Enclosure Management Cabling Guide for Intel® C200 and C600 Series Chipset Based Server Systems with Hot-Swap Drive Enclosures

Cabling Guide for:

- Intel® C200 or C600 Series Chipset based Server Boards and Systems
- Intel® RAID Controllers RS25FB044, RS25AB080, RS25DB080, RT3WB080, RS2VB080, RS2VB040, RS2SG244, RS2WG160, RS2BL080, RS2BL080DE, RS2BL040, RS2MB044, RS2WC080, RS2WC040, SRCSASJV, SRCSASRB, SRCSASLS4I, SRCSATAWB, SRCSASBB8I
- Intel® Integrated RAID Module RMS25PB080, RMS25PB040, RMT3PB080, RMS25CB080, RMS25CB040, RMT3CB080, RMS25KB080, RMS25KB040, RMS25JB080, RMS25JB040, RMS2MH080, RMS2AF080, RMS2AF040, RMS2LL080, RMS2LL040
- Intel® RAID Expander Card RES2SV240, RES2CV360, RES2CV240

Revision 1.3

July, 2012

Revision History

Date	Revision Number	Modifications
March , 2012	1.0	Initial release
March 22, 2012	1.1	“S2600GL / S2600GZ cabling” updated
April, 2012	1.2	“S2600GL / S2600GZ cabling” updated; S2600CP cabling
July, 2012	1.3	“Cabling Overview of Major Hardware Configuration Types” updated;

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Contents

1. Enclosure Management Cabling List

This section introduces the cabling from server boards' onboard RAID options, and from RAID add-in cards or RAID modules. Below table covers possible hardware configurations with selected server board, chassis, and backplane.

Note: Rack server systems' cables from server boards' onboard RAID options have been defined in rack server systems' Technical Product Specifications, Service Guide or Quick Installation Guide, and won't be discussed in this document.

Note: The **On-board SATA/SAS Capable Controller**'s SAS/SATA ports number 4~7 are disabled by default. Only ports number 0~3 work by default. Refer to *Intel® RAID Quick Reference Guide*, or *Intel® RAID C600 Upgrade Key – Installation Guide* from http://www.intel.com to get more details of how to enable SCU SAS/SATA ports number 4~7.

Note: The **On-board SATA/SAS Capable Controller** ports, if connected to backplanes or drives through expander devices, cannot support booting from these drives in RSTe mode.

AHCI Capable SATA Controller Cabling Details

Boards	Backplane	Cabling from AHCI Capable SATA Controller
Boards which have all six SATA ports for their AHCI capable SATA Controller	FUP4X35HSBP or FR1304HSBP	Use SATA-to-SATA cable, & SGPIO cable (G22461-00x)

Note: The six AHCI ports are numbered as Ports 0 – 5. Port 2 connect to backplane slot 0. Port 3 to slot 1. Port 4 to slot 2. Port 5 to slot 3. Port 0 and 1 are capable of 6Gb/s and are primarily for optical drives or direct attached drives.

Ports 0 and 1 can be connected to a backplane in sequence after ports 2-5 if desired. That means, port 0 to slot 4, port 1 to slot 5. However, fault LED on Port 0 and Port 1 will not be functional.

S1200BTL / S1200BTS cabling

Boards	chassis	backplane	Cabling from AHCI Capable SATA Controller	Cabling from RAID add-in card or RAID module
S1200BTL	P4304	No backplane: 4 fixed 3.5" drives	SATA-to-SATA cable	miniSAS-to-SATA cable without SGPIO header (G30800-00x) – For SATA devices; Or miniSAS-to-SAS cable without SGPIO header – For SAS devices.
		FUP4X35HSBP	SATA-to-SATA cable; & SGPIO cable (G22461-00x)	AXXCBL740MS7P; If RMS2AF0x0 or RMS2LL0x0 are used, use SATA-to-SATA cable & SGPIO cable (G10943-00x)
	R1304 (21 inch length)	No backplane: 4 fixed 3.5" drives	n/a	miniSAS-to-SATA cable without SGPIO (G30800-00x) – For SATA devices; miniSAS-to-SAS cable without SGPIO header – For SAS devices.
		FR1304HSBP	n/a	AXXCBL740MS7P
	R1304 (15 inch length)	No backplane: 2 fixed 3.5" drives	n/a	SATA-to-SATA cable
S1200BTS	P4304	No backplane: 4 fixed 3.5" drives	SATA-to-SATA cable	SATA-to-SATA cable
	R1304 (21 inch length)	No backplane: 4 fixed 3.5" drives	n/a	SATA-to-SATA cable

S2600GL / S2600GZ cabling (Also fit other rack server systems)

Boards	chassis	backplane	Cabling from On-board SATA/SAS Capable Controller	Cabling from Mezzanine ROC add-in card	Cabling from RAID add-in card or PCIe ROC module
S2600GL and S2600GZ	R1304; R1208 (all with 27 inch length)	FR1304HSBP	AXXCBL1030MR7R	AXXCBL850MS7R	AXXCBL850MS7R
		F1U8X25HSBP	AXXCBL730MRMR, & AXXCBL550MRMR	AXXCBL585MSMR	AXXCBL585MSMR & AXXCBL770MSMR
	R2208; R2216; R2224; R2308; R2312 (all with 27 inch length)	FXX8X25HSBP in Bay 1	AXXCBL730MSMS	AXXCBL600MSMS & AXXCBL500MSMS	AXXCBL650MSMS & AXXCBL730MSMS
		FXX8X25HSBP in Bay 2	n/a	AXXCBL500MSMS	AXXCBL650MSMS (riser 2) or AXXCBL730MSMS (riser 1)
		FXX8X25HSBP in Bay 3	n/a	AXXCBL600MSMS & AXXCBL730MSMS	AXXCBL730MSMS
		2 x FXX8X25HSBP (to expander)	AXXCBL600MSMS & AXXCBL730MSMS	AXXCBL500MSMS	AXXCBL730MSMS
		2 x FXX8X25HSBP (Expander to HSBP)	Use cables in Expander Kit	Use cables in Expander Kit	Use cables in Expander Kit
		3 x FXX8X25HSBP (to expander)	Use cables in Expander Kit	Use cables in Expander Kit	Use cables in Expander Kit
		3 x FXX8X25HSBP (Expander to HSBP)	Use cables in Expander Kit	Use cables in Expander Kit	Use cables in Expander Kit
		F2U8X35HSBP	AXXCBL730MSMS	AXXCBL500MSMS & AXXCBL650MSMS	AXXCBL730MSMS
		F2U12X35HSBP (needs PCIe expander - RES2SV240)	AXXCBL185MSMS AXXCBL600MSMS AXXCBL650MSMS AXXCBL730MSMS	AXXCBL185MSMS AXXCBL600MSMS AXXCBL650MSMS AXXCBL730MSMS	AXXCBL500MSMS AXXCBL600MSMS AXXCBL650MSMS AXXCBL730MSMS

Note: The onboard ESRT2 doesn't support expander.

Note: Booting from RSTe of SAS/SATA Capable Controller (also called Storage Controller Unit, or SCU) through expanders is not supported in legacy mode.

S2600CP cabling (Also fit other general purpose server systems)

System or Backplane names.	P4308CP4MHEN	P4308CP4MHGC	P4208CP4MHGC	No backplane (Fixed drives)
Cabling from RAID add-in card or ROC module	AXXCBL650MSMS	AXXCBL650MSMS	AXXCBL650MSMS	AXXCBL850MS7R

2. Cabling Overview of Major Hardware Configuration Types

This section provides an overview of how to make cabling with different RAID controllers, backplanes, with or without expander.

Note: Before any cabling operation, please choose the target choice from the configurations below, then refer to the corresponding steps to make the successful cabling.

Note: Intel® C200 series chipset based server board's onboard RAID controller only supports SATA devices. It doesn't support SAS devices (SAS drives, expander, etc)

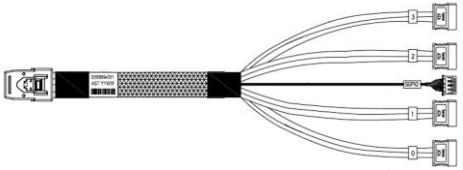
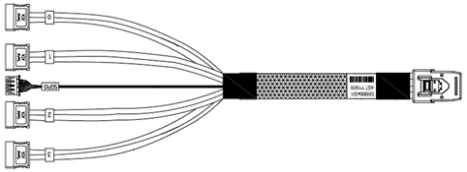
Note: Intel® C600 series chipset based server boards' onboard RAID controller need proper Intel® C600 Chipset RAID upgrade key to support SAS devices. Otherwise, the RAID controller only supports SATA devices and doesn't support SAS devices (SAS drives, expander, etc). Refer to the Intel® C600 Chipset RAID upgrade key's User Guide to know which key enables SAS support.

Note: Choose SAS/SATA cables with a proper SAS/SATA header shape (either straight or with a 90 degree angle), to fit the mechanical needs for different backplanes.

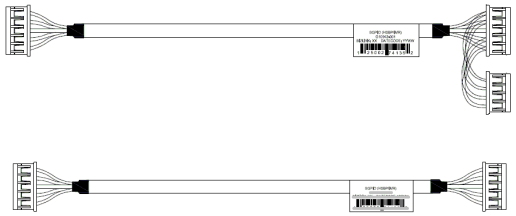
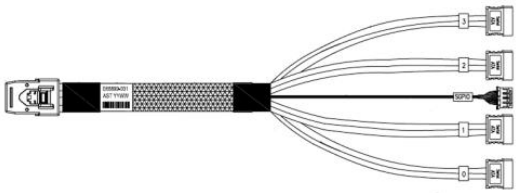
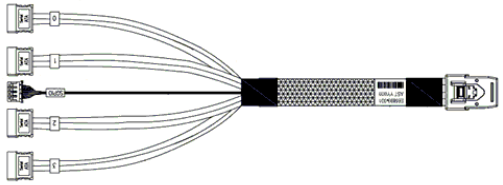
Configuration 1: RAID controller, backplane, drives

- RAID controller refers to one of below parts:
  - Intel® Server Board's onboard RAID controller
  - Intel® RAID controller
  - Intel® RAID module
- Backplane is listed in Hot-Swap Backplane Overview in Section 2
- Drives refer to SAS drives and SATA drives

Step 1: Choose a proper SAS/SATA cable between RAID controller and backplane.

Item	SAS/SATA port type on RAID controller	SAS/SATA port type on backplane	SAS/SATA cables type	SAS/SATA cable shape
1	SATA	SATA	SATA to SATA cable	
2	Mini-SAS	SATA	Mini-SAS to SATA cable with 5-pin SGPIO (G17758-xxx in the integrated system, or AXXCBL740MS7P)	
3	SATA	Mini-SAS	SATA to mini-SAS cable (G14989-xxx, with 5-pin SGPIO)	
4	Mini-SAS	Mini-SAS	Mini-SAS to mini-SAS cable	

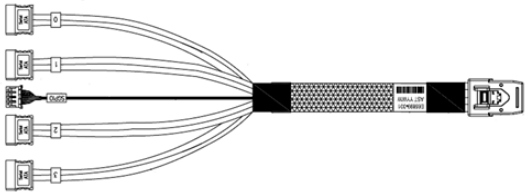
Step 2: Choose a proper drive fault LED management cable between RAID controller and backplane.

Item	SAS/SATA port type on RAID controller	SAS/SATA port type on backplane	SGPIO Cables selected	Cable shape
5	SATA	SATA	SGPIO Y cable (G10943-xxx: 5-pin header on one end. 5-pin and 4-pin headers on the other end. For use with RMS2AF0x0,RMS2LL0x0, or onboard RAID.) SGPIO cable (G22461-xxx: 5-pin headers on both ends. For use with onboard RAID.)	
6	Mini-SAS	SATA	Mini-SAS to SATA cable (G17758-xxx: with 5-pin SGPIO)	
7	SATA	Mini-SAS	SATA to mini-SAS cable (G14989-xxx, with 5-pin SGPIO)	
8	Mini-SAS	Mini-SAS	Mini-SAS to mini-SAS cable	

Configuration 2: RAID controller, expander, backplane, drives

- RAID controller refers to one of below parts:
  - Intel® Server Board's onboard RAID controller
  - Intel® RAID controller
  - Intel® RAID module
- Expander refers to Intel® RAID Expander Card RES2SV240
- Backplane is listed in Hot-Swap Backplane Overview in Section 2
- Drives refer to SAS drives and SATA drives

Step 1: Choose a proper SAS/SATA cable between RAID controller and expander.

Item	SAS/SATA port type on RAID controller	SAS/SATA cables type	SAS/SATA cable shape
9	SATA	SATA to mini-SAS cable (G14989-xxx, with 5-pin SGPIO)	
10	Mini-SAS	Mini-SAS to mini-SAS cable	

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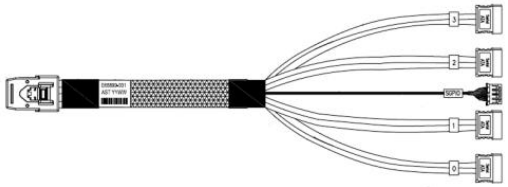
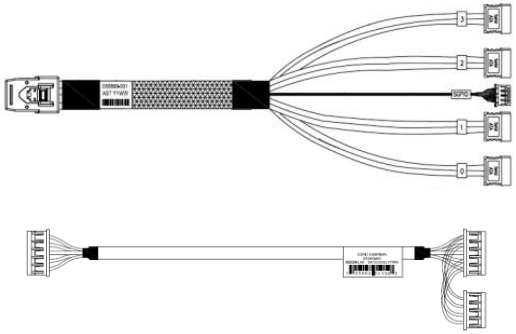
Step 2: Choose a proper SAS/SATA cable between expander and backplane.

Item	SAS/SATA port type on backplane	SAS/SATA cables type	SAS/SATA cable shape
11	SATA*	Mini-SAS to SATA cable (G17758-xxx: with 5-pin SGPIO)	
12	Mini-SAS	Mini-SAS to mini-SAS cable	

Note *: Only 1U rack 4 x 3.5' backplane and Pedestal 4 x 3.5' backplane have SATA ports. It's not recommended to use expander between RAID controller and either backplane.

Step 3: Choose a proper drive fault LED management cable between expander and backplane.

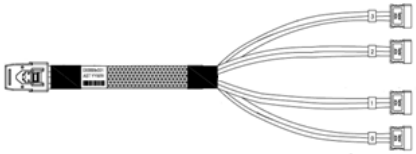
Item	SAS/SATA port type on backplane	SGPIO Cables selected	Cable shape
13	SATA*	Mini-SAS to SATA cable (G17758-xxx: with 5-pin SGPIO) SGPIO Y cable (G10943-xxx: 5-pin header on one end. 5-pin and 4-pin headers on the other end. For use with RMS2AF0x0,RMS2LL0x0, or onboard RAID.)	
14	Mini-SAS	Use SGPIO pins inside the Mini-SAS to mini-SAS cable	

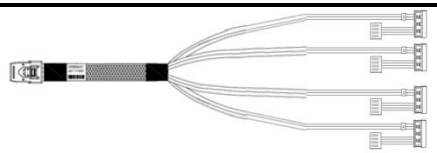
Note *: Only 1U rack 4 x 3.5' backplane and Pedestal 4 x 3.5' backplane have SATA ports. It's not recommended to use expander between RAID controller and either backplane.

● Configuration 3: RAID controller, drives, no backplane

- ***Note***: No drive fault LED function is supported in this configuration.
  - RAID controller refers to one of below parts:
    - Intel® Server Board's onboard RAID controller
    - Intel® RAID controller
    - Intel® RAID module
  - Drives refer to SAS drives and SATA drives

Step 1*: Choose a proper SAS/SATA cable between RAID controller and drive.

Item	SAS/SATA port type on RAID controller	Drive type	SAS/SATA cables type	SAS/SATA cable shape
15	SATA	SATA	SATA to SATA cable	
16	Mini-SAS	SATA	Mini-SAS to SATA cable (G30800-xxx ,no SGPIO)	
17	SATA	SAS	SATA to SAS cable (E66563-xxx)	

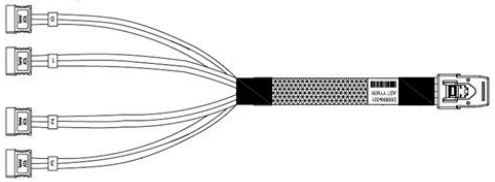
18	Mini-SAS	SAS	Mini-SAS to SAS cable (This cable doesn't exist in Intel and user can order it from market.)	

Note *: Server system in this configuration needs to have power supply headers for SATA or SAS drives.

Configuration 4: RAID controller, expander, drives, no backplane

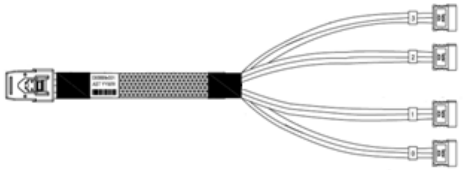
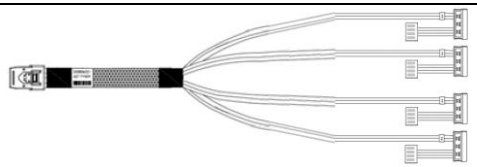
- ***Note***: No drive fault LED function is supported in this configuration.
  - RAID controller refers to one of below parts:
    - Intel® Server Board's onboard RAID controller
    - Intel® RAID controller
    - Intel® RAID module
  - Expander refers to Intel® RAID Expander Card RES2SV240
  - Drives refer to SAS drives and SATA drives

Step 1: Choose a proper SAS/SATA cable between RAID controller and expander.

Item	SAS/SATA port type on RAID controller	SAS/SATA cables type	SAS/SATA cable shape
19	SATA	SATA to mini-SAS cable	
20	Mini-SAS	Mini-SAS to mini-SAS cable	

Step 2*: Choose a proper SAS/SATA cable between expander and drive.

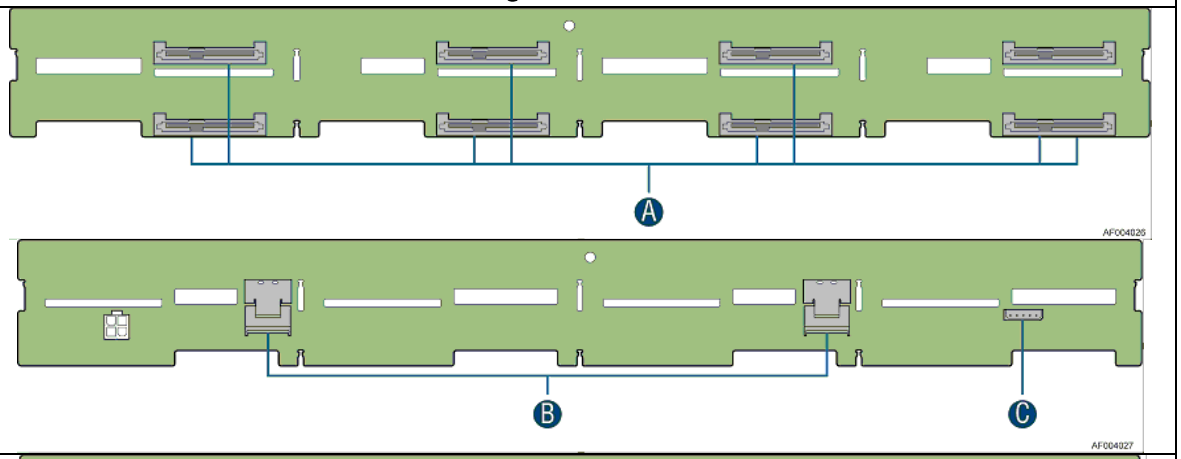
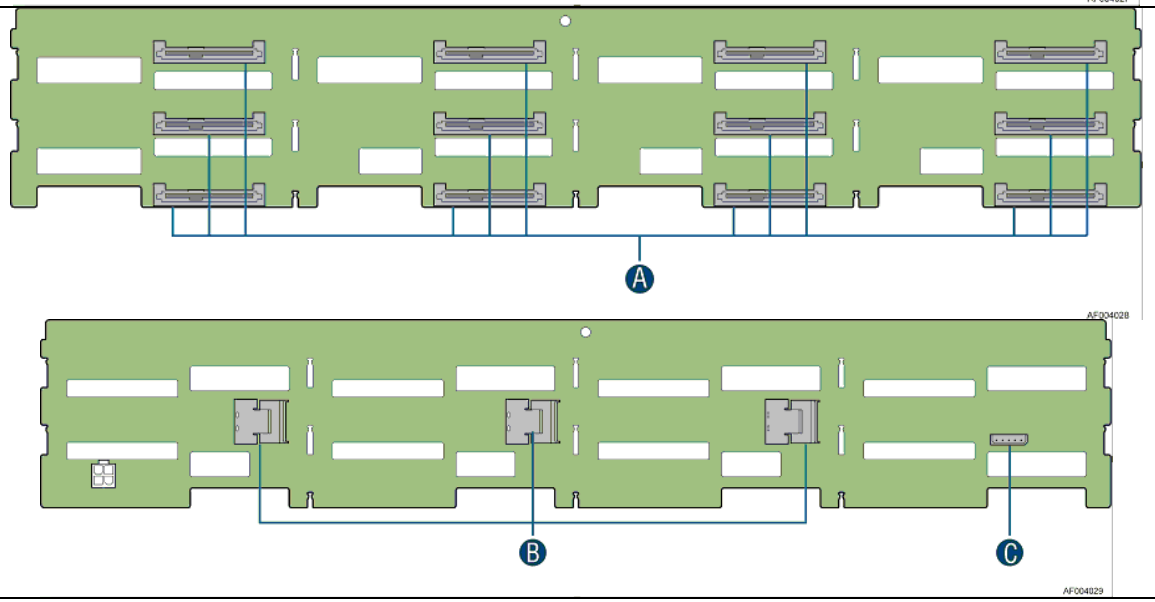
Item	SAS/SATA port type on RAID controller	Drive type	SAS/SATA cables type	SAS/SATA cable shape

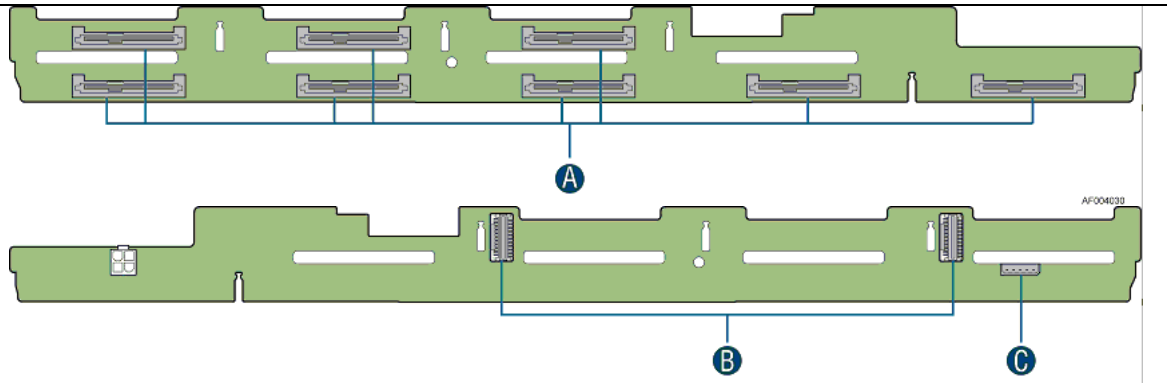
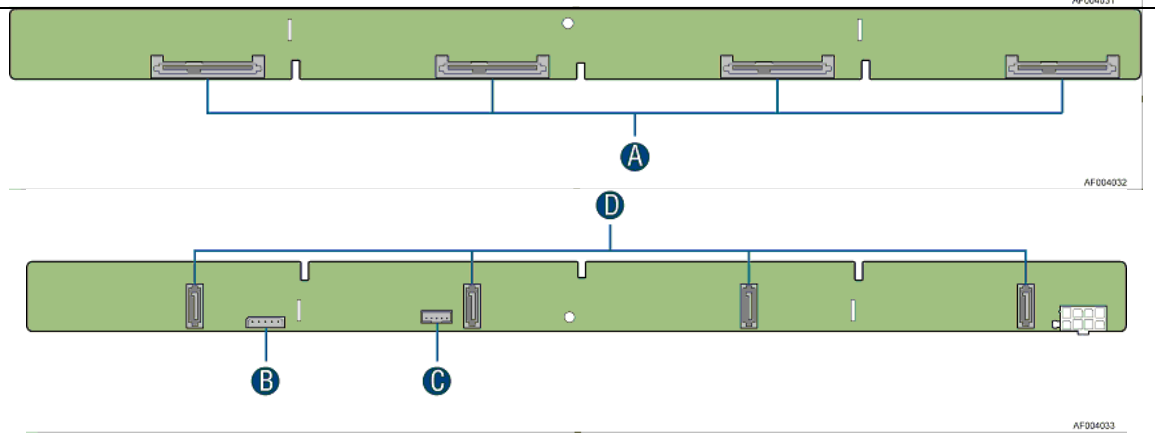
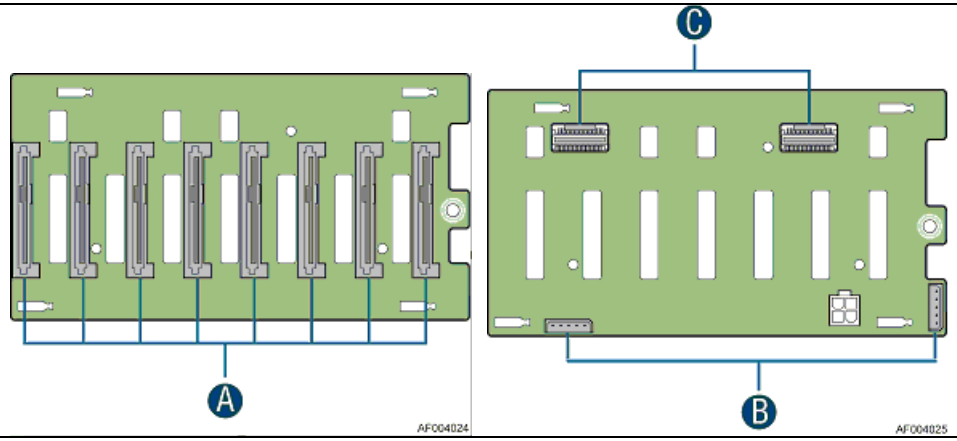
21	Mini-SAS	SATA	Mini-SAS to SATA cable (G30800-xxx ,no SGPIO)	
22	Mini-SAS	SAS	Mini-SAS to SAS cable (This cable doesn't exist in Intel and user can order it from market.)	

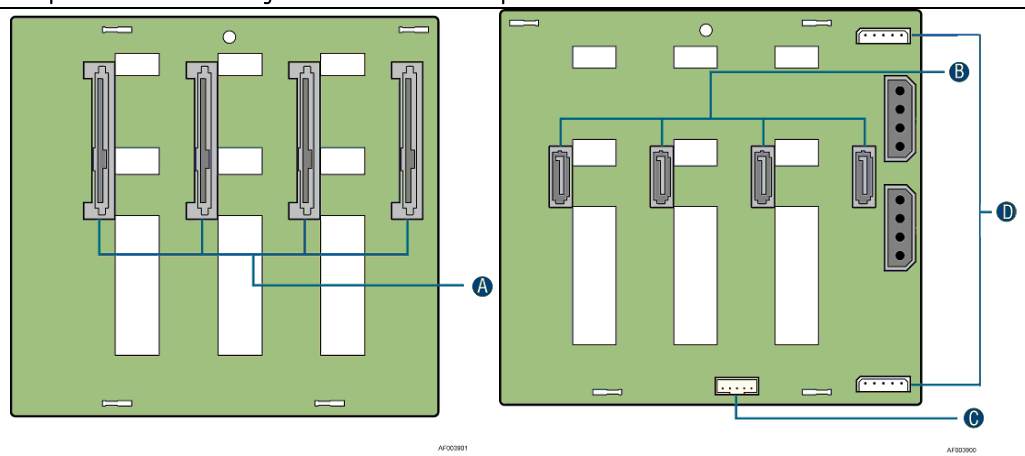
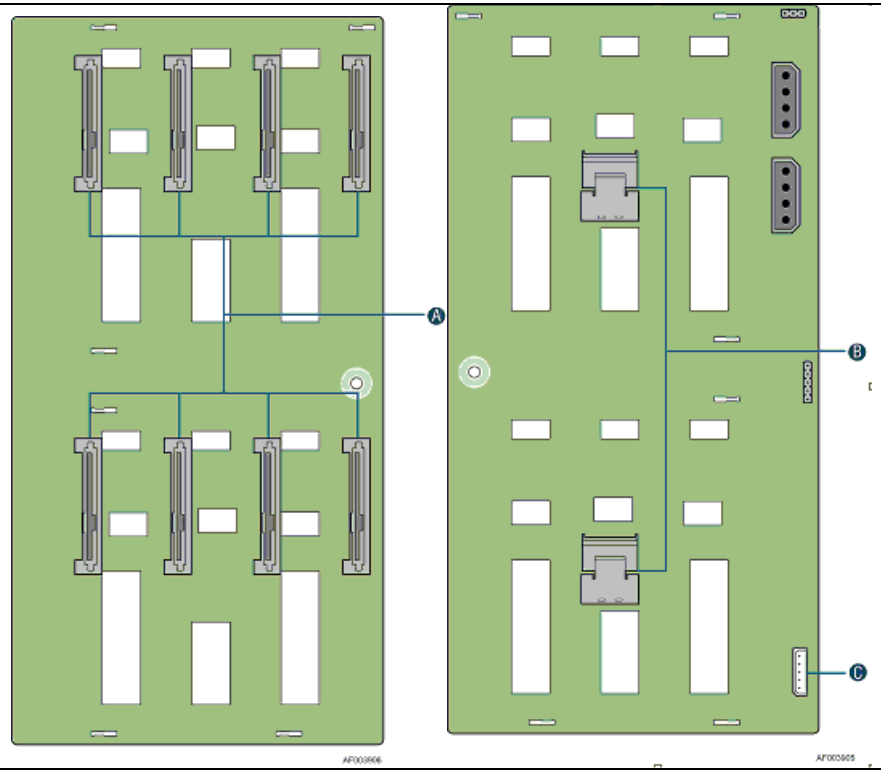
Note *: Server system in this configuration needs to have power supply headers for SATA or SAS drives.

3. Hot-Swap Backplane Overview

Note: Before any cabling operation, please refer to the respective RAID module or RAID controller *Tested Hardware and Operating System lists*, in order to confirm their compatible Intel® Server Boards or Systems.

Supported Chassis	Backplane P/N	Description	Disk drive slot view Cabling connector view
2U	F2U8X35HSBP	A: 8 x 3.5' drive slots. B: 2 x SFF8087 connectors including sideband SGPIO. C: I2C 5-pin header (not for SES enclosure management)	
2U	F2U12X35HSBP	A: 12 x 3.5' drive slots. B: 3 x SFF8087 connectors including sideband SGPIO. C: I2C 5-pin header (not for SES enclosure management)	

1U	F1U8X25HSBP	A: 8 x 2.5' drive slots. B: 2 x SFF8087 connectors including sideband SGPIO. C: I2C 5-pin header (not for SES enclosure management)	
1U	FR1304HSBP	A: 4 x 3.5' drive slots. B: I2C 5-pin header (not for SES enclosure management)* C: SGPIO 5-pin header D: 4 x SATA connectors	
2U or Pedestal	FXX8X25HSBP	A: 8 x 2.5' drive slots. B: I2C 5-pin header (not for SES enclosure management)* C: 2 x SFF8087 connectors including sideband SGPIO.	

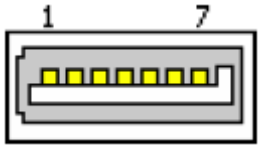
pedestal	FUP4X35HSBP	A: 4 x 3.5' drive slots. B: 4 x SATA connectors C: SGPIO 5-pin header. D: I2C 5-pin header (not for SES enclosure management)*	
pedestal	FUP8X35HSBP	A: 8 x 3.5' drive slots. B: 2 x SFF8087 connectors including sideband SGPIO. C: I2C 5-pin header (not for SES enclosure management)	

***Note*:** The I2C 5-pin headers on the backplanes listed in below table only support backplane firmware update function. They don't support Enclosure Management features such as Drive Fault LED management through I2C headers. FR1304HSBP, FXX8X25HSBP or FUP4X35HSBP has a pair of I2C 5-pin headers. One is input header and the other is output header. When multiple FR1304HSBP,

FXX8X25HSBP or FUP4X35HSBP are present in one server chassis, user can use daisy chain topology to connect the I2C cables to these backplanes, so as to ensure a successful backplane firmware update among all the present backplanes at a time.

4. Connector Pinout Definition

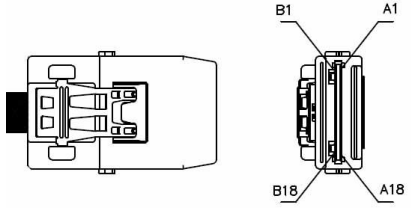
SATA Connector Shape



SATA connector can support both SAS and SATA devices through backplanes. Below signal names are with respect to the host; the device connected to the host reverses the signal names. Transmit pins connect to receive pins on the other device. The SAS/SATA connector is keyed at pin 1.

SATA Connector Pin-out

Pin #	Signal	Description
1	GND	Ground
2	TX0+	Transmitter differential pair
3	TX0-	Transmitter differential pair
4	GND	Ground
5	RXD-	Receiver differential pair
6	RXD+	Receiver differential pair
7	GND	Ground



On Intel® C200 or C600 Series Chipset based Server Boards and Systems, all MiniSAS (SFF8087) internal connectors are 36pin which includes 8pin SGPIO signals. The miniSAS-to-miniSAS and miniSAS-to-SATA cables must include the 8pin SGPIO signals, otherwise cannot support RAID enclosure management function.

36pin MiniSAS (SFF8087) Internal Connector with one SGPIO Connector Pin-out

Controller Connector Pin-out		Backplane Connector Pin-out		Port
SFF-8087 Pin #	Pin Definition	Pin #	Pin Definition	
A1	GND	7	GND	Port 0
A2	RX0+	6	TX+	
A3	RX0-	5	TX-	
B1	GND	4	GND	
B2	TX0+	2	RX-	
B3	TX0-	3	RX+	
B4	GND	1	GND	
A4	GND	7	GND	Port 1
A5	RX1+	6	TX+	
A6	RX1-	5	TX-	
A7	GND	4	GND	
B5	TX1+	2	RX-	
B6	TX1-	3	RX+	
B7	GND	1	GND	
B8	SB0/SCLK/SCL	1	SCLK	SGPIO
B9	SB1/SLOAD/SDA	2	SLOAD	
B10	SB2/GND	4	GND	
A9	SB3/GND			
A10	SB4/SDATA_OUT/RST	3	SDATAOUT0	
A11	SB5/SDATA_IN/ADDR			
A8	SB7/BP_TYPE			
B11	SB6/CTLR_TYPE			
A12	GND	7	GND	Port 2
A13	RX2+	6	TX+	
A14	RX2-	5	TX-	
B12	GND	4	GND	
B13	TX2+	2	RX-	
B14	TX2-	3	RX+	
B15	GND	1	GND	
A15	GND	7	GND	Port 3
A16	RX3+	6	TX+	
A17	RX3-	5	TX-	

Controller Connector Pin-out		Backplane Connector Pin-out		Port
SFF-8087 Pin #	Pin Definition	Pin #	Pin Definition	
A18	GND	4	GND	
B16	TX3+	2	RX-	
B17	TX3-	3	RX+	
B18	GND	1	GND	

When SAS/SATA devices are directly connected to RAID controllers without backplanes, the RAID enclosure management feature is not supported. Thus, those miniSAS-to-miniSAS and miniSAS-to-SATA cables either with or without 8pin SGPIO signals inside are OK to be used.

24pin MiniSAS (SFF8087) Internal Connector (without SGPIO Connector) Pin-out

Controller Pinout		Backplane Pinout		Port
SFF8087	Pin Definition	SATA Connector	Pin Definition	
A1	GND	7	GND	Port 0
A2	RX0+	6	TX+	
A3	RX0-	5	TX-	
B1	GND	4	GND	
B2	TX0+	3	RX-	
B3	TX0-	2	RX+	
B4	GND	1	GND	
A4	GND	7	GND	Port 1
A5	RX1+	6	TX+	
A6	RX1-	5	TX-	
A7	GND	4	GND	
B5	TX1+	3	RX-	
B6	TX1-	2	RX+	
B7	GND	1	GND	
B8	Sideband 0			
B9	Sideband 1			
B10	Sideband 2			
A9	Sideband 3			
A10	Sideband 4			
A11	Sideband 5			
A8	Sideband 6			
B11	Sideband 7			

Controller Pinout		Backplane Pinout		Port
SFF8087	Pin Definition	SATA Connector	Pin Definition	
A12	GND	7	GND	Port 2
A13	RX2+	6	TX+	
A14	RX2-	5	TX-	
B12	GND	4	GND	
B13	TX2+	3	RX-	
B14	TX2-	2	RX+	
B15	GND	1	GND	
A15	GND	7	GND	Port 3
A16	RX3+	6	TX+	
A17	RX3-	5	TX-	
A18	GND	4	GND	
B16	TX3+	3	RX-	
B17	TX3-	2	RX+	
B18	GND	1	GND	

Note: Intel® RAID Expander Card RES2SV240 has twenty-four independent ports supporting 6Gb/s, 3 Gb/s, or 1.5Gb/s SAS and SATA data transfers using six SFF-8087 mini-SAS connectors. This controller supports 4 inputs and 20 outputs configuration, or 8 inputs and 16 outputs configuration. Refer to Figure 4 in *Intel® RAID Expander Card RES2SV240 Hardware User's Guide (E93121-0xx)* for more details of the cabling.

5. Frequently Asked Questions

1. Does **AHCI Capable SATA Controller** support SAS device?

   Answer: No. The **AHCI Capable SATA Controller** only supports SATA device.

2. Does the **AHCI Capable SATA Controller** support expander device?

   Answer: No. Expander is a SAS device, which cannot be supported by **AHCI Capable SATA Controller**.

3. Does **On-board SATA/SAS Capable Controller** support SAS device?

   Answer: Yes, but user needs to install one of below Intel® RAID C600 Upgrade Keys to enable the support for SAS device: RKSAS4, RKSAS4R5, RKSAS8, RKSAS8R5. For more details, please refer to *Intel® RAID Quick Reference Guide (G46033-0xx).*

4. Why ports number 4-7 of my **On-board SATA/SAS Capable Controller** doesn't recognize any device?

   Answer: In order to enable ports number 4-7 of the **On-board SATA/SAS Capable Controller**, user needs to install one of below Intel® RAID C600 Upgrade Keys to enable the support for SAS device: RKSATA8, RKSATA8R, RKSAS8, RKSAS8R5. For more details, please refer to *Intel® RAID Quick Reference Guide (G46033-0xx).*

5. Does **On-board SATA/SAS Capable Controller** support SAS RAID 5?

   Answer: Yes. The ESRT2 mode of **On-board SATA/SAS Capable Controller** supports SAS RAID 5 when one of below Intel® RAID C600 Upgrade Keys is installed: RKSAS4R5, RKSAS8R5. For more details, please refer to *Intel® RAID Quick Reference Guide (G46033-0xx).*

6. Does RSTe mode of **On-board SATA/SAS Capable Controller** support SAS RAID 5?

   Answer: No. This hasn't been planned. User can choose ESRT2 mode to support SAS RAID 5. For more details, please refer to *Intel® RAID Quick Reference Guide (G46033-0xx).*

7. Why SATA devices cannot make RAID 5 in RSTe mode of **On-board SATA/SAS Capable Controller** ?

   Answer: When **On-board SATA/SAS Capable Controller** SAS function is enabled by one of below Intel® RAID C600 Upgrade Keys: RKSAS4, RKSAS4R5, RKSAS8, RKSAS8R5, RSTe RAID 5 is disabled.

8. Why cannot I boot from disks or RAID arrays in RSTe mode of **On-board SATA/SAS Capable Controller**?

Answer: Check whether the targeted boot disks are connected through expander devices to the ports of **On-board SATA/SAS Capable Controller**. When Drives or RAID arrays in RSTe mode are connected through expander devices, they cannot act as boot devices, but still can be recognized under operating systems, if system boots from other devices and RSTe driver is loaded under operating system.