

To: T10 Technical Committee
 From: Jay Neer (Jay.Neer@Molex.com)
 Date: March 17, 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 changes requested by the SAS Phy working group.

- SAS keying needs to be defined in the proposal:
 End device has center blocking key
 Table routing has key on left
 Subtractive routing has key on right
 Cable has center and right slot on one end, center and left slot on other end.
 The figures are included. Text which accompanies the figures and where it will be located has been left to the discretion of the editor.
- Reorder sidebands to match the SFF-8484 internal multilane version.
 Done
- Map pin numbering convention to physically match PCI Express and include it in the SFF document for both internal and external versions.
 The objective has been achieved in a friendlier manner to SAS by having Circuit Identifier on the opposite side so that the SAS pin numbering remains the same.
- Change internal configuration to a single cable version as done with the SFF-8484 version
 Done.
- ...and make the appearance of the connection illustration similar to the existing internal multilane figure.
 Done.
- Fix connector designations to match those on the figures.
 Done.

Note: The tables and modified to the SAS-style have one oddity. Although Word highlights text in color in the Tables 24C, 25CW and 26CW, the Acrobat 5 PDF shows all text as black.

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

~~SAS external cables shall use the 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.

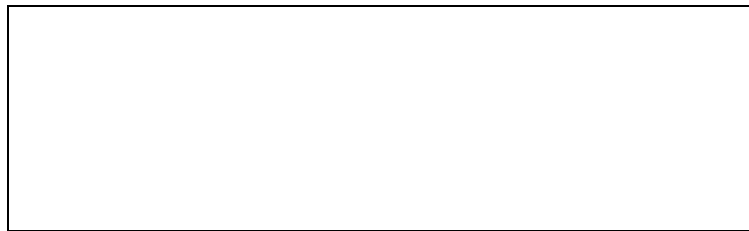


Figure 61 - SAS external cable plug connector

5.2.3.3.2 SAS external receptacle connector

~~SAS devices with external ports shall use the 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.

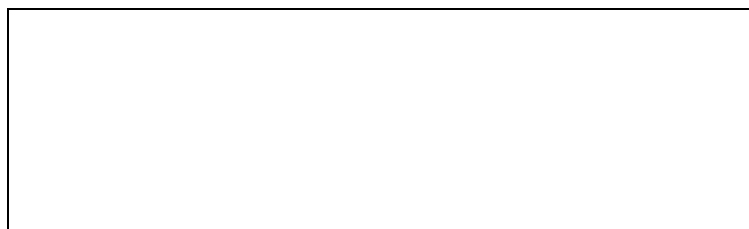
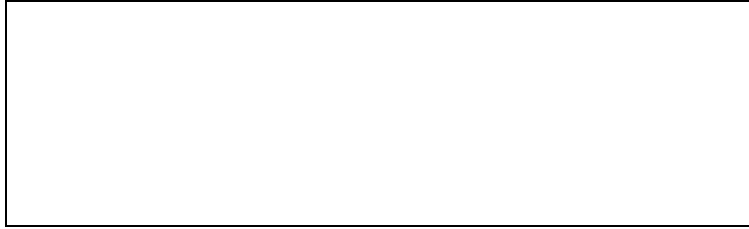


Figure 62 - SAS external receptacle connector

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

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



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 with latch is defined in SFF-8088 as the free (plug) cable connector. 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.

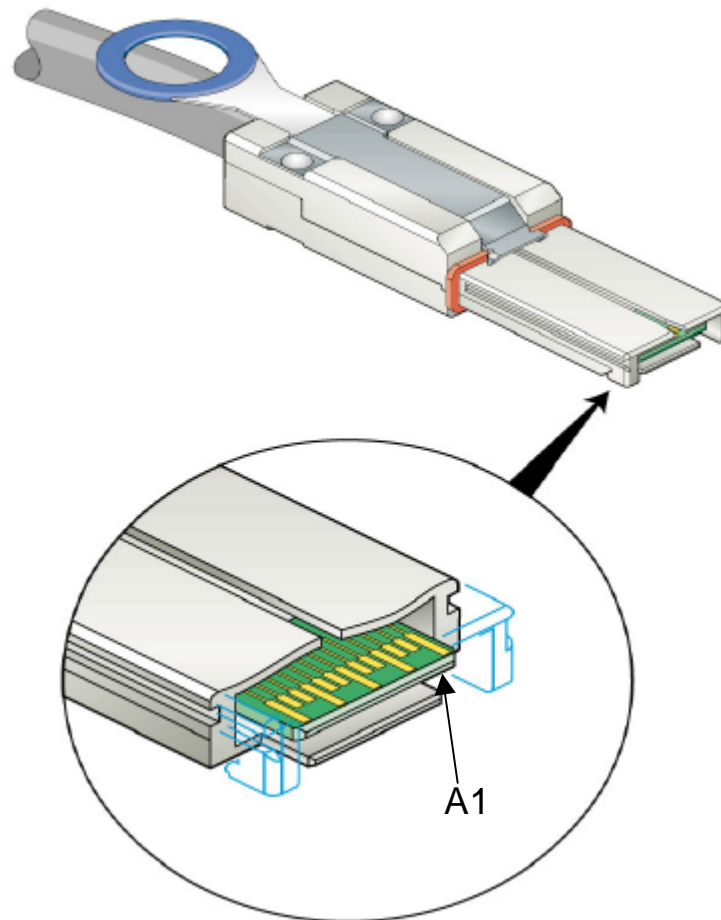


Figure 61C — SAS external compact cable plug connector

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 is defined in SFF-8088 as the fixed (receptacle) right angle connector. SFF-8086 defines the receptacle mating interface (the receptacle body is common to both internal and external connectors).

The SAS external compact 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 contacts 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.

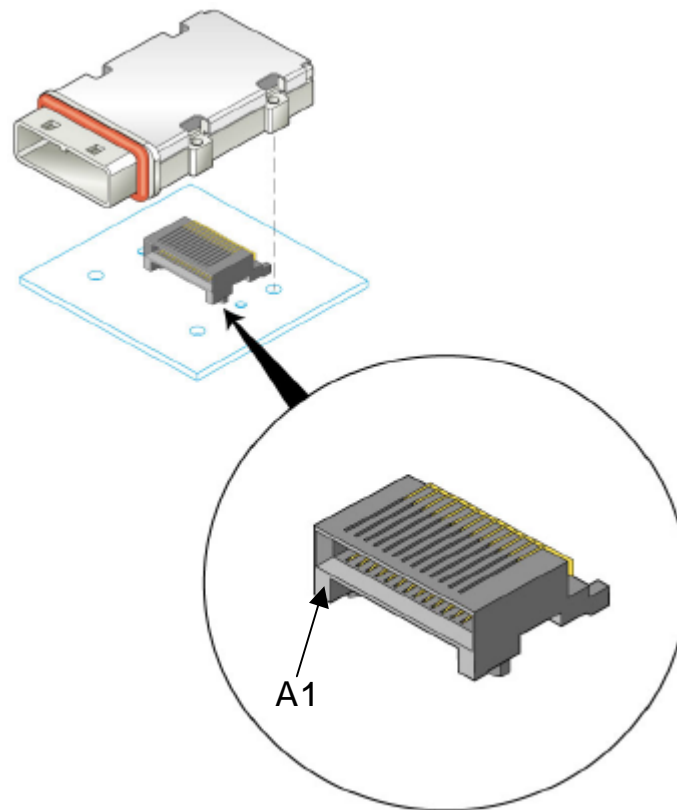


Figure 62C — SAS external compact receptacle connector

5.2.3.3.6 SAS external compact connector pin assignments

Table 24C defines the signal assignments for pins in the 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	Signal pin to use based on number of physical links supported by the cable			
	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	B11
Tx3+	N/C	N/C	N/C	B12
Tx2-	N/C	N/C	B8	B8
Tx2+	N/C	N/C	B9	B9
Tx1-	N/C	B5	B5	B5
Tx1+	N/C	B6	B6	B6
Tx0-	B2	B2	B2	B2
Tx0+	B3	B3	B3	B3
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

~~SAS internal wide cables shall use the 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.

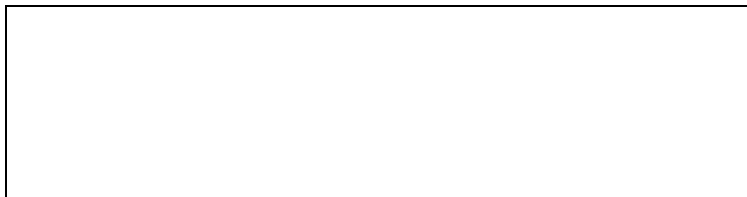


Figure 63 - SAS internal wide plug connector

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.

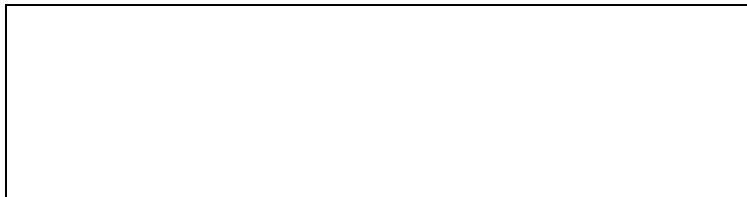


Figure 64 - SAS internal wide cable receptacle connector

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

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 ~~5.2.3.4.2~~) 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



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 as the fixed (receptacle) right angle connector. 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 eight 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.

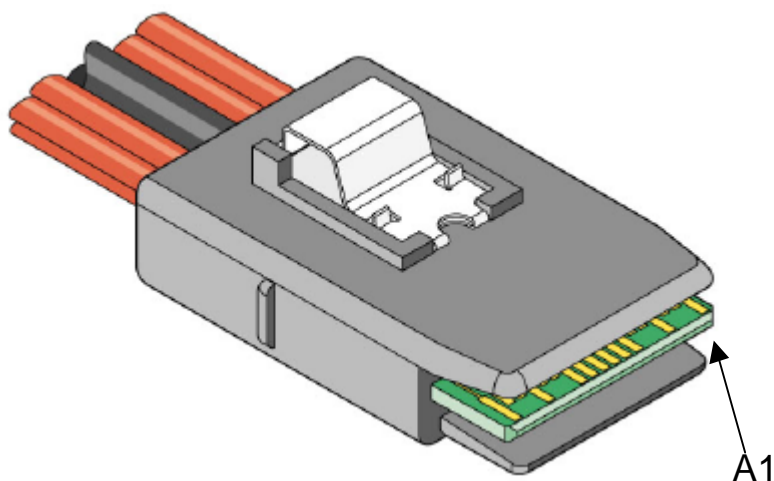


Figure 63CW — SAS internal compact wide cable plug connector

5.2.3.4.5 SAS internal compact wide receptacle connector

The SAS internal compact wide receptacle connector is defined in SFF-8087 as the fixed (receptacle) right angle connector. SFF-8086 defines the receptacle mating interface (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 eight 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.

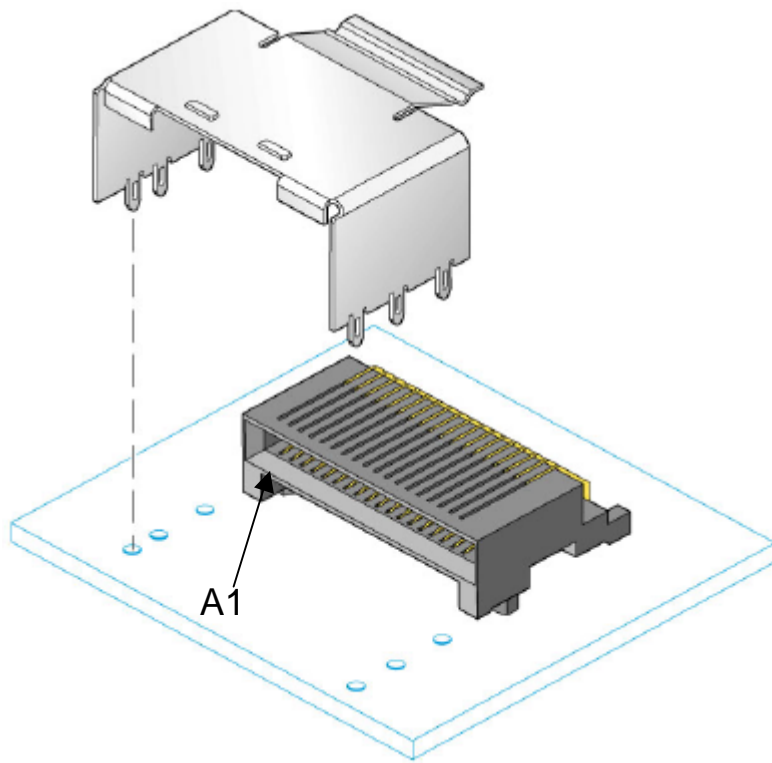


Figure 64CW — SAS internal compact wide receptacle connector

5.2.3.4.6 SAS internal compact wide connector pin assignments

Table 25CW defines the signal assignments for pins in the 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	Signal pin to use based on number of physical links supported by the cable			
	One	Two	Three	Four
Rx0+	A2	A2	A2	A2
Rx0-	A3	A3	A3	A3
Tx0-	B3	B3	B3	B3
Tx0+	B2	B2	B2	B2
Rx1+	N/C	A5	A5	A5
Rx1-	N/C	A6	A6	A6
Tx1-	N/C	B6	B6	B6
Tx1+	N/C	B5	B5	B5
Sideband 0	B8	B8	B8	B8
Sideband 1	B9	B9	B9	B9
Sideband 2	B10	B10	B10	B10
Sideband 3	A9	A9	A9	A9
Sideband 4	A10	A10	A10	A10
Sideband 5	A11	A11	A11	A11
Sideband 6	A8	A8	A8	A8
Sideband 7	B11	B11	B11	B11
Rx2+	N/C	N/C	A13	A13
Rx2-	N/C	N/C	A14	A14
Tx2-	N/C	N/C	B14	B14
Tx2+	N/C	N/C	B13	B13
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
SIGNAL	A1 A4 A7 A12 A15 A18			
GROUND	B1 B4 B7 B12 B15 B18			
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 the 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	Signal pin to use based on number of physical links supported by the cable			
	One	Two	Three	Four
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
Rx2+	N/C	N/C	A13	A13
Rx2-	N/C	N/C	A14	A14
Tx2-	N/C	N/C	B14	B14
Tx2+	N/C	N/C	B13	B13
Sideband 7	A11	A11	A11	A11
Sideband 6	B8	B8	B8	B8
Sideband 5	B11	B11	B11	B11
Sideband 4	B10	B10	B10	B10
Sideband 3	B9	B9	B9	B9
Sideband 2	A10	A10	A10	A10
Sideband 1	A9	A9	A9	A9
Sideband 0	A8	A8	A8	A8
Rx1+	N/C	A5	A5	A5
Rx1-	N/C	A6	A6	A6
Tx1-	N/C	B6	B6	B6
Tx1+	N/C	B5	B5	B5
Rx0+	A2	A2	A2	A2
Rx0-	A3	A3	A3	A3
Tx0-	B3	B3	B3	B3
Tx0+	B2	B2	B2	B2
SIGNAL	A1 A4 A7 A12 A15 A18			
GROUND	B1 B4 B7 B12 B15 B18			
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 connector is defined in SFF-8470 and the SAS external compact cable connector is defined in SFF-8088 (and companion specification SFF-8086).

Both ~~as the~~ are four lane interfaces. The external cables ~~does~~ 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 ~~(e.g., Tx 0+ (S16) of connector shall connect to Rx 0+ (S1) of the other connector) (see 5-2.3.3.1)~~. 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 cables defined, and two connector types.

The SAS internal wide connector is defined in SFF-8484 and the SAS internal compact wide connector is defined in SFF-8087 (and companion specification SFF-8086).

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.

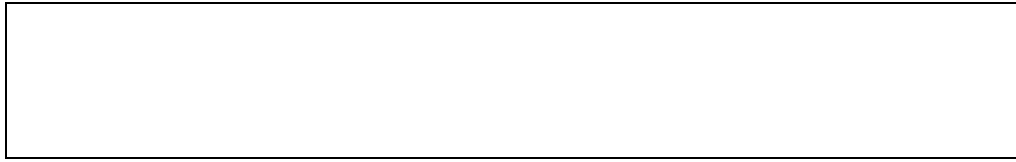


FIGURE 67 - SAS internal wide cable controller to backplane

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.

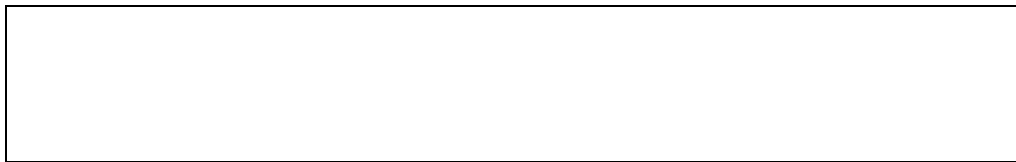


FIGURE 70 - SAS internal wide backplane-based fanout cable

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.

Figure 6767CW shows the SAS internal compact wide cable being used to attach a controller to a backplane.

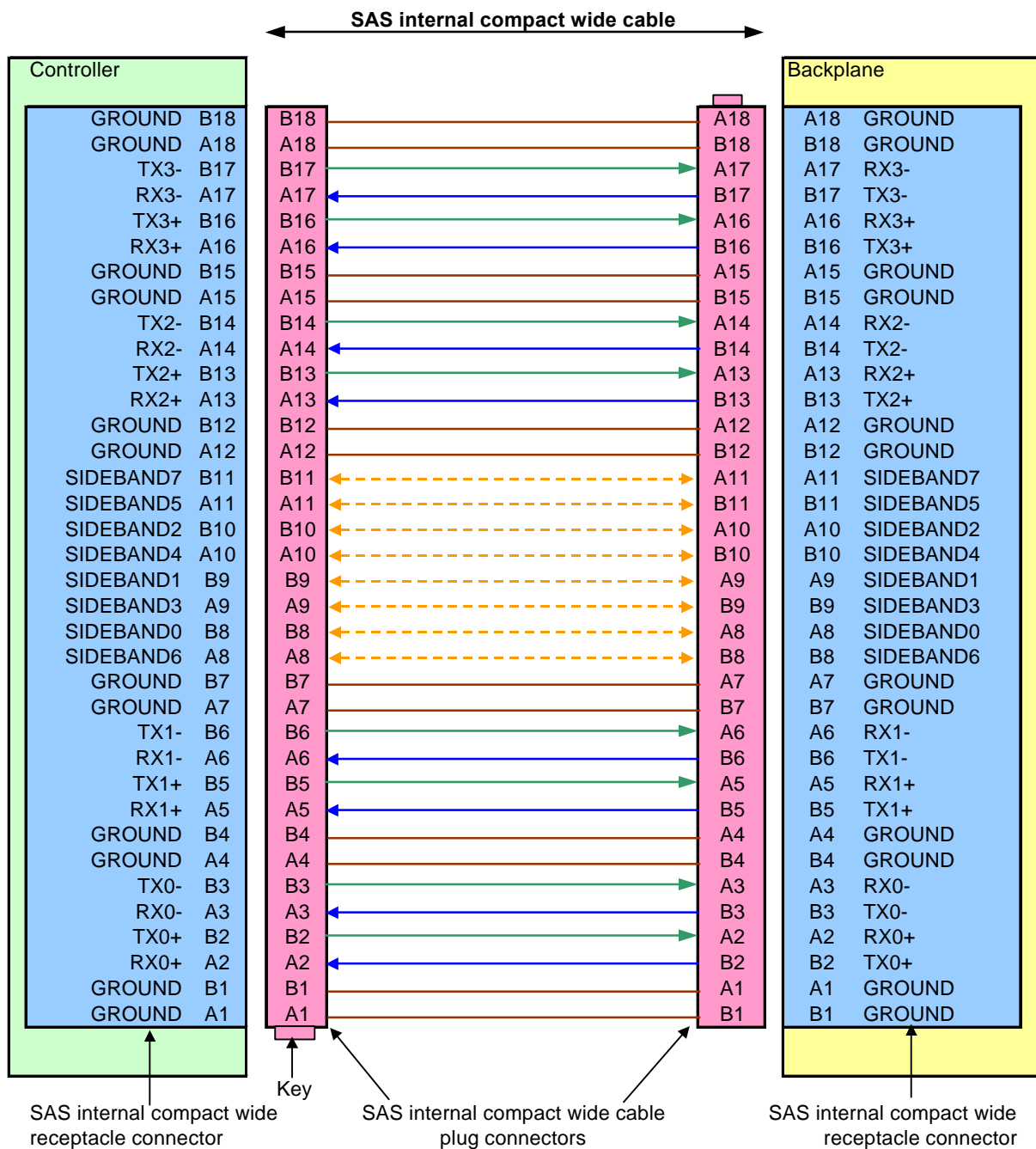


Figure 67CW - SAS internal compact wide cable attaching controller to backplane

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.

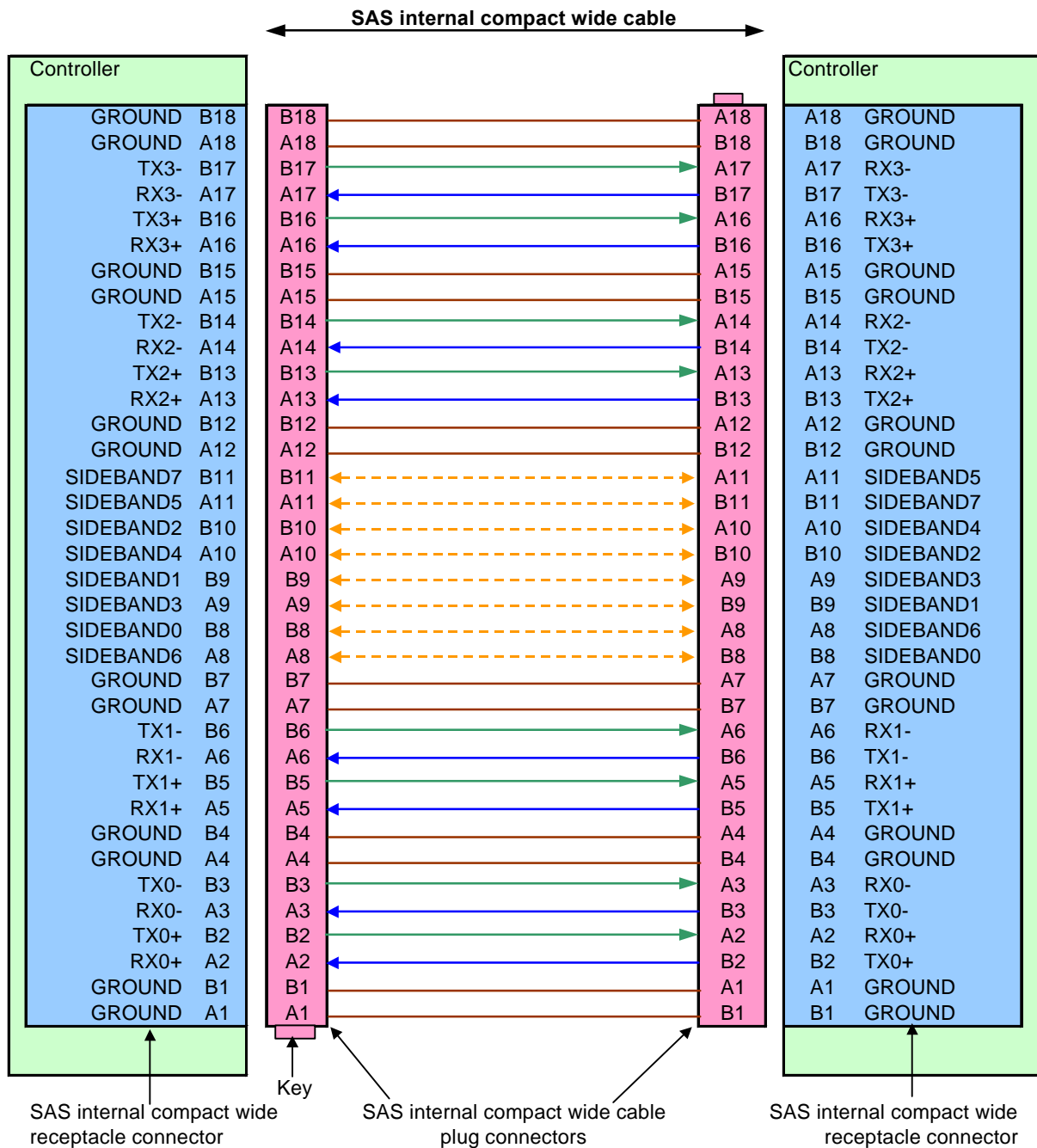


Figure 68CW - SAS internal compact wide cable attaching controller to controller

NOTE 10CW - 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 SIDEBAND6 of the other controller).

Figure 6969CW shows the SAS internal compact wide controller-based fanout cable.

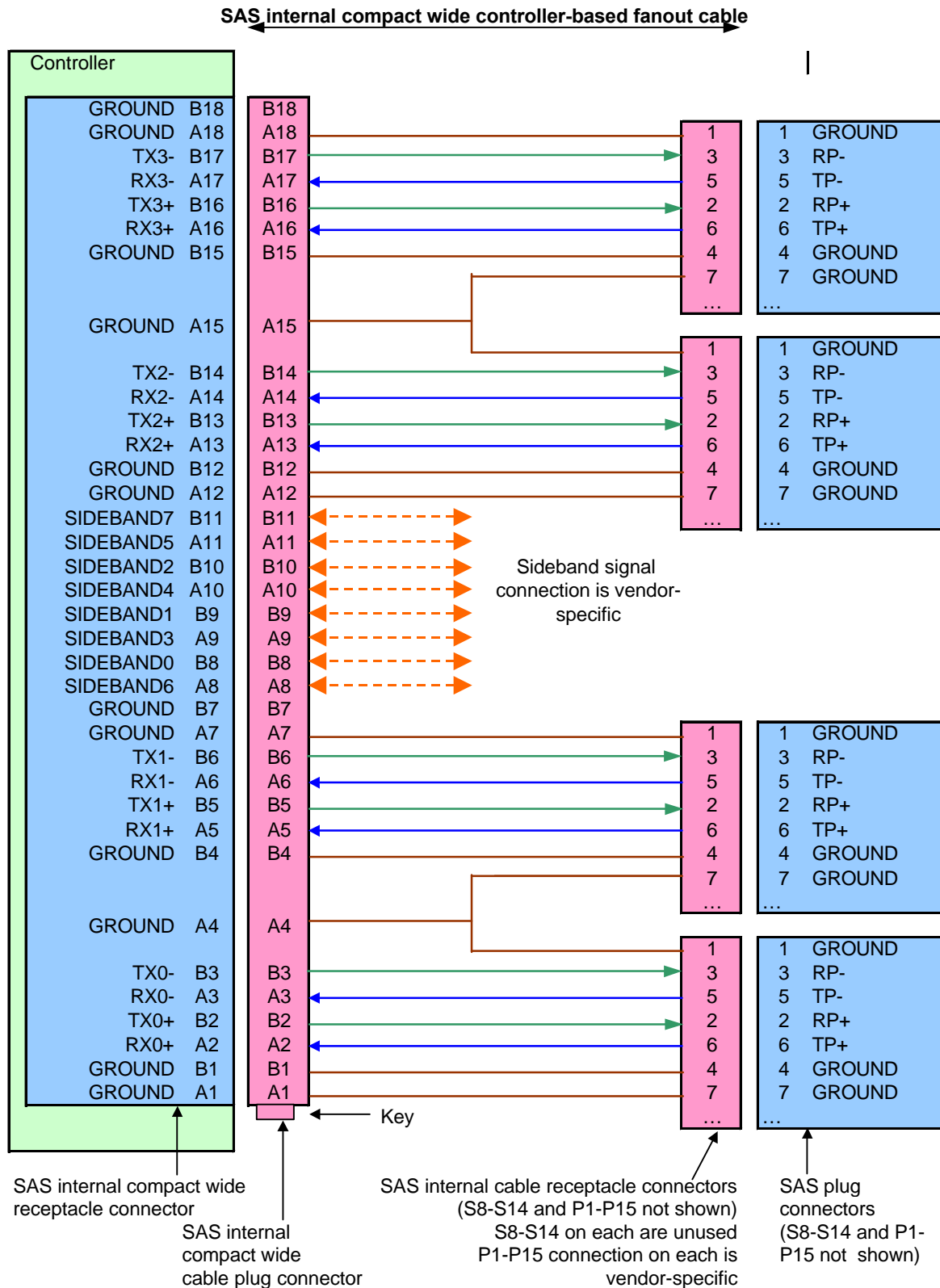


Figure 6969CW - SAS internal compact wide controller-based fanout cable

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

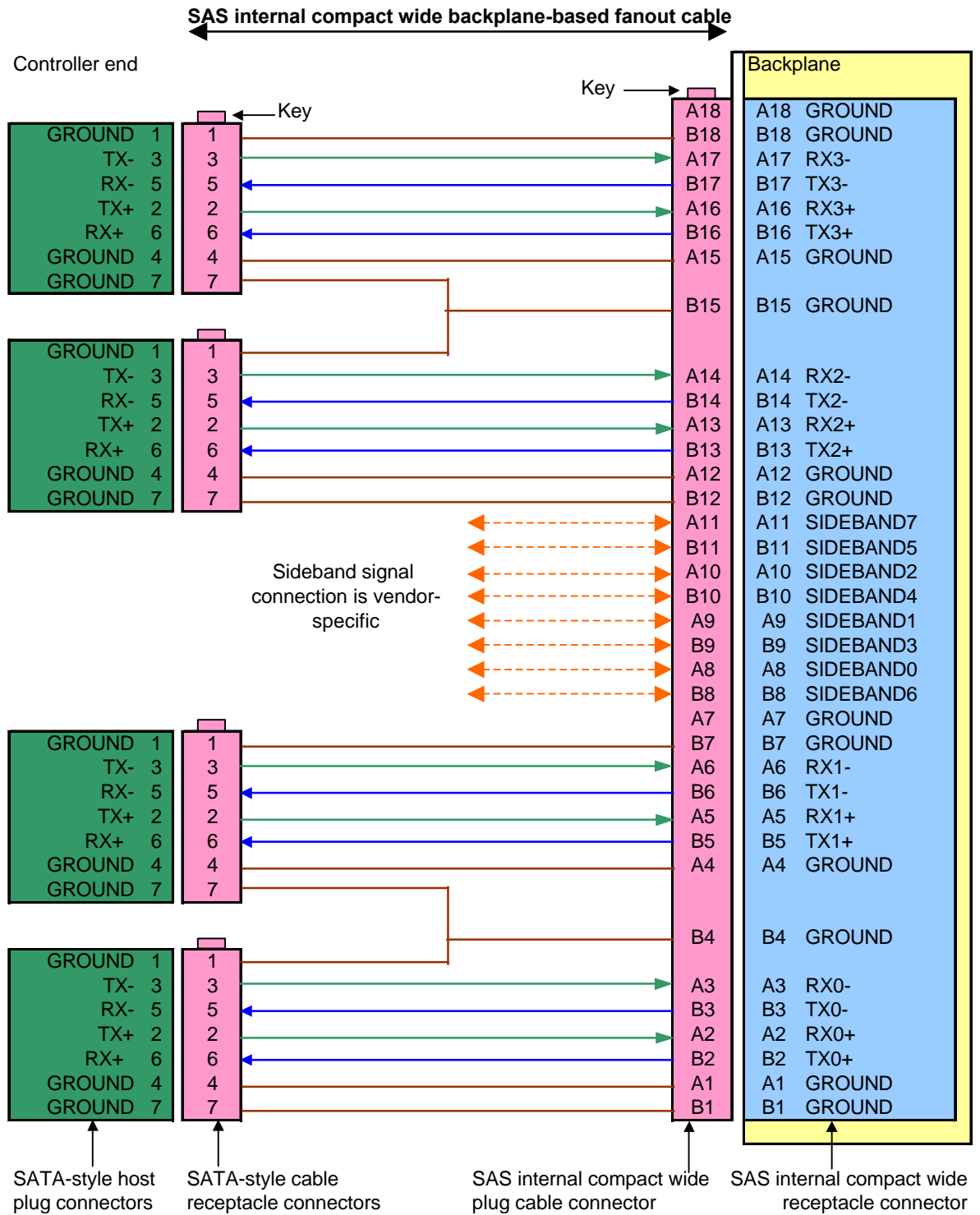


Figure 70CW - SAS internal compact wide backplane-based fanout cable

The SAS working group requested that keying be provided for the connectors.

The text which accompanies the figures may belong in 5.2.3.3.4 and 5.2.3.3.5, or be added in a new section at the choice of the editor.

