BROADCOM®

SAS 9305-16e PCI Express to 12Gb/s SAS Host Bus Adapter

User Guide

Version 1.1

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For a comprehensive list of changes to this document, see the Revision History.

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Chapter 1: Avago SAS 9305-16e Host Bus Adapter User Guide

1.1 Overview

The PCI Express (PCIe)-to-Serial Attached SCSI (SAS) host bus adapter (HBA), referred to as the Avago 12Gb/s SAS HBA, provides high-performance external storage connectivity for servers and workstations. The 12Gb/s SAS HBA provides sixteen lanes of 12Gb/s SAS connectivity and is matched with eight lanes of PCIe 3.0 8Gb/s performance. The low-profile design of the SAS HBA includes a full-height mounting bracket and a low-profile mounting bracket that create a universal fit for any server. The 12Gb/s SAS HBA is developed on the Fusion-MPT-based SAS 3216 controller that integrates the latest enhancements in PCIe 3.0 technology and 12Gb/s SAS technology.

1.2 Features

This section lists the 12Gb/s SAS HBA features.

- Implements one SAS 3216 sixteen-port 12Gb/s SAS to PCIe 3.0 controller
- Supports eight-lane, full-duplex PCIe 3.0 performance
- Supports sixteen external 12Gb/s SATA+SAS ports
- Supports SATA link rates of 3Gb/s and 6Gb/s
- Supports SAS link rates of 3Gb/s, 6Gb/s, and 12Gb/s
- Provides sixteen x4 external mini-SAS HD connectors (SFF-8644)
- Supports passive copper cable, active copper cable, and optical cable
- Supports up to 1024 SATA or SAS end devices
- Offered with a full-height bracket and a and a low-profile vented bracket
- Provides one heartbeat LED
- Provides a universal asynchronous receiver/transmitter (UART) debug/diagnostic port

1.3 Functional Descriptions

1.3.1 PCI Express Interface

PCIe is a high-speed standard local bus for point-to-point interfacing of I/O components to the processor and the memory subsystems in high-end computers and servers.

The 12Gb/s SAS HBA supports eight-lane PCIe performance up to 64Gb/s single direction and 128Gb/s dual direction.

1.3.2 SAS-3 Interface

The SAS 3216 controller chip contains the SATA+SAS functionality for the 12Gb/s SAS HBA with SAS performance of 1200 MB/s per port in each direction.

1.3.3 LED Management

The 12Gb/s SAS HBA offers enclosure LED management support for your enclosure implementation through SCSI Enclosure Services (SES).

1.4 Operating System Support

The Avago 12Gb/s SAS HBA supports all major operating systems: Windows, Linux (Oracle, SuSE, Red Hat), Solaris, VMware, FreeBSD, CentOS, Canonical, Citrix, Fedora, and Debian.

Refer to http://www.avagotech.com/support/download-search for details on the software versions and device driver support. Contact Oracle support for Oracle driver or software support.

1.5 SAS 9305-16e HBA Characteristics

1.5.1 Memory

The 12Gb/s SAS HBA provides one a128Mb Flash ROM to store the firmware and the BIOS.

1.5.2 LEDs

The 12Gb/s SAS HBA has a Heartbeat LED (LED2) that blinks green to indicate the HBA is capable of general activity and a thermal event LED (LED1) that illuminates if the IOC experiences an over temperature condition.

1.5.3 Connectors

UART Connectors (J1). The UART connector debug port requires a special cable and Avago support to gather detailed IOC status. The UART connector uses the following layout.

Table 1 SAS 9305-16e HBA UART Pinout, J1 UART

Pin	Function
1	UART0_TX
2	Gnd
3	UART0_RX
4	1.8 V

Software Test and Debug (J5). Used by Avago support to assist in debugging functional issues.

SBR Recovery (J6). This port enables recovery of corrupted SBR files. Avago support can assist with this process.

SATA+SAS Connector (J7). The 12Gb/s SAS HBA supports SATA devices and SAS devices in an enclosure connected by cable to SFF-8644 mini-SAS HD external connectors.

PCIe Connector (J8). The 12Gb/s SAS HBA supports a x8 interface. The PCIe host interface connection is through the edge connector, J8. The signal definitions and pin numbers conform to the PCIe specification.

1.5.4 Physical Characteristics

This 12Gb/s SAS HBA is a 6.6 in. × 2.7 in. (167.65 mm × 68.90 mm) board. The component height on the top and bottom of the 12Gb/s SAS HBA complies with the PCIe specification. The following figure shows the HBA board layout.

Figure 1 Avago SAS 9305-16e HBA Board Layout
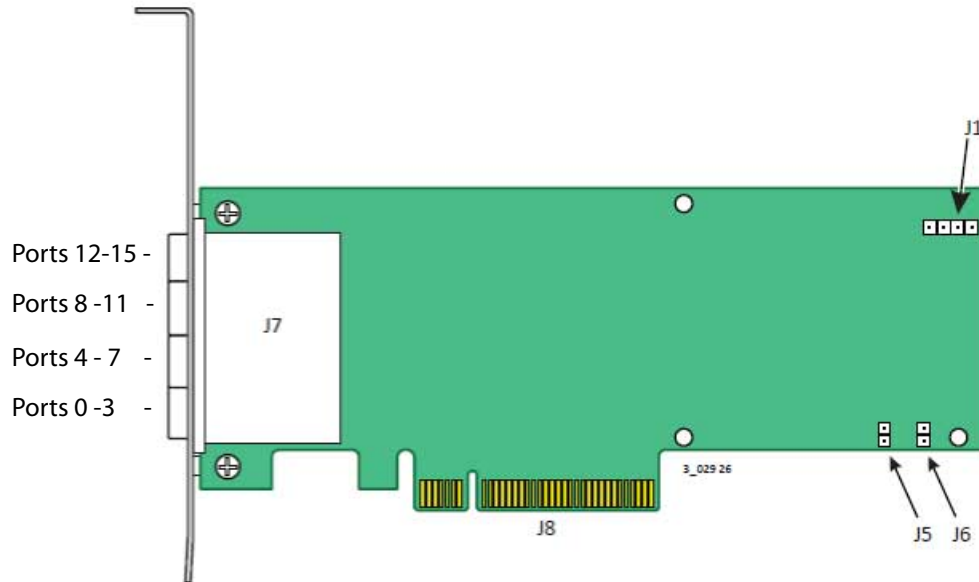
- **J1** – UART connector
- **J5** – Software test and debug
- **J6** – SBR Recovery
- **J7** – SFF-8644 mini-SAS HD external connector
- **J8** – PCIe x8 board edge connector

1.5.5 Electrical Characteristics

The power requirements for the SAS 12Gb/s HBA under normal operation are as follows:

- Power values:
  — Typical = 13.0 W

Typical configuration assumes nominal silicon and voltage with all links running maximum I/Os at 25 °C ambient temperature. Actual power consumption might vary depending on system and environmental configurations.

1.5.6 Thermal and Atmospheric Limits

The atmospheric limits for the 12Gb/s SAS HBA are as follows:

- Relative humidity range: 5 percent to 90 percent noncondensing
- Maximum dew point temperature: 32 °C (89.6 °F)
- Minimum airflow: 200 linear feet per minute at 55 °C inlet temperature

The following limits define the storage and transit environment for the 12Gb/s SAS HBA:

- Temperature range: –45 °C to +105 °C (–49 °F to +221 °F) (dry bulb)

■ Relative humidity range: 5 percent to 90 percent noncondensing

1.6 12Gb/s SAS HBA Certifications and Safety Characteristics

All Avago 12Gb/s SAS HBAs meet or exceed the requirements of UL flammability rating 94V-0. Each bare board is marked with the supplier's name or trademark, type, and UL flammability rating. Because these boards are installed in a PCIe bus slot, all voltages are less than the SELV 42.4-V limit.

The design and implementation of the 12Gb/s SAS HBA minimizes electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge.

The 12Gb/s SAS HBA meets the following integrated electromagnetic interference (EMI) compliance labels:

■ CE mark
■ RCM mark
■ Canadian Compliance Statement
■ FCC Class B, marked with the FCC Self-Certification logo
■ UL Listed Mark for Canada/U.S.
■ Japan VCCI
■ Korean KCC
■ Taiwan BSMI

The 12Gb/s SAS HBA meets the following environmental directives:

■ Restriction of Hazardous Substances (RoHS)
■ Waste of electrical and electronic equipment (WEEE)

1.7 Hardware Installation Instructions

To install the 12Gb/s SAS HBA, follow these steps:

1. **Unpack the HBA, and inspect it for damage.** Unpack the HBA in a static-free environment. Remove the HBA from the anti-static bag, and carefully inspect the device for damage. If you notice any damage, contact Avago or your reseller support representative.

      ATTENTION   To avoid the risk of data loss, back up your data before you change your system configuration.

2. **Prepare the computer.** Turn off the computer, and disconnect the power cord from the rear of the power supply.

      CAUTION   Disconnect the computer from the power supply and from any networks to which you will install the HBA, or you risk damaging the system or experiencing electrical shock.

3. **Remove the cover from the chassis.**

4. **Check the mounting bracket on the HBA (system- dependent)** If required for your system, replace the full-height mounting bracket that ships on the HBA with the low-profile bracket supplied. Complete the following steps to attach the short bracket.

   a. Using a #1 Phillips screwdriver that is ESD safe, remove the two Phillips screws that connect the full-profile bracket to the board. Unscrew the two screws located at the top and bottom edges of the board. Avoid touching any board components with the screwdriver or bracket.

   b. Remove the full-profile bracket. Do not damage the HBA.

   c. Place the HBA on top of the low-profile bracket. Position the bracket so that the screw holes in the tabs align with the openings in the board.

   d. Using a #1 Phillips torque screwdriver that is ESD safe, set to a maximum torque of 4.8 ± 0.5 inch-pounds. Replace the two Phillips screws removed in step a.

   > **ATTENTION** Exceeding this torque specification can damage the board, connectors, or screws, and can void the warranty on the board.

5. **Insert the HBA into an available PCIe slot.** Locate an empty x8 PCIe slot adequate for your board. Remove the blank bracket panel on the rear of the computer that aligns with the empty PCIe slot. Save this bracket screw, if applicable. Align the HBA to a PCIe slot. Press down gently, but firmly, to seat the HBA correctly in the slot. The following figure shows how to insert the HBA into a PCIe slot.

   > **NOTE** The shape, size, and locations of the components on your HBA and its bracket might vary from this illustration. The HBA requires an x8 PCIe slot.

Figure 2 Installing the 12Gb/s SAS 9305-16e HBA in a PCIe Slot
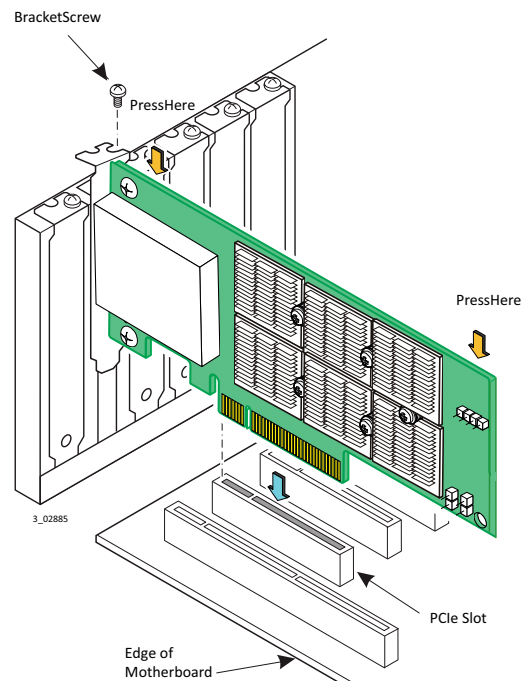
6. **Connect SAS cables between the HBA and the SAS enclosure that contains SATA or SAS devices.** The 12Gb/s SAS HBA has four SFF-8644, external x4, mini-SAS HD connectors. Use a cable with an external mini-SAS HD

connector (SFF-8644) on one end (to connect to the HBA) and the appropriate connector to attach to the enclosure that contains SAS devices or SATA devices on the other end.

7. **Make sure the system provides the required airflow for the controller.** Airflow must be at least 200 linear feet per minute (LFM) at 55 °C inlet temperature to avoid operating the SAS 3216 processor above the maximum junction temperature.

8. **Replace the cover and reconnect any cords and cables, and power up the system.** Replace the chassis cover, reconnect any power cords, and reconnect any network cables. Turn on the power.

1.8   Configuring the 9305-16e HBA with Port Widths Greater than x1

The SAS 3216device has 16 SAS PHYs. The PHYs are managed in groups of eight by dedicated hardware in ascending PHY order. PHYs 0 to 7 are managed by one dedicated instance of the SAS PHY management hardware, and PHYs 8 to 15 are managed by a separate instance of the SAS PHY management hardware. These SAS PHY management hardware instances, or SAS cores, cannot communicate with each other.

When configuring a wide port using the 9305-16e controller, the connections must be attached exclusively to PHYs that are all managed by the same SAS core. If they are not managed by the same SAS core, then unexpected controller and host behavior will occur. By default, the connectors are mapped as shown in Figure 1, Avago SAS 9305-16e HBA Board Layout.

Board ports 0 through 7 are connected to PHYs on the SAS 3216 device managed by SAS Core 1. Board ports 8 through 15 are connected to PHYs managed by SAS Core 0.

Table 2 Board Port to SAS Core Association

Board Ports	Ports 0-3	Ports 4-7	Ports 8-11	Ports 12-15
SAS Core Instance	SAS Core 1	SAS Core 1	SAS Core 0	SAS Core 0

Ports 0-7 can be configured as eight separate ports or combined into one or more groups called wide ports (one x4, two x4s, one x8, and so on.). Similarly, ports 8-15 can be configured as eight separate ports or combined into one or more wide-ports. A single wide port cannot combine individual ports or PHYs sourced by different SAS cores.

When configuring a boot-device in a multi-path environment, the target must be connected to one or more ports on the same SAS core with *AutoPortConfig* enabled. The boot device appears to the host system as a single device on the active path. A different controller is managed by the multi-path environment as the passive path.

When configuring data-storage devices in a multi-path environment, the rule for creating wide ports applies, but multiple ports from different SAS cores can be connected to the data-storage devices. The multi-path environment manages data-storage devices that are presented by the controller more than once.

1.9   Technical Support

For assistance installing, configuring, or running the 12Gb/s SAS HBA, contact Technical Support at http://www.avagotech.com/support/.

1.10   Revision History

1.10.1   pub-005244, Version 1.1, June 17, 2016

The following document changes were made.

■   Added Section 1.8, Configuring the 9305-16e HBA with Port Widths Greater than x1.

1.10.2   pub-005244, Version 1.0, January 27, 2016

Initial document release.