To: T10 Technical Committee
From: Jay Neer (Jay.Neer@Molex.com)
Date: March 2, 2005
Subject: SAS 1-1 Compact Connectors (Internal and External)

This proposal has been prepared in the style of SAS 1-1 Rev 8, and identifies changes and additions to Rev 8.

This revision incorporates the comments (much appreciated) received from Kevin Marks. As to Alvin Cox's question at SAS Phy, the compact internal and compact external connectors meet or exceed the electrical requirements specified by SAS.

Updates from Rev 0 include:

- Replaced Figures 67CW-70CW to correct cabling pinouts
- Expanded 5.2.4.3.2 to include an explanation of cabling
- Added 2.4 references
- Added 5.2.4.2 as needing changes to current text
- Added references to SFF-8086 in 5.2.3.3.4/5 and 5.2.3.4.4/5

Additions to 2.4

SFF-8086 Compact Multilane Connector Mating Interface
SFF-8087 Compact Multilane Unshielded Connector
SFF-8088 Compact Multilane Shielded Connector

Changes and additions to 5.2.3

Add to Table 22

SAS external compact cable plug	4	5.2.3.3.4	SAS external compact receptacle	4	5.2.3.3.5
SAS external compact receptacle	4	5.2.3.3.5	SAS external compact cable plug	4	5.2.3.3.4
SAS internal compact wide cable plug	4	5.2.3.4.4	SAS internal compact wide receptacle	4	5.2.3.4.5
SAS internal compact wide receptacle	4	5.2.3.4.5	SAS internal compact wide cable plug	4	5.2.3.4.4

5.2.3.3 SAS external connectors

SAS external cables shall use either the SAS external cable plug connector or the SAS external compact plug connector.

SAS devices with external ports shall use either the SAS external receptacle connector or the SAS external compact receptacle connector.

5.2.3.3.1 SAS external cable plug connector

The SAS external cable plug connector is defined in SFF-8470 as the four lane free (plug) connector with jack screws. The SAS external cable plug connector shall not include keys and may include key slots. Key slots are not defined by this standard. The SAS external cable plug connector attaches to a SAS external receptacle connector, providing contact for up to four physical links.

Table 24 (see 5.2.3.3.3) defines the pin assignments.

Figure 61 shows the SAS external cable plug connector.

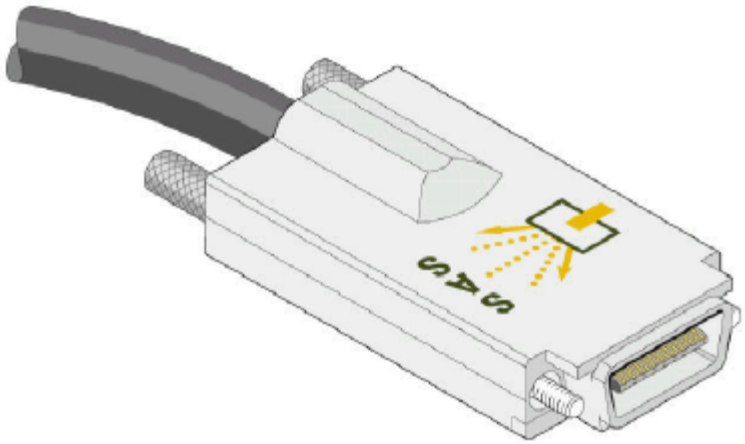

Figure 61 — SAS external cable plug connector

5.2.3.3.2 SAS external receptacle connector

The SAS external receptacle connector is defined in SFF-8470 as the four lane fixed (receptacle) connector with jack screws.

The SAS external cable receptacle connector shall not include keys and may include key slots. Key slots are not defined by this standard. The SAS external receptacle connector attaches to a SAS external cable plug connector, providing contact for up to four physical links.

Table 24 (see 5.2.3.3.3) defines the pin assignments.

Figure 62 shows the SAS external receptacle connector.

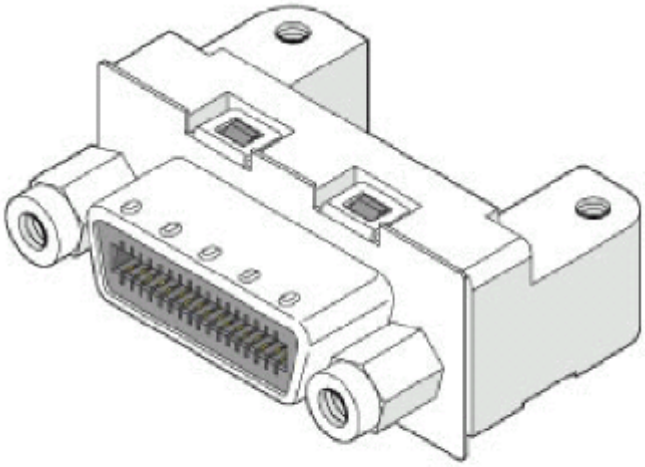

Figure 62 — SAS external receptacle connector

5.2.3.3.3 SAS external connector pin assignments

Table 24 defines the signal assignments for pins in SAS external cable plug connectors (see 5.2.3.3.1) and SAS external receptacle connectors (see 5.2.3.3.2) for applications using one, two, three, or four of the physical links. External cables should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, and 4X on each connector's housing).

Table 24 — SAS external connector pin assignments and physical link usage

Signal	Signal pin to use based on number of physical links supported by the cable			
	One	Two	Three	Four
Rx 0+	S1	S1	S1	S1
Rx 0-	S2	S2	S2	S2
Rx 1+	N/C	S3	S3	S3
Rx 1-	N/C	S4	S4	S4
Rx 2+	N/C	N/C	S5	S5
Rx 2-	N/C	N/C	S6	S6
Rx 3+	N/C	N/C	N/C	S7
Rx 3-	N/C	N/C	N/C	S8
Tx 3-	N/C	N/C	N/C	S9
Tx 3+	N/C	N/C	N/C	S10
Tx 2-	N/C	N/C	S11	S11
Tx 2+	N/C	N/C	S12	S12
Tx 1-	N/C	S13	S13	S13
Tx 1+	N/C	S14	S14	S14
Tx 0-	S15	S15	S15	S15
Tx 0+	S16	S16	S16	S16
SIGNAL GROUND	G1 - G9			
CHASSIS GROUND	Housing			
Key: N/C = not connected				

SIGNAL GROUND shall not be connected to CHASSIS GROUND in the cable connector.

5.2.3.3.4 SAS external compact cable plug connector

The SAS external compact cable plug connector assembly is defined in SFF-8088 the four lane free plug connector with latch. SFF-8086 defines the circuit board (the circuit board is common to both internal and external connectors).

The SAS external compact cable plug connector shall not include keys and may include key slots. Key slots are not defined by this standard. The SAS external compact cable plug connector attaches to a SAS external compact receptacle connector, providing contact for up to four physical links.

Table 24C (see 5.2.3.3.6) defines the pin assignments.

Figure 61C shows the SAS external compact cable plug connector.

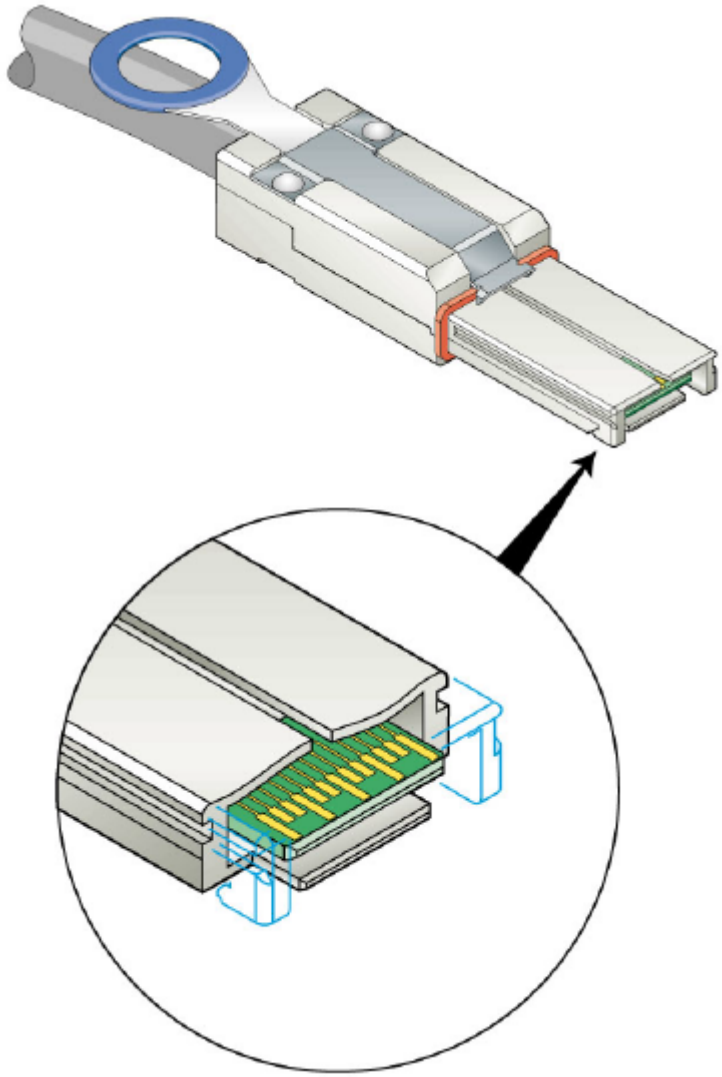

Figure 61C — SAS external compact cable plug connector

5.2.3.3.5 SAS external compact receptacle connector

SAS devices with external ports shall use the SAS external compact receptacle connector. The SAS external compact connector hell is defined in SFF-8088 as the four lane fixed receptacle connector with latch. SFF-8086 defines the receptacle mating interface and the board footprint (the receptacle body is common to both internal and external connectors).

The SAS external compact cable receptacle connector shall not include keys and may include key slots. Key slots are not defined by this standard. The SAS external compact receptacle connector attaches to a SAS external compact cable plug connector, providing contact for up to four physical links.

Table 24C (see 5.2.3.3.3) defines the pin assignments.

Figure 62C shows the SAS external compact receptacle connector.

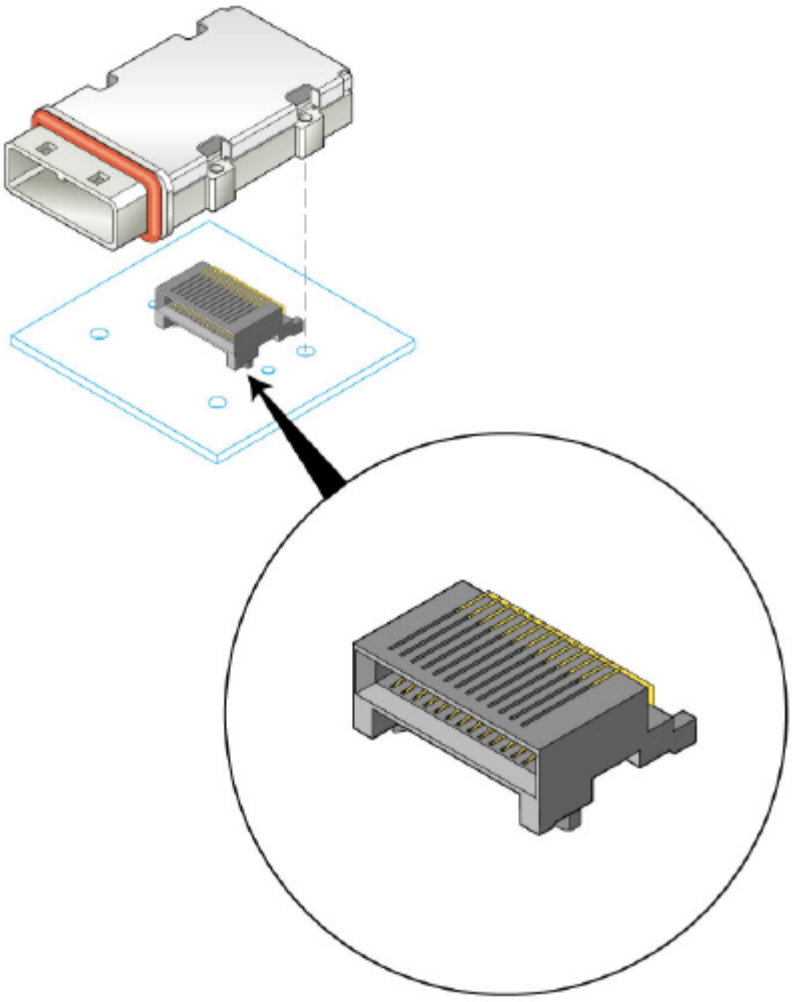

Figure 62C — SAS external compact receptacle connector

5.2.3.3.6 SAS external compact connector pin assignments

Table 24C defines the signal assignments for pins in SAS external compact cable plug connectors (see 5.2.3.3.1) and SAS external compact receptacle connectors (see 5.2.3.3.2) for applications using one, two, three, or four of the physical links. External cables should be labeled to indicate how many physical links are included (e.g., 1X, 2X, 3X, and 4X on each connector's housing).

Table 24C — SAS external compact connector pin assignments and physical link usage

	Signal pin to use based on number of physical links supported by the cable			
Signal	One	Two	Three	Four
Rx0+	A2	A2	A2	A2
Rx0-	A3	A3	A3	A3
Rx1+	N/C	A5	A5	A5
Rx1-	N/C	A6	A6	A6
Rx2+	N/C	N/C	A8	A8
Rx2-	N/C	N/C	A9	A9
Rx3+	N/C	N/C	N/C	A11
Rx3-	N/C	N/C	N/C	A12
Tx3+	N/C	N/C	N/C	B12
Tx3-	N/C	N/C	N/C	B11
Tx2+	N/C	N/C	B9	B9
Tx2-	N/C	N/C	B8	B8
Tx1+	N/C	B6	B6	B6
Tx1-	N/C	B5	B5	B5
Tx0+	B3	B3	B3	B3
Tx0-	B2	B2	B2	B2
SIGNAL GROUND	A1 A4 A7 A10 A13 B1 B4 B7 B10 B13			
CHASSIS GROUND	Housing			
Key: N/C = not connected				

SIGNAL GROUND shall not be connected to CHASSIS GROUND in the cable connector.

5.2.3.4 SAS internal wide connectors

SAS internal wide cables shall use either the SAS internal wide cable receptacle or SAS internal compact wide cable plug connector.

5.2.3.4.1 SAS internal wide plug connector

The SAS internal wide plug connector is defined in SFF-8484.

The SAS internal wide plug connector attaches to a SAS internal wide cable receptacle connector, providing contact for up to four physical links and six sideband signals.

Table 25 and table 26 (see 5.2.3.4.3) define the pin assignments.

Figure 63 shows the SAS internal wide plug connector.

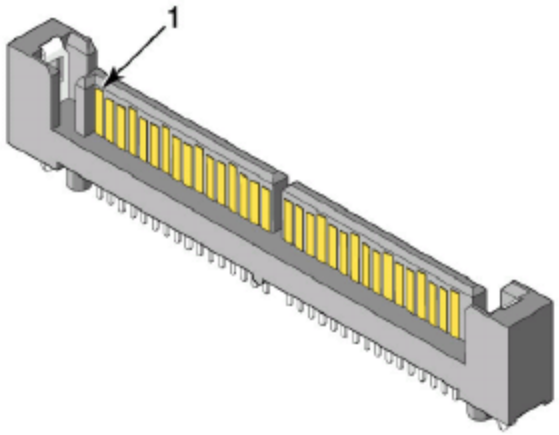

Figure 63 — SAS internal wide plug connector

5.2.3.4.2 SAS internal wide cable receptacle connector

The SAS internal wide cable receptacle connector is defined in SFF-8484.

The SAS internal wide cable receptacle connector attaches to a SAS internal wide plug connector, providing contact for up to four physical links and six sideband signals.

Table 25 and table 26 (see 5.2.3.4.3) define the pin assignments.

Figure 64 shows the SAS internal wide cable receptacle connector.

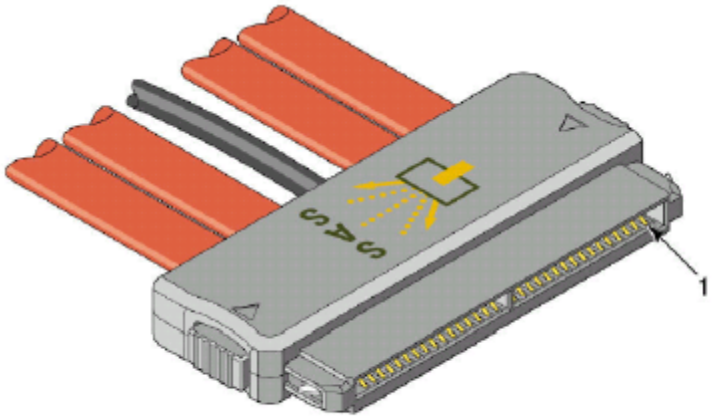

Figure 64 — SAS internal wide cable receptacle connector

5.2.3.4.3 SAS internal wide connector pin assignments

Table 25 defines the signal assignments for pins in SAS internal wide plug connectors (see 5.2.3.4.1) and SAS internal wide cable receptacle connectors (see 5.2.3.4.2) for controller applications using one, two, three, or four of the physical links. SAS 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).

Table 25 — Controller SAS internal wide connector pin assignments and physical link usage

Signal	Signal pin to use based on number of physical links supported by the cable [a]			
	One	Two	Three	Four
Rx 0+	2	2	2	2
Rx 0-	3	3	3	3
Tx 0-	5	5	5	5
Tx 0+	6	6	6	6
Rx 1+	N/C	8	8	8
Rx 1-	N/C	9	9	9
Tx 1-	N/C	11	11	11
Tx 1+	N/C	12	12	12
Sideband 0	14	14	14	14
Sideband 1	15	15	15	15
Sideband 2	16	16	16	16
Sideband 3	17	17	17	17
Sideband 4	18	18	18	18
Sideband 5	19	19	19	19
Rx 2+	N/C	N/C	21	21
Rx 2-	N/C	N/C	22	22
Tx 2-	N/C	N/C	24	24
Tx 2+	N/C	N/C	25	25
Rx 3+	N/C	N/C	N/C	27
Rx 3-	N/C	N/C	N/C	28
Tx 3-	N/C	N/C	N/C	30
Tx 3+	N/C	N/C	N/C	31
SIGNAL GROUND	1, 4, 7, 10, 13, 20, 23, 26, 29, 32			

[a] N/C = not connected

The use of the sideband signals by a controller is vendor-specific. One implementation of the sideband signals by a controller is an SGPIO initiator interface (see SFF-8485). Other implementations shall be compatible with the signal levels defined in SFF-8485.

Table 26 defines how the signal assignments for pins in SAS internal wide plug connectors (see 5.2.3.4.1) and SAS internal wide cable receptacle connectors (see 5.2.3.4.2) 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).

Table 26 — Backplane SAS internal wide connector pin assignments and physical link usage

Signal	Signal pin to use based on number of physical links supported by the cable [a]			
	One	Two	Three	Four
Rx 3+	N/C	N/C	N/C	2
Rx 3-	N/C	N/C	N/C	3
Tx 3-	N/C	N/C	N/C	5
Tx 3+	N/C	N/C	N/C	6
Rx 2+	N/C	N/C	8	8
Rx 2-	N/C	N/C	9	9
Tx 2-	N/C	N/C	11	11
Tx 2+	N/C	N/C	12	12
Sideband 5	14	14	14	14
Sideband 4	15	15	15	15
Sideband 3	16	16	16	16
Sideband 2	17	17	17	17
Sideband 1	18	18	18	18
Sideband 0	19	19	19	19
Rx 1+	N/C	21	21	21
Rx 1-	N/C	22	22	22
Tx 1-	N/C	24	24	24
Tx 1+	N/C	25	25	25
Rx 0+	27	27	27	27
Rx 0-	28	28	28	28
Tx 0-	30	30	30	30
Tx 0+	31	31	31	31
SIGNAL GROUND	1, 4, 7, 10, 13, 20, 23, 26, 29, 32			

[a] N/C = not connected

The use of the sideband signals by a backplane is vendor-specific. One implementation of the sideband signals by a backplane is an SGPIO target interface (see SFF-8485). Other implementations shall be compatible with the signal levels defined in SFF-8485.

5.2.3.4.4 SAS internal compact wide cable plug connector

The SAS internal compact wide cable plug connector assembly is defined in SFF-8087. SFF-8086 defines the circuit board (the circuit board is common to both internal and external connectors).

The SAS internal compact wide cable plug connector attaches to a SAS internal compact wide receptacle connector, providing contact for up to four physical links and six sideband signals.

Table 25CW and table 26CW (see 5.2.3.4.6) define the pin assignments.

Figure 63CW shows the SAS internal compact wide cable plug connector.

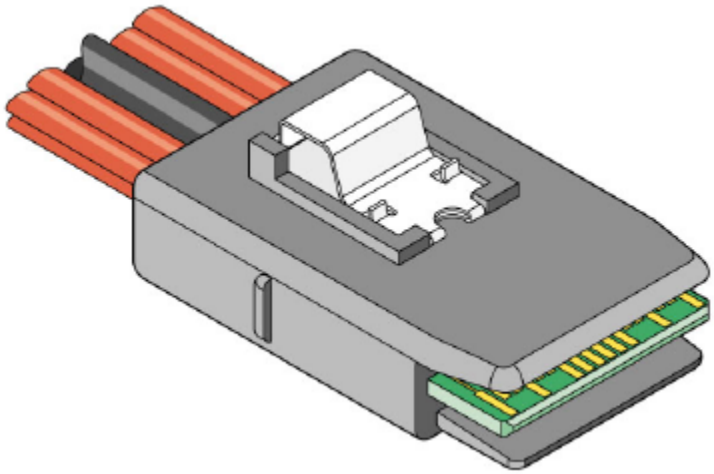

Figure 63CW — SAS internal compact wide cable plug connector

5.2.3.4.5 SAS internal compact wide receptacle connector

The SAS internal compact wide receptacle connector shell is defined in SFF-8087 and SFF-8086 defines the receptacle mating interface and the board footprint (the receptacle is common to both internal and external connectors).

The SAS internal compact wide cable plug connector attaches to a SAS internal compact wide receptacle connector, providing contact for up to four physical links and six sideband signals.

Table 25CW and table 26CW (see 5.2.3.4.6) define the pin assignments.

Figure 64CW shows the SAS internal compact wide receptacle connector.

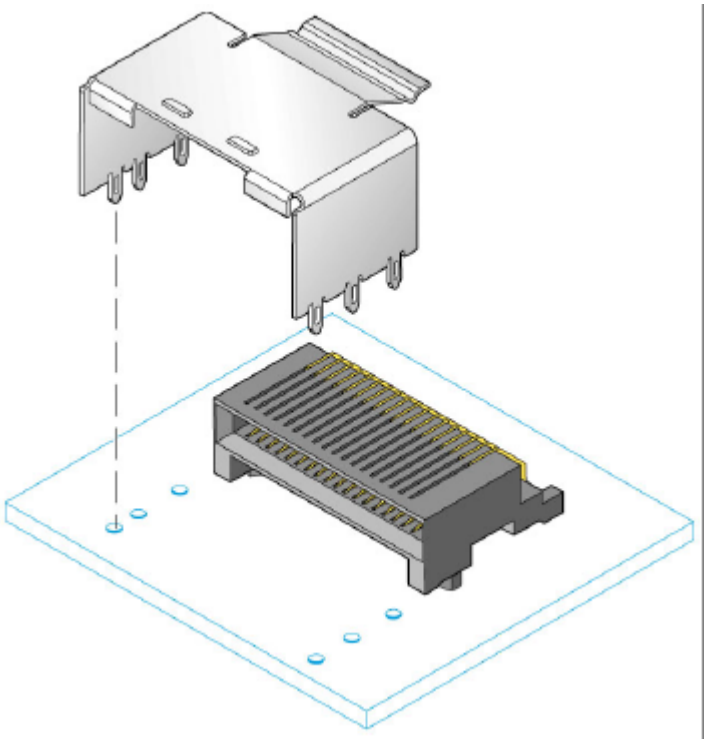

Figure 64CW — SAS internal compact wide receptacle connector

5.2.3.4.6 SAS internal compact wide connector pin assignments

Table 25CW defines the signal assignments for pins in SAS internal compact wide cable plug connectors (see 5.2.3.4.4) and SAS internal compact wide receptacle connectors (see 5.2.3.4.5) for controller applications using one, two, three, or four of the physical links. SAS internal compact 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).

Table 25CW — Controller SAS internal compact wide connector pin assignments and physical link usage

	Signal pin to use based on number of physical links supported by the cable			
Signal	One	Two	Three	Four
Rx0+	A2	A2	A2	A2
Rx0-	A3	A3	A3	A3
Rx1+	N/C	A5	A5	A5
Rx1-	N/C	A6	A6	A6
Sideband 6	A8	A8	A8	A8
Sideband 3	A9	A9	A9	A9
Sideband 4	A10	A10	A10	A10
Sideband 5	A11	A11	A11	A11
Rx2+	N/C	N/C	A13	A13
Rx2-	N/C	N/C	A14	A14
Rx3+	N/C	N/C	N/C	A16
Rx3-	N/C	N/C	N/C	A17
Tx3+	N/C	N/C	N/C	B17
Tx3-	N/C	N/C	N/C	B16
Tx2+	N/C	N/C	B14	B14
Tx2-	N/C	N/C	B13	B13
Sideband 7	B11	B11	B11	B11
Sideband 2	B10	B10	B10	B10
Sideband 1	B9	B9	B9	B9
Sideband 0	B8	B8	B8	B8
Tx1+	N/C	B6	B6	B6
Tx1-	N/C	B5	B5	B5
Tx0+	B3	B3	B3	B3
Tx0-	B2	B2	B2	B2
SIGNAL GROUND	A1 A4 A7 A12 A15 A18 B1 B4 B7 B12 B15 B18			
CHASSIS GROUND	Housing			
Key: N/C = not connected				

The use of the sideband signals by a controller is vendor-specific. One implementation of the sideband signals by a controller is an SGPIO initiator interface (see SFF-8485). Other implementations shall be compatible with the signal levels defined in SFF-8485.

Table 26CW defines how the signal assignments for pins in SAS internal compact wide cable plug connectors (see 5.2.3.4.4) and SAS internal compact wide receptacle connectors (see 5.2.3.4.5) for backplane applications using one, two, three, or four of the physical links. Internal compact 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).

Table 26CW — Backplane SAS internal compact wide connector pin assignments and physical link usage

	Signal pin to use based on number of physical links supported by the cable			
Signal	One	Two	Three	Four
Tx3-	N/C	N/C	N/C	A2
Tx3+	N/C	N/C	N/C	A3
Tx2-	N/C	N/C	A5	A5
Tx2+	N/C	N/C	A6	A6
Sideband 5	A8	A8	A8	A8
Sideband 4	A9	A9	A9	A9
Sideband 3	A10	A10	A10	A10
Sideband 6	A11	A11	A11	A11
Tx1-	N/C	A13	A13	A13
Tx1+	N/C	A14	A14	A14
Tx0-	A16	A16	A16	A16
Tx0+	A17	A17	A17	A17
Rx0-	B17	B17	B17	B17
Rx0+	B16	B16	B16	B16
Rx1-	N/C	B14	B14	B14
Rx1+	N/C	B13	B13	B13
Sideband 0	B11	B11	B11	B11
Sideband 1	B10	B10	B10	B10
Sideband 2	B9	B9	B9	B9
Sideband 7	B8	B8	B8	B8
Rx2-	N/C	N/C	B6	B6
Rx2+	N/C	N/C	B5	B5
Rx3-	N/C	N/C	N/C	B3
Rx3+	N/C	N/C	N/C	B2
SIGNAL GROUND	A1 A4 A7 A12 A15 A18 B1 B4 B7 B12 B15 B18			
CHASSIS GROUND	Housing			
Key: N/C = not connected				

The use of the sideband signals by a backplane is vendor-specific. One implementation of the sideband signals by a backplane is an SGPIO target interface (see SFF-8485). Other implementations shall be compatible with the signal levels defined in SFF-8485.

Changes and additions to 5.2.4.

- The introductory text for internal wide cables is not applicable to both connectors, because the wide connector uses a receptacle on the cable side, and the compact wide uses a plug on the cable side.
- It may be possible to rewrite the usage to cover both variations of the wide connector, but in this proposal the text is heavily duplicated with the relevant changes from receptacle to plug and pinout cabling considerations.
- Figures 67-70 are unchanged and represented by a rectangle in the following pages.

5.2.4.2 SAS external cables

There are two external cable connectors.
The SAS external cable connectors are defined in SFF-8470 and the SAS external compact cable connector is defined in SFF-8088.

Both are four lane interfaces with jack screws. The external cables do not include power or the READY LED signal.
Although the connectors always supports four physical links, the cable may support one, two, three, or four physical links.

On external cable assemblies, the Tx signal from one connector shall be connected to the corresponding Rx signal of the other connector. SIGNAL GROUND shall not be connected to CHASSIS GROUND in the cable.

5.2.4.3 SAS internal wide cables

There are several types of SAS internal wide cable defined, and two connector types (SFF-8484 internal wide and SFF-8087 internal compact wide):

5.2.4.3.1 SAS internal wide cable usage

a) symmetric cable: SAS internal wide cable receptacle connectors on each end;
b) controller-based fanout cable: SAS internal wide cable receptacle connector on one end (i.e., the controller end) and four SAS internal cable receptacle connectors on the other end (i.e., the backplane end); and
c) backplane-based fanout cable: Four SATA-style signal cable receptacle connectors on one end (i.e., the controller end) and a SAS internal wide cable receptacle connector on the other end (i.e., the backplane end).

In the symmetric cable, one connector shall have its key on the opposite end of the other connector, causing the Tx pins on one end to route to the Rx pins on the other end. The Tx signal from one connector shall be connected to the corresponding Rx signal on the other connector (e.g., a Tx (pin 6) of one connector shall connect to an Rx (pin 27) of the other connector. The physical link number of that pin depends on the application).

Although the SAS internal wide cable receptacle connector always supports four physical links, the SAS internal wide cable may support one, two, three, or four physical links when used for controller-to-backplane applications. The cable shall support four physical links for controller-to-controller applications.

Figure 67 shows the SAS internal wide cable being used to attach a controller to a backplane.

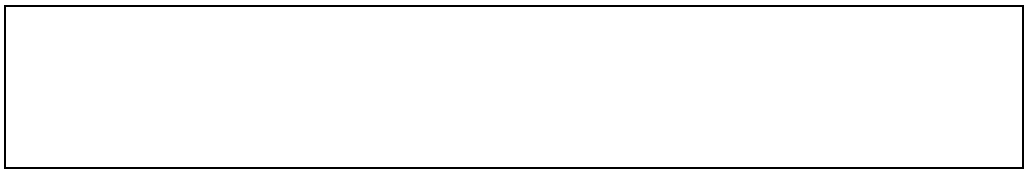

FIGURE 67 - SAS internal wide cable controller to backplane

NOTE 8 - For controller to backplane uses, up to four physical links may be used. SIDEBAND signals on the controller are attached to the corresponding SIDEBAND signals on the backplane (e.g., SIDEBAND0 of the controller is attached to SIDEBAND0 of the backplane).

Figure 68 shows the SAS internal wide cable attaching two controllers.

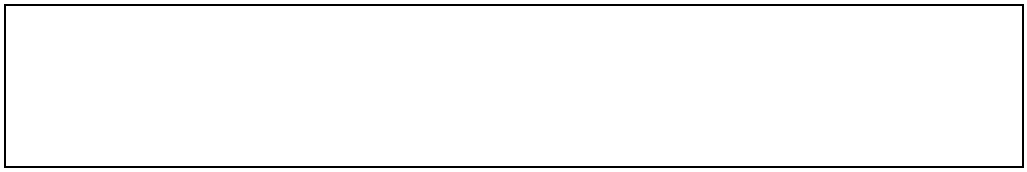

FIGURE 68 - SAS internal wide cable controller to controller

NOTE 9 - For controller to controller uses, all four physical links should be used, because one controller's physical link 0 is attached the other controller's physical link 3. If both controllers used only physical link 0, they would not communicate.

NOTE 10 - For controller to controller uses, SIDEBAND signals on one controller are not attached to their corresponding SIDEBAND signals on the other controller (e.g, SIDEBAND0 of one controller is attached to SIDEBAND5 of the other controller).

Figure 69 shows the SAS internal wide controller-based fanout cable.

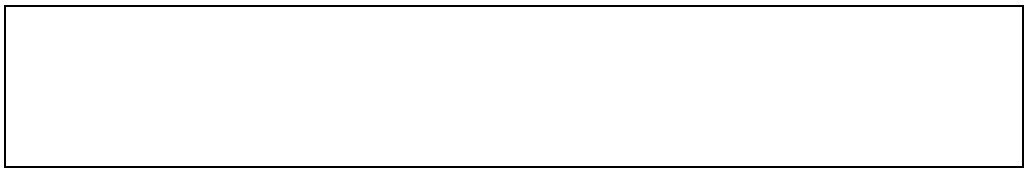

FIGURE 69 - SAS internal wide controller-based fanout cable

Figure 70 shows the SAS internal wide backplane-based fanout cable.

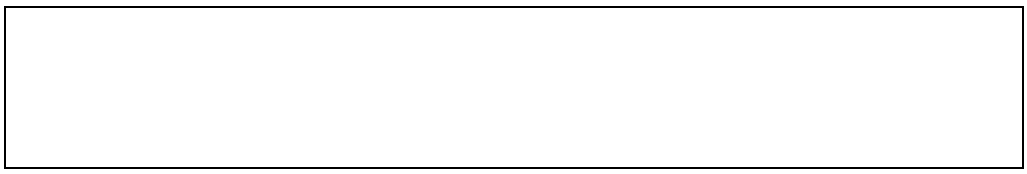

FIGURE 70 - SAS internal wide backplane-based fanout cable

5.2.4.3.2 SAS internal compact wide cable usage

a) symmetric cable: SAS internal compact wide cable plug connectors on each end;
b) controller-based fanout cable: SAS internal compact wide cable plug connector on one end (i.e., the controller end) and four SAS internal cable receptacle connectors on the other end (i.e., the backplane end); and
c) backplane-based fanout cable: Four SATA-style signal cable receptacle connectors on one end (i.e., the controller end) and a SAS internal compact wide cable plug connector on the other end (i.e., the backplane end).

Although the SAS internal compact wide cable plug connector always supports four physical links, the SAS internal wide cable may support one, two, three, or four physical links when used for controller-to-backplane applications. The cable between backplane and controller connects the Tx/Rx pairs as shown in Figure *1*.

Backplane receptacle										
Gnd	Rx0-	Rx0+	Gnd	:	The cable is a straight connection. The effect is of two receptacles face-face, so the pin numbering alignment is in reverse from one end to the other. A1 on the connector receptacle faces A18 on the backplane receptacle.	:	Gnd	Rx0-	Rx0+	Gnd
B18	B17	B16	B15	:		:	B4	B3	B2	B1
A18	A17	A16	A15	:		:	A4	A3	A2	A1
Gnd	Tx0+	Tx0-	Gnd	:		:	Gnd	Tx3+	Tx3-	Gnd
CID										
										CID
Gnd	Rx0+	Rx0-	Gnd	:		:	Gnd	Rx0+	Rx0-	Gnd
A1	A2	A3	A4	:		:	A15	A16	A17	A18
B1	B2	B3	B4	:		:	B15	B16	B17	B18
Gnd	Tx0-	Tx0+	Gnd	:		:	Gnd	Tx3-	Tx3+	Gnd
Controller Receptacle										

Figure *1*

The cable shall support four physical links for controller-to-controller applications. This cable terminates at like-numbered pins except on crossovers and inversions for signals, as illustrated in Figure *2*.

Controller Receptacle										
Gnd	Tx0-	***Tx0+***	Gnd	:	The lanes in the cable are a Side pair (A/B) and a signaling pair (adjacent pins) for the four signals. Each signal inverts and crosses over e.g. Side B pin 3 inverts to Side A, and crosses over to pin 2 for the Tx0//Rx0 signal.	:	Gnd	Tx3-	Tx3+	Gnd
B1	B2	***B3***	B4	:		:	B15	B16	B17	B18
A1	A2	A3	A4	:		:	A15	A16	A17	A18
Gnd	Rx0+	Rx0-	Gnd	:		:	Gnd	Rx3+	Rx3-	Gnd
										CID
										CID
Gnd	***Rx0+***	Rx0-	Gnd	:		:	Gnd	Rx3+	Rx3-	Gnd
A1	***A2***	A3	A4	:		:	A15	A16	A17	A18
B1	B2	B3	B4	:		:	B15	B16	B17	B18
Gnd	Tx0-	Tx0+	Gnd	:		:	Gnd	Tx3-	Tx3+	Gnd
Controller Receptacle										

Figure *2*

SFF-8086 defines a CID (Circuit Identifier) on the circuit board (plug), receptacle, and footprint figures. Pin numbering is defined by the standard(s) adopting the compact connector. For SAS, the CID is the highest numbered pin on Side A i.e. A18 on the internal compact wide connector and A13 on the external compact connector.

Figure 67CW shows the SAS internal compact wide cable being used to attach a controller to a backplane.

Controller				**Cable**				**Backplane**		
Ground	B18			B18	-----	B1			B1	Ground
Ground		A18		A18	-----	A1		A1		Ground
Tx3+	B17			B17	→	B2			B2	Rx3+
Rx3-		A17		A17	←	A2		A2		Tx3-
Tx3-	B16			B16	→	B3			B3	Rx3-
Rx3+		A16		A16	←	A3		A3		Tx3+
Ground	B15			B15	-----	B4			B4	Ground
Ground		A15		A15	-----	A4		A4		Ground
Tx2+	B14			B14	→	B5			B5	Rx2+
Rx2-		A14		A14	←	A5		A5		Tx2-
Tx2-	B13			B13	→	B6			B6	Rx2-
Rx2+		A13		A13	←	A6		A6		Tx2+
Ground	B12			B12	-----	B7			B7	Ground
Ground		A12		A12	-----	A7		A7		Ground
Sideband 7	B11			B11	←→	B8			B8	Sideband 7
Sideband 5		A11		A11	←→	A8		A8		Sideband 5
Sideband 2	B10			B10	←→	B9			B9	Sideband 2
Sideband 4		A10		A10	←→	A9		A9		Sideband 4
Sideband 1	B9			B9	←→	B10			B10	Sideband 1
Sideband 3		A9		A9	←→	A10		A10		Sideband 3
Sideband 0	B8			B8	←→	B11			B11	Sideband 0
Sideband 6		A8		A8	←→	A11		A11		Sideband 6
Ground	B7			B7	-----	B12			B12	Ground
Ground		A7		A7	-----	A12		A12		Ground
Tx1+	B6			B6	→	B13			B13	Rx1+
Rx1-		A6		A6	←	A13		A13		Tx1-
Tx1-	B5			B5	→	B14			B14	Rx1-
Rx1+		A5		A5	←	A14		A14		Tx1+
Ground	B4			B4	-----	B15			B15	Ground
Ground		A4		A4	-----	A15		A15		Ground
Tx0+	B3			B3	→	B16			B16	Rx0+
Rx0-		A3		A3	←	A16		A16		Tx0-
Tx0-	B2			B2	→	B17			B17	Rx0-
Rx0+		A2		A2	←	A17		A17		Tx0+
Ground	B1			B1	-----	B18			B18	Ground
Ground		A1		A1	-----	A18		A18		Ground
SAS internal compact wide receptacle connector				internal compact wide cable				SAS internal compact wide receptacle connector		
SAS internal compact wide cable plug connector						SAS internal compact wide cable plug connector				

FIGURE 67CW - SAS internal compact wide cable attaching controller to backplane

NOTE 8CW - For controller to backplane uses, up to four physical links may be used. SIDEBAND signals on the controller are attached to the corresponding SIDEBAND signals on the backplane (e.g., SIDEBAND0 of the controller is attached to SIDEBAND0 of the backplane)

Figure 68CW shows the SAS internal compact wide cable attaching two controllers.

Controller				Cable				Controller		
Ground	B18			B18	-----	B18			B18	Ground
Ground		A18		A18	-----	A18		A18		Ground
Tx3+	B17			B17	→	**A16**		**A16**		**Rx3+**
Rx3-		A17		A17	←	**B16**			**B16**	**Tx3-**
Tx3-	B16			B16	→	**A17**		**A17**		**Rx3-**
Rx3+		A16		A16	←	**B17**			**B17**	**Tx3+**
Ground	B15			B15	-----	B15			B15	Ground
Ground		A15		A15	-----	A15		A15		Ground
Tx2+	B14			B14	→	**A13**		**A13**		**Rx2+**
Rx2-		A14		A14	←	**B13**			**B13**	**Tx2-**
Tx2-	B13			B13	→	**A14**		**A14**		**Rx2-**
Rx2+		A13		A13	←	**B14**			**B14**	**Tx2+**
Ground	B12			B12	-----	B12			B12	Ground
Ground		A12		A12	-----	A12		A12		Ground
Sideband 7	B11			B11	↔	B11			B11	Sideband 7
Sideband 5		A11		A11	↔	A11		A11		Sideband 5
Sideband 2	B10			B10	↔	B10			B10	Sideband 2
Sideband 4		A10		A10	↔	A10		A10		Sideband 4
Sideband 1	B9			B9	↔	B9			B9	Sideband 1
Sideband 3		A9		A9	↔	A9		A9		Sideband 3
Sideband 0	B8			B8	↔	B8			B8	Sideband 0
Sideband 6		A8		A8	↔	A8		A8		Sideband 6
Ground	B7			B7	-----	B7			B7	Ground
Ground		A7		A7	-----	A7		A7		Ground
Tx1+	B6			B6	→	**A5**		**A5**		**Rx1+**
Rx1-		A6		A6	←	**B5**			**B5**	**Tx1-**
Tx1-	B5			B5	→	**A6**		**A6**		**Rx1-**
Rx1+		A5		A5	←	**B6**			**B6**	**Tx1+**
Ground	B4			B4	-----	B4			B4	Ground
Ground		A4		A4	-----	A4		A4		Ground
Tx0+	B3			B3	→	**A2**		**A2**		**Rx0+**
Rx0-		A3		A3	←	**B2**			**B2**	**Tx0-**
Tx0-	B2			B2	→	**A3**		**A3**		**Rx0-**
Rx0+		A2		A2	←	**B3**			**B3**	**Tx0+**
Ground	B1			B1	-----	B1			B1	Ground
Ground		A1		A1	-----	A1		A1		Ground
SAS internal compact wide receptacle connector				internal compact wide cable				SAS internal compact wide receptacle connector		
SAS internal compact wide cable plug connector						SAS internal compact wide cable plug connector				
NOTE:The are connectors are reversed from each other (one is latch up and the other is latch down). The Tx/Rx signals are highlighted.										

FIGURE 68CW - SAS internal compact wide cable attaching to controller

Figure 69CW shows the SAS internal compact wide controller-based fanout cable.

Controller			Cabling			Backplane End	
Ground	B18		B18				
Ground		A18	A18	----------	1	1	Ground
Tx3+	B17		B17	→	2	2	RP+
Rx3-		A17	A17	←	5	5	TP-
Tx3-	B16		B16	→	3	3	RP-
Rx3+		A16	A16	←	6	6	TP+
Ground	B15		B15	----------	4	4	Ground
Ground		A15	A15	----------	7	7	Ground
				----------	1	1	Ground
Tx2+	B14		B14	→	2	2	RP+
Rx2-		A14	A14	←	5	5	TP-
Tx2-	B13		B13	→	3	3	RP-
Rx2+		A13	A13	←	6	6	TP+
Ground	B12		B12	----------	4	4	Ground
Ground		A12	A12	----------	7	7	Ground
Sideband 7	B11		B11		Sideband signal connection is vendor-specific		
Sideband 5		A11	A11				
Sideband 2	B10		B10				
Sideband 4		A10	A10				
Sideband 1	B9		B9				
Sideband 3		A9	A9				
Sideband 0	B8		B8				
Sideband 6		A8	A8				
Ground	B7		B7				
Ground		A7	A7	----------	1	1	Ground
Tx1+	B6		B6	→	2	2	RP+
Rx1-		A6	A6	←	5	5	TP-
Tx1-	B5		B5	→	3	3	RP-
Rx1+		A5	A5	←	6	6	TP+
Ground	B4		B4	----------	4	4	Ground
Ground		A4	A4	----------	7	7	Ground
				----------	1	1	Ground
Tx0+	B3		B3	→	2	2	RP+
Rx0-		A3	A3	←	5	5	TP-
Tx0-	B2		B2	→	3	3	RP-
Rx0+		A2	A2	←	6	6	TP+
Ground	B1		B1	----------	4	4	Ground
Ground		A1	A1	----------	7	7	Ground
SAS internal wide compact receptacle connector			SAS internal compact wide contoller-based fanout cable			SAS device plug connectors	
SAS internal compact 1X plug connectors					SAS internal cable receptacle connectors		

FIGURE 69CW - SAS internal compact wide controller-based fanout cable

Figure 70CW shows the SAS internal compact wide backplane-based fanout cable.

Controller End			Cabling			Backplane		
				B1		B1	Ground
Ground	1	1	----------	A1	A1		Ground
Tx+	2	2	→	B2		B2	Rx3+
Rx-	5	5	←	A2	A2		Tx3-
Tx-	3	3	→	B3		B3	Rx3-
Rx+	6	6	←	A3	A3		Tx3+
Ground	4	4	----------	B4		B4	Ground
Ground	7	7	----------	A4	A4		Ground
Ground	1	1	----------				
Tx+	2	2	→	B5		B5	Rx2+
Rx-	5	5	←	A5	A5		Tx2-
Tx-	3	3	→	B6		B6	Rx2-
Rx+	6	6	←	A6	A6		Tx2+
Ground	4	4	----------	B7		B7	Ground
Ground	7	7	----------	A7	A7		Ground
Sideband signal connection is vendor-specific				B8		B8	Sideband 7
				A8	A8		Sideband 5
				B9		B9	Sideband 2
				A9	A9		Sideband 4
				B10		B10	Sideband 1
				A10	A10		Sideband 3
				B11		B11	Sideband 0
				A11	A11		Sideband 6
				B12		B12	Ground
Ground	1	1	----------	A12	A12		Ground
Tx+	2	2	→	B13		B13	Rx1+
Rx-	5	5	←	A13	A13		Tx1-
Tx-	3	3	→	B14		B14	Rx1-
Rx+	6	6	←	A14	A14		Tx1+
Ground	4	4	----------	B15		B15	Ground
Ground	7	7	----------	A15	A15		Ground
Ground	1	1	----------				
Tx+	2	2	→	B16		B16	Rx0+
Rx-	5	5	←	A16	A16		Tx0-
Tx-	3	3	→	B17		B17	Rx0-
Rx+	6	6	←	A17	A17		Tx0+
Ground	4	4	----------	B18		B18	Ground
Ground	7	7	----------	A18	A18		Ground
SAS device plug connectors		SAS internal compact wide backplane fanout cable			SAS internal wide compact receptacle connector		
SAS internal cable receptacle connectors				SAS internal compact 1X plug connectors			

FIGURE 70CW - SAS internal compact wide backplane-based fanout cable