To: T10 Technical Committee
From: Rob Elliott, HP (elliott@hp.com)
Date: 2 July 2003
Subject: 03-240r0 SAS-1.1 Internal wide connector and cable

Revision history
Revision 0 (2 July 2003) First revision

Related documents
sas-r04a - Serial Attached SCSI revision 4a
sff-8484 - 4-Wide Internal Serial Attachment Connector (Brian Miller, Amphenol)

Overview
A 4-wide internal cable and connector solution is being designed for connecting controllers (e.g. PCI cards) to backplanes. It is intended to be used in place of: 4 SATA host connectors (on the controller) to 4 separate SATA cables to 4 SATA host connectors (on the backplane). This cable/connector is being proposed for both SATA II and SAS.

Figure 1 shows the connector. It follows the design of the SATA host connector. Either a round cable or a ribbon-like cable could be used.

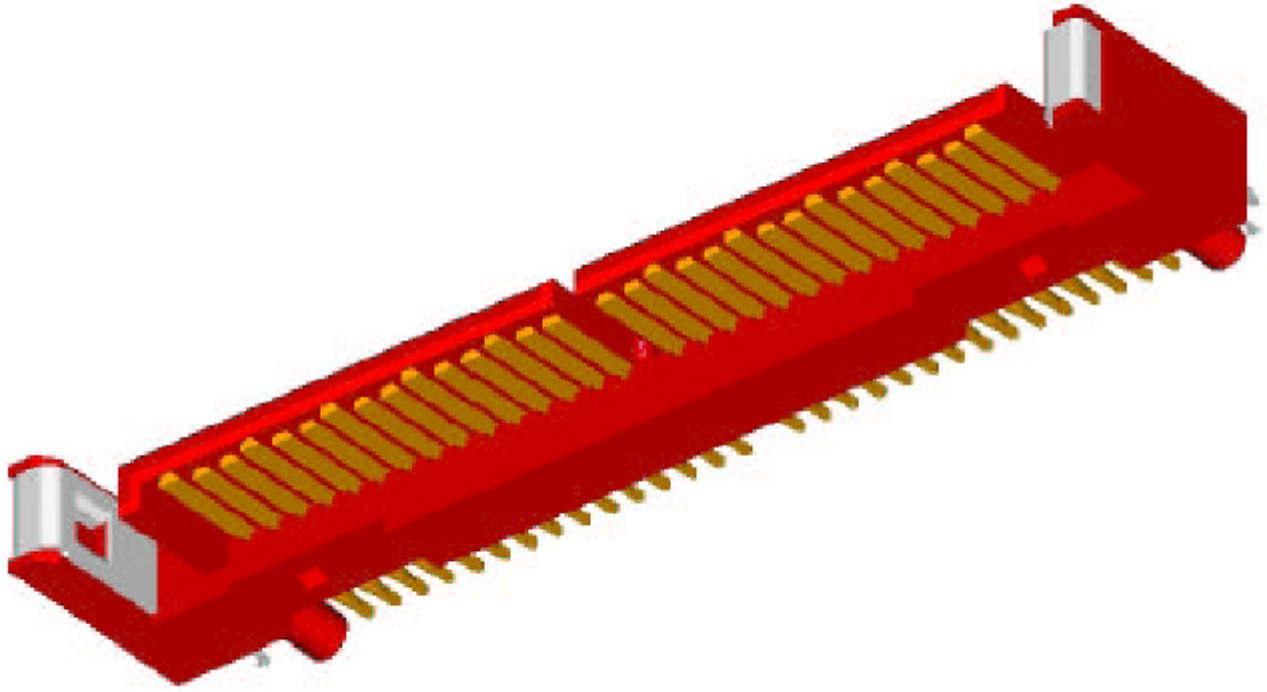

Figure 1 — 4-wide connector picture (from Amphenol)

The connector includes 4 high-speed serial channels and 4 sideband signals (in the middle). It is split into two tongues for stability.

SAS-1.1 should define signal assignments for this connector.

Suggested changes

[Add reference to SFF document]

5.2.3 Connectors

Figure 2 shows the internal wide cable environment.

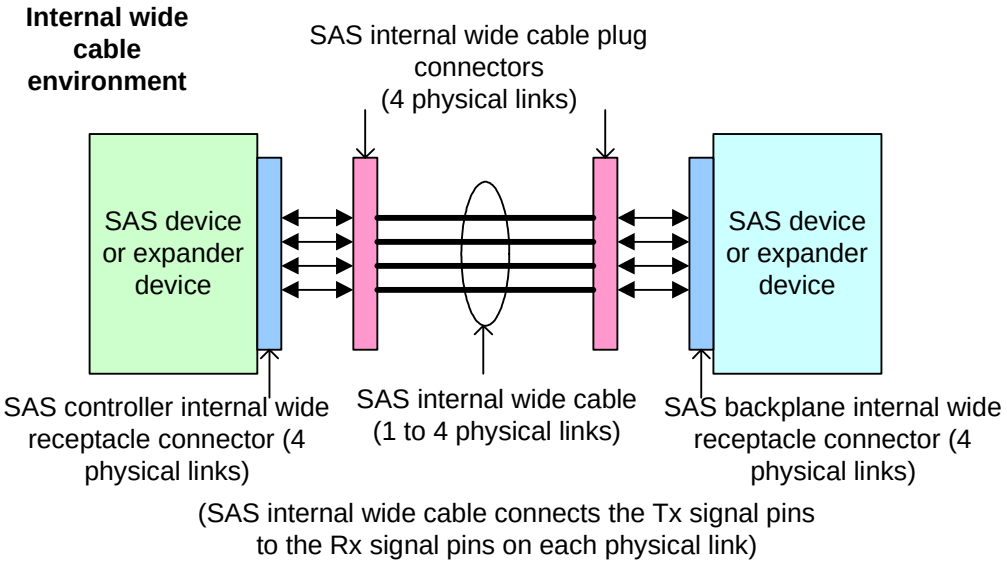

Figure 2 — Internal wide cable environment

The internal wide connectors have different pinouts for the controller side and the backplane side so one side's Tx signals are attached to the other side's Rx signals. Two controllers may also be attached together, provided all four physical links are used, since one side's physical link 0 is attached to the other side's physical link 3.

The internal wide connector contains 4 vendor-specific sideband signals which are crossed when attaching a controller to a backplane but are not crossed when attaching a controller to a controller.

Table 1 summarizes the connectors defined in this standard.

Table 1 — Connectors

Type of connector	Physical links	Reference	Attaches to	Physical links	Reference
SAS plug	2		SAS internal cable receptacle	1 or 2	
			SAS backplane receptacle	2	
SAS internal cable SATA-style signal cable receptacle	1	ATA/ATAPI -7 V3	SATA-style host plug	1	ATA/ATAPI -7 V3
SAS internal cable receptacle	1 or 2		SAS plug	2	
			SATA device plug	1	SATA
SAS backplane receptacle	2		SAS plug	2	
			SATA device plug	1	ATA/ATAPI -7 V3
SAS internal wide receptacle	4	0.0.0	SAS internal wide cable plug	4	0.0.0
SAS external cable plug	4		SAS external receptacle	4	
SAS external receptacle	4		SAS external cable plug	4	

0.0.0.1 SAS internal wide cable plug connector

SAS internal wide cables shall use the SAS internal wide cable plug connector. The SAS internal wide cable plug connector is defined in SFF-8484. The SAS internal wide cable plug connector attaches to a SAS internal wide receptacle connector, providing contact for up to four physical links.

Table 2 and table 3 define the pin assignments.

0.0.0.2 SAS internal wide receptacle connector

The SAS internal wide receptacle connector is defined in SFF-8484. The SAS internal wide receptacle connector attaches to a SAS internal wide cable plug connector, providing contact for up to four physical links.

Table 2 and table 3 define the pin assignments.

0.0.0.3 SAS internal wide connector pin assignments

Table 2 defines how the connector signal pairs are used in internal wide connectors for controller applications using one, two, three, or four of the physical links. Internal wide cables should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, and 4X on each connector's housing). The sideband signals are vendor-specific.

Table 2 — Controller physical link usage in SAS internal wide connector

Signal	Signal pin to use based on number of physical links supported by the cable			
	One	Two	Three	Four
Rx 0+	S2	S2	S2	S2
Rx 0-	S3	S3	S3	S3
Tx 0-	S5	S5	S5	S5
Tx 0+	S6	S6	S6	S6
Rx 1+	N/C	S8	S8	S8
Rx 1-	N/C	S9	S9	S9
Tx 1-	N/C	S11	S11	S11
Tx 1+	N/C	S12	S12	S12
Sideband 0	SB14	SB14	SB14	SB14
Sideband 1	SB15	SB15	SB15	SB15
Sideband 2	SB16	SB16	SB16	SB16
Sideband 3	SB17	SB17	SB17	SB17
Rx 2+	N/C	N/C	S19	S19
Rx 2-	N/C	N/C	S20	S20
Tx 2-	N/C	N/C	S22	S22
Tx 2+	N/C	N/C	S23	S23
Rx 3+	N/C	N/C	N/C	S25
Rx 3-	N/C	N/C	N/C	S26
Tx 3-	N/C	N/C	N/C	S28
Tx 3+	N/C	N/C	N/C	S29
SIGNAL GROUND	G1, G4, G7, G10, G13, G18, G21, G24, G27, G30			
CHASSIS GROUND	Housing			

Key:
N/C = not connected

Table 3 defines how the connector signal pairs are used in internal wide connectors for backplane applications using one, two, three, or four of the physical links. Internal wide cables should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, and 4X on each connector's housing). The sideband signals are vendor-specific.

Table 3 — Backplane physical link usage in SAS internal wide connector

Signal	Signal pin to use based on number of physical links supported by the cable			
	One	Two	Three	Four
Rx 3+	S2	S2	S2	S2
Rx 3-	S3	S3	S3	S3
Tx 3-	S5	S5	S5	S5
Tx 3+	S6	S6	S6	S6
Rx 2+	N/C	S8	S8	S8
Rx 2-	N/C	S9	S9	S9
Tx 2-	N/C	S11	S11	S11
Tx 2+	N/C	S12	S12	S12
Sideband 3	SB14	SB14	SB14	SB14
Sideband 2	SB15	SB15	SB15	SB15
Sideband 1	SB16	SB16	SB16	SB16
Sideband 0	SB17	SB17	SB17	SB17
Rx 1+	N/C	N/C	S19	S19
Rx 1-	N/C	N/C	S20	S20
Tx 1-	N/C	N/C	S22	S22
Tx 1+	N/C	N/C	S23	S23
Rx 0+	N/C	N/C	N/C	S25
Rx 0-	N/C	N/C	N/C	S26
Tx 0-	N/C	N/C	N/C	S28
Tx 0+	N/C	N/C	N/C	S29
SIGNAL GROUND	G1, G4, G7, G10, G13, G18, G21, G24, G27, G30			
CHASSIS GROUND	Housing			
Key: N/C = not connected				

5.2.4 Cables

0.0.0.4 SAS internal wide cables

SAS internal wide cables shall use a SAS internal wide cable receptacle connector on each end. One connector shall have its key on the other side, causing the Tx pins on one side to route to the Rx pins on the other side.

Figure 3 shows the SAS internal wide cable attaching two controllers.

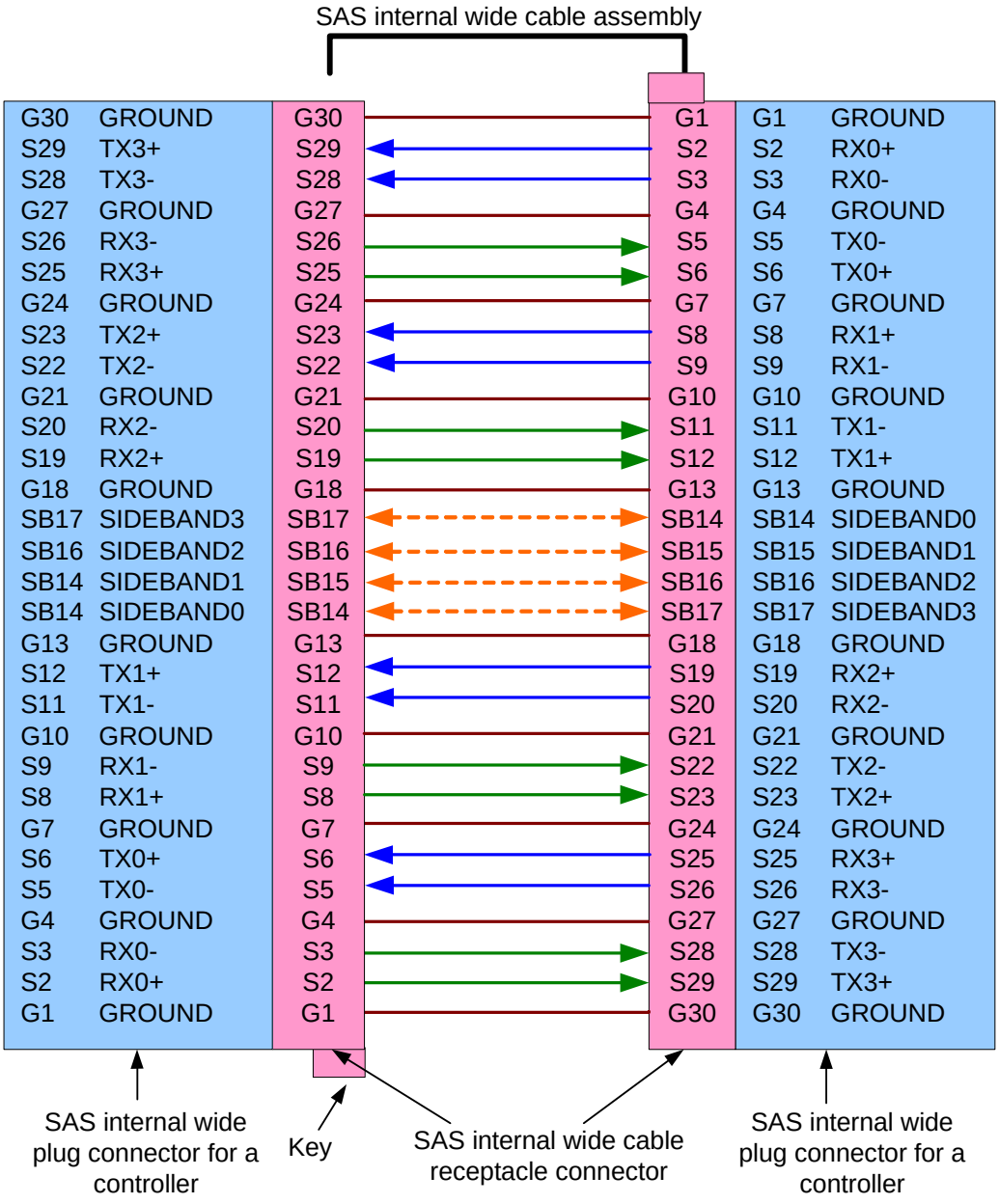

Figure 3 — SAS internal wide cable attaching controller to controller

NOTE 1 - For controller to controller applications, all four physical links should be used, because one side's physical link 0 is the other side's physical link 3. If both sides just used physical link 0, they would not communicate. The sideband signals are also crossed.

Figure 4 shows the SAS internal wide cable being used to attach a controller to a backplane.

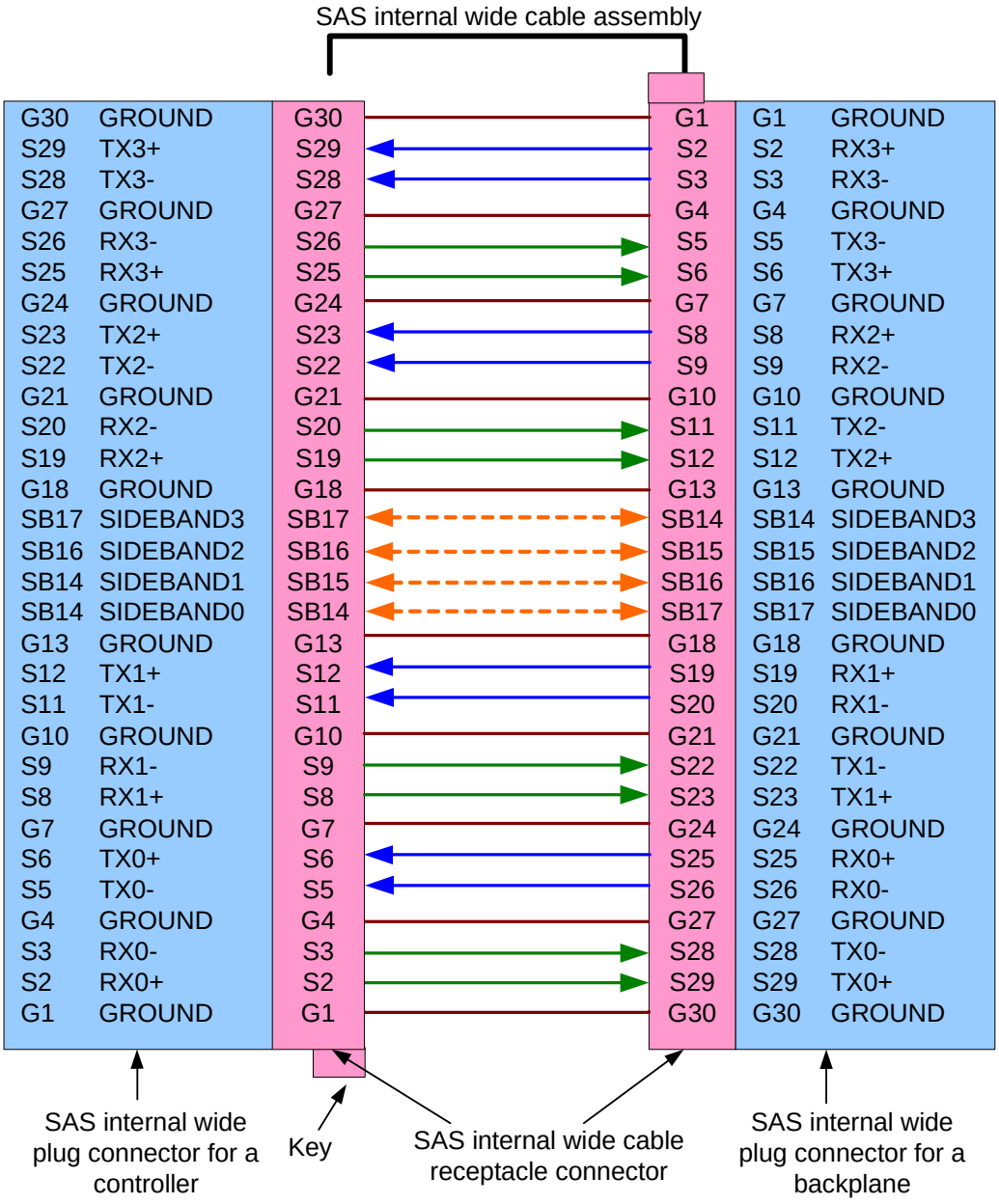

Figure 4 — SAS internal wide cable attaching controller to backplane

NOTE 2 - For controller to backplane applications, up to four physical links may be used. The sideband signals are not crossed.