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SFF-8448

Specification for

SAS Sideband Signal Assignments

Rev 1.3b June 19, 2018

Secretariat: SFF TA TWG

Abstract: This specification documents the signal assignments for known Vendor Specific sidebands that are defined in SAS (Serial Attached SCSI) and non-SAS/ Other Protocols.

This specification provides a common reference/ implementation for systems manufacturers, system integrators, and suppliers.

This specification is made available for public review, and written comments are solicited from readers. Comments received by the members will be considered for inclusion in future revisions of this specification.

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Change History

Rev 1.0 October 1, 2015
- Updated style from 2005 Rev 0.5 to current template
- Added sidebands 8 & 9 to match SFF-9400
- Added an additional usage type within sidebands 6 & 7 which changes Table 5-2
  - Changed Reserved to "Other Bus Type"
  - The 2-wire interface was carried over to the "MID" which allows the host to determine the usage of the VSP (3-5, 8 & 9)

Rev 1.1 April 13, 2016
- Changed "Other Bus Type" to "Other Circuit Size/ Bus Type"
- Replaced Sideband 8 and Sideband 9 with Sideband + and Sideband -
- Defined logic levels

Rev 1.2 August 29, 2016
- Added SAS-3 to 9401 in 2.1
- Added SFF-9402 to 2.1
- Added clarifications to Table 3-1
- Deleted Table 3-2
- Reconstructed the text in Section 3 to further explain the sideband functionality between the three interfaces described
- Deleted SFF-9401
- Updated Table 3-1 per workgroup conference call

Rev 1.3 2016 November 30, 2016
- Established a purpose for this document
- Utilizing open-drain outputs when sourcing the Sideband / VSP signals
- Added statement about HSCL for Non-SAS related applications.
- Define what the abbreviation for VSP
- Update 2-Wire sideband type names for better understanding
- Updated VSP assignments in Table 3-1
- Updated definitions of the different 2-wire bus types.
- Added non-SAS applications to address Other 2-wire Type and HSCL logic.
- Changed K Ohm to Kohm
- Added statement about non-SAS high speed interface in the Sideband +/-, VSP+/- and Cabling Legacy Interfaces
- Updated Header information
- Updated the Abstract definition
- Added r002 to the September 13, 2016 update history
- Section 1 Scope - updated the description.
- Section 2.1 Industry Documents, Added SES-2, SES-3 and updated the description for SFF-9402
- Updated Section 3 opening paragraph as to what this document provides based on input from Seagate.
- In Section 3.1 made reference to 3.3V (VCC) for single-ended signals based on input from Seagate.
- Added “Update History” that was missing above this section based on input from Amphenol.
- Removed Sideband+ and Sideband- from Table 3 1 RECOMMENDED SIDEBAND ASSIGNMENTS SFF-8485 (SGPIO) column and replaced with dashes based on input from HPE.
- Section 3.5 Cabling of Legacy Interfaces - changed SFF-8611 to SFF-8621 which includes the cable and board mount connectors.

Rev 1.3a June 15,2018
- Removed “Reference Guide” from header
- Cleaned up Change History

Rev 1.3b June 18, 2018
- Replaced “Reference Guide For” in the title block with “Specification for”

Foreword

The development work on this specification was done by the SNIA SFF TWG, an industry group. Since its formation as the SFF Committee in August 1990, the membership has included a mix of companies which are leaders across the industry.

When 2 1/2" diameter disk drives were introduced, there was no commonality on external dimensions e.g. physical size, mounting locations, connector type, connector location, between vendors. The SFF Committee provided a forum for system integrators and vendors to define the form factor of disk drives.

During their definition, other activities were suggested because participants in SFF faced more challenges than the form factors. In November 1992, the charter was expanded to address any issues of general interest and concern to the storage industry. The SFF Committee became a forum for resolving industry issues that are either not addressed by the standards process or need an immediate solution.

In July 2016, the SFF Committee transitioned to SNIA (Storage Networking Industry Association), as a TA (Technology Affiliate) TWG (Technical Work Group).

Industry consensus is not a requirement to publish a specification because it is recognized that in an emerging product area, there is room for more than one approach. By making the documentation on competing proposals available, an integrator can examine the alternatives available and select the product that is felt to be most suitable.

SFF meets during the T10 (see www.t10.org) and T11 (see www.t11.org) weeks, and SSWGs (Specific Subject Working Groups) are held at the convenience of the participants. Material presented to SFF becomes public domain, and there are no restrictions on the open mailing of the presented material by Members.

Many of the specifications developed by SFF have either been incorporated into standards or adopted as standards by ANSI, EIA, JEDEC and SAE.
For those who wish to participate in the activities of the SFF TWG, the signup for membership can be found at:
http://www.snia.org/sff/join

The complete list of SFF Specifications which have been completed or are currently being worked on by the SFF Committee can be found at:
http://www.snia.org/sff/specifications/SFF-8000.TXT

If you wish to know more about the SFF TWG, the principles which guide the activities can be found at:
http://www.snia.org/sff/specifications/SFF-8032.PDF

Suggestions for improvement of this specification will be welcome, they should be submitted to:
http://www.snia.org/feedback

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1 Scope

This specification defines the signal assignments which permit known Vendor Specific definitions of sideband usage in SAS and non-SAS/ Other Protocols to coexist.

1.1 Copyright

1.2 Disclaimer

Suggestions for revisions should be directed to:

http://www.snia.org/feedback/

2 References

2.1 Industry Documents

- INCITS 417 Serial Attached SCSI 1.1 (SAS-1.1)
- INCITS 478 Serial Attached SCSI 2.1 (SAS-2.1)
- INCITS 519 Serial Attached SCSI 3 (SAS-3)
- INCITS 534 Serial Attached SCSI 4 (SAS-4)
- SFF-8485 Serial GPIO (General Purpose Input/Output) Bus
- SFF-9400 Universal 4/8X Pinouts
- SFF-9402 Specification for Multi-Protocol Internal Cables for SAS and/or PCIe
- SCSI Enclosure Services - 2 (SES-2) T10/1559
- SCSI Enclosure Services – 3 (SES-3) T10/2149

2.2 Sources

There are several projects active within the SFF TWG. The complete list of specifications which have been completed or are still being worked on are listed in

http://www.snia.org/sff/specifications/SFF-8000.TXT

Copies of ANSI standards may be purchased from the InterNational Committee for Information Technology Standards.

http://www.techstreet.com/incitsgate.tmpl

2.3 Conventions

The dimensioning conventions are described in ANSI-Y14.5M, Geometric Dimensioning and Tolerancing. All dimensions are in millimeters, which are the controlling dimensional units (if inches are supplied, they are for guidance only).

The ISO convention of numbering is used i.e., the thousands and higher multiples are separated by a space and a period is used as the decimal point. This is equivalent to the English/American convention of a comma and a period.

American	French	ISO
0.6	0,6	0.6
1,000	1 000	1 000
1,323,462.9	1 323 462,9	1 323 462.9

2.4 Definitions

For the purpose of SFF Specifications, the following definitions apply:

Reserved: Where this term is used for defining the signal on a connector pin its actual function is set aside for future standardization. It is not available for vendor specific use. Where this term is used for bits, bytes, fields and code values; the bits, bytes, fields and code values are set aside for future standardization. The default value shall be zero. The originator is required to define a reserved field or bit as zero, but the receiver should not check reserved fields or bits for zero.

3 Sideband Assignments

This specification provides a set of recommended sideband signal assignments to avoid electrical damage when different sideband types are connected together. Functionality between different sideband types is not guaranteed.

The sidebands are defined in Serial Attached SCSI (SAS) as being Vendor Specific. The assignments shown in this specification enable known Vendor Specific applications to coexist. With the introduction of other interfaces that are non-SAS related that utilize the same physical connectors, it raises concern over interoperability issues and the possibility that harm could be caused to the circuitry of one device or another. Sideband [0-7] are defined in SAS and Vendor Specific Pins (VSP) are all considered 3.3V logic and utilize open-drain outputs when sourcing the signal. Sideband +/- and VSP +/- use High Speed Current Steering Logic (HCSL) signal levels for a differential clock sourced by the non-SAS related applications.

There are three known usages of sidebands at present, one as defined in SFF-8485(SGPIO) and the others are 2-Wire interfaces. (Refer to SFF-9402).

Table 3-1 RECOMMENDED SIDEBAND ASSIGNMENTS

Signal	SFF-8485 (SGPIO)	Standard 2-Wire Type	Other 2-Wire Type
Sideband 0	SClock	2W_SCL	2W_SCL
Sideband 1	SLoad	2W_SDA	2W_SDA
Sideband 2	Ground	Ground	Ground
Sideband 3	Ground	Ground	VSP
Sideband 4	SDataOut	Reset	VSP
Sideband 5	SDataIn	ADD	VSP
Sideband 6	Controller_Type	Controller_Type	VSP
Sideband 7	Backplane_Type	Backplane_Type	Backplane_Type/ VSP
Sideband +	-	Sideband +	VSP +
Sideband -	-	Sideband -	VSP -

The SAS standard requires that VSP usage of the sidebands not conflict with SFF-8485 (SGPIO). The assignments in Table 3-1 meet this requirement as well as allow other Vendor Specific implementations and avoid conflicts between the different sideband types shown.

Controller/ Root and Backplanes are able to adapt to whichever sideband methodology is in use via the Backplane_Type and/or Controller_Type. The Controller/ Root interface monitors the Backplane_Type and the Backplane checks Controller_Type. The Backplane_Type has priority over the Controller_Type as to the sideband interface used. If the backplane supports multiple sideband types, it would monitor Controller_Type and responds back to the requested controller via its Backplane_Type.

3.1 SideBand Type Identification

Sideband Type identification may be accomplished with pull-up or pull-down resistors via the Backplane_Type and driven by open-drain logic/ resistors on the Controller_Type. Independent of Sideband Type being used, single-ended signals are considered operating from 3.3V (VCC) and use 3.3V logic with open-drain when sourcing the signals. To address both SGPIO and 2-Wire interfaces, a “LOW” level (0) input voltage (VIL) 0.8 V maximum and a “HIGH” level (1) input voltage (VIH) 2.4 V minimum are required. Refer to the associated SFF-8485 and 2-Wire specifications for detailed information.

- SGPIO = LOW
- Standard 2-Wire Type = HIGH
- Other 2-Wire Type = HIGH

When the Backplane_Type is supporting 2-Wire type interfaces, it is recommended to use a 4.7 Kohm resistor with a relative tolerance of 5% connected to VCC. Once the Backplane_Type has been determined, it does not preclude the Controller/ Root from using this signal for some other user/vendor specific defined application. As an example, if used as part of a secondary 2-Wire interface, this signal would already be pulled up on the Backplane.

3.2 SGPIO

A SAS Controller is always the SGPIO initiator. SClock, SLoad and SDataOut are sourced by the controller and the backplane drives SDataIn. Refer to the industry specification for SGPIO (SFF-8485) for required termination and switching thresholds.

3.3 2-Wire Bus Types

As described above, there are two different 2-Wire bus types: Standard 2-Wire and Other 2-Wire . As shown in Table 3-1, these two buses along with Backplane_Type are on the same pins on two different bus protocols. This allows the controller/ root, to first determine if the bus is SGPIO (Backplane_Type = LOW) or via 2-Wire (Backplane_Type = HIGH) communication to determine the type of high speed bus it is managing. This was implemented to cover the case where some interfaces share the same connectors which have no mechanical keying to prevent cables from one interface being installed in the other. These provide a method for the controller/root complex to identify the interface it is connected to (backplane/ endpoint) before enabling the rest of the interface.

- **Standard 2-Wire Type**

The Standard 2-Wire Type is sourced from the controller for SAS drive management mainly when supporting Storage Enclosure Services (SES). This bus includes the sideband signals Reset and ADD (address) which are sourced by the controller end as a 2-Wire Reset (open-drain) and address (NC or pulled to ground) that serve as inputs for the backplane end of the interface. Reset and ADD on the backplane are typically pulled up to values similar to the 2-Wire interface termination on the backplane end. Note: Reset and ADD are “NOT” required to support the 2-Wire interface and may be vendor specific providing it does not conflict (result in damage) with the standard 2-Wire or SGPIO implementation.

- **Other 2-Wire Type**

The Other 2-Wire Type is sourced from a host or root to manage other non-SAS related interfaces. With the exception of these two signals and the Backplane_Type, the remaining signals are labeled VSP which may not work with the Standard 2-Wire or SGPIO but would not cause any damage. Refer to SFF-9402 for pin assignments.

3.4 Sideband +/-, VSP +/-

Sideband +/- and VSP +/- are HSCL sourced from the Root devices only. These two signals are associated with a differential pair utilized in non-SAS high speed interface. They are not compatible with 3.3V logic. Refer to SFF-9402 specification for more details.

3.5 Cabling of Legacy Interfaces

It is still possible to have sideband signal conflicts when transitioning between legacy SFF-8087/ SFF-8643 (SAS-3) and the newly defined connectors SFF-8621/ SFF-8654 that are specified in SAS-4 and other non-SAS high speed interface.