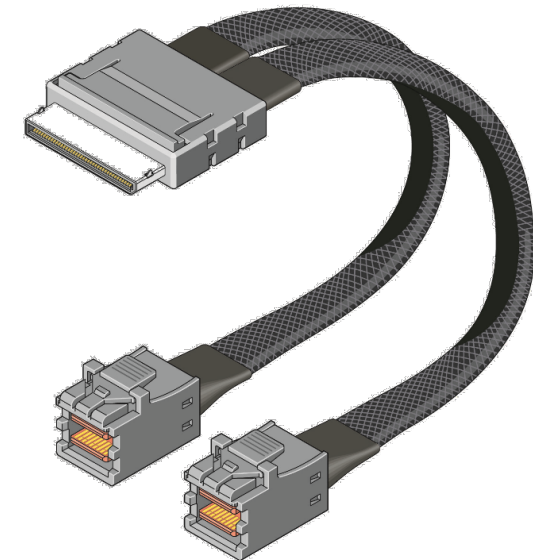
- Sideband Requirements: Refer to Integrator's Guide for details

SAS Internal Fanout Cable Assembly Types

- Mini SAS HD 4i to 4 SAS Drive
- SlimSAS 4i to 4 SAS Drive
- SlimSAS 4i to 4 SATA Signal
- SlimSAS 8i to 2 SlimSAS 4i
- SAS MiniLink 8i to 2 Mini SAS HD 4i
- SAS MiniLink 4i to 4 SAS Drive
- SAS MiniLink 4i to 4 SATA Signal
- SAS MiniLink 8i to 2 SAS MiniLink 4i
- SAS MiniLink 8i to 2 Mini SAS HD 4i
- 4 SATA to Mini SAS HD 4i



Speaker
Photo Will
Be Placed
Here



Figures

Top: SlimSAS 4i to 4 SAS Drive

Bottom: SAS MiniLink 8i to 2 Mini SAS HD 4i

SAS External Cable Assemblies

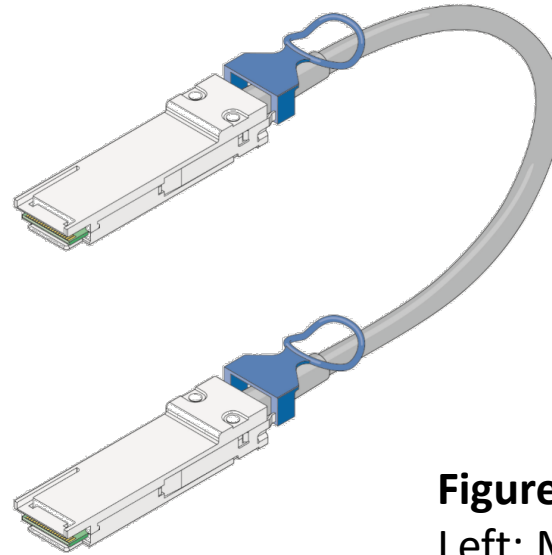
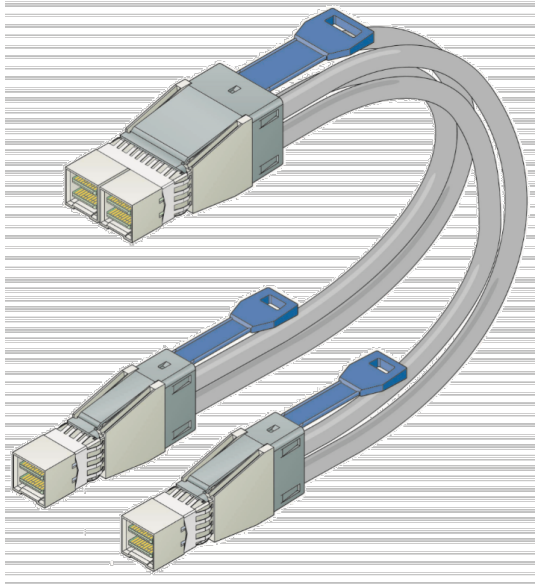
Speaker
Photo Will
Be Placed
Here

- **Basic Requirements:**
 - SAS external cable assemblies do not include:
 - Power
 - READY LED signal
 - POWER DISABLE signal
 - The connector always support 4 or 8 physical links, but the cable may support between 1 & 8 physical links
 - SAS external cable assemblies should be labeled to indicate how many links are included (e.g., 1X, 2X, 3X, etc.)
 - TX signals on one end of the cable connect to RX signals on the other end (e.g., TX 0+ connects to RX 0+)
 - Signal returns are not connected to CHASIS GROUND in the cable assembly
- **Sideband Requirements: None, all communication between devices is done in-band**

SAS External Cable Assembly Types

- Mini SAS HD 4x to Mini SAS HD 4x
- Mini SAS HD 8x to Mini SAS HD 8x
- Mini SAS HD 8x to 2 Mini SAS HD 4x
- QSFP to QSFP

Speaker
Photo Will
Be Placed
Here



Figures

Left: Mini SAS HD 8x to 2 Mini SAS HD 4x

Right: QSFP to QSFP

Plugfests & Additional Information

Plugfests

- Multiple SAS component vendors gather at a third-party test site so equipment can be tested with other vendors
- Demonstrates interoperability & configurability of SAS/SCSI infrastructure
- Ensures interoperability and fewer problems for the end user
- For information about upcoming STA-sponsored plugfests, visit our website:
<https://www.scsita.org/sas-plugfest-program/>

Speaker
Photo Will
Be Placed
Here

Stay in Touch

- Please visit our [website](#) to learn more about STA
- To stay up to date on the latest SAS developments, sign up for our [email newsletter](#)
- Find us on:



- Comments or suggestions?
 - If you have any feedback or would like to receive future editions of the SAS Integrator's Guide, please email us at info@scsita.org

Speaker
Photo Will
Be Placed
Here

References

- INCITS 567: Serial Attached SCSI (SAS-4.1)
- SFF-8147: 54mm X 78.5mm Form Factor with Micro SAS Connector
- SFF-8223: 2.5" Form Factor Drive with Serial Attached Connector
- SFF-8323: 3.5" Form Factor Drive with Serial Attached Connector
- SFF-8482: Serial Attachment 2X Unshielded Connector
- SFF-8486: Serial Attachment 4X Unshielded Connector
- SFF-8523: 5.25" Drive Form Factor with Serial Connector
- SFF-8611: MiniLink 4/8X I/O Cable Assemblies
- SFF-8612: MiniLink 4/8X I/O Shielded Connector
- SFF-8630: Serial Attachment 4X Unshielded Connector
- SFF-8643: Mini Multilane 4/8X 12 Gb/s Unshielded Cage/Connector (HD12un)
- SFF-8644: Mini Multilane 4/8X 12 Gb/s Shielded Cage/Connector (HD12sh)
- SFF-8654: 0.6mm 4/8X Unshielded I/O Connector
- SFF-8662: QSFP+ 4X 28 Gb/s Connector (Style A)
- SFF-8672: QSFP+ 4X 28 Gb/s Connector (Style B)

Speaker
Photo Will
Be Placed
Here

INCITS documents are available at: <https://www.incits.org>

SFF specifications are available at: <https://snia.org/technology-communities/sff/specifications>



Please take a moment to rate this session.

Your feedback is important to us.