LSI® SAS 9201-16e PCI Express® to 6Gb/s Serial Attached SCSI (SAS) Host Bus Adapter

User Guide

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

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LSI SAS 9201-16e PCI Express to 6Gb/s SAS HBA User Guide

1 Overview

The LSI® SAS 9201-16e PCI Express® (PCIe®)-to-Serial Attached SCSI (SAS) host bus adapter (HBA), hereinafter referred to as the LSI SAS 9201-16e HBA, provides high-performance external storage connectivity for servers and workstations. The LSI SAS 9201-16e HBA provides sixteen lanes of 6Gb/s SAS connectivity and eight lanes of PCIe 2.0 5Gb/s performance. The LSI SAS 9201-16e HBA is based on the Fusion-MPT™-architected LSI SAS 2116 controller that integrates the latest enhancements in PCIe 2.0 technology and 6Gb/s SAS technology.

The LSI SAS 9201-16e HBA has onboard Flash memory for the firmware and BIOS, and onboard DDR-2 SDRAM.

2 HBA Features

This section lists the LSI SAS 9201-16e HBA features.

- Implements one LSI SAS 2116 sixteen-port 6Gb/s to PCIe 2.0 controller
- Supports eight-lane, full-duplex PCIe 2.0 performance
- Supports sixteen external 6Gb/s SATA+SAS ports
- Supports SAS link rates of 1.5Gb/s, 3.0Gb/s, and 6.0Gb/s
- Provides four x4 external mini-SAS connectors (SFF-8088)
- Supports DDR-2 speeds up to 800 MT/s
- Supports active cable and passive cable
- Supports up to 512 SATA or SAS end devices
- Provides one heartbeat LED and two activity LED headers
- Provides a universal asynchronous receiver/transmitter (UART) debug/diagnostic port

3 Functional Descriptions

3.1 PCIe

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 a high-end personal computer (PC). The LSI SAS 2116 controller chip contains the PCIe functionality for the LSI SAS 9201-16e HBA. The LSI SAS 2116 controller connects directly to the PCIe bus and generates timing and protocol in compliance with the PCIe specifications.

The LSI SAS 2116 controller chip JTAG signals are not connected to the corresponding signals in the PCIe connector. The following table shows the LSI SAS 9201-16e HBA 5Gb/s PCIe performance.

Table 1 Aggregate Bandwidth

Lanes	Single Direction	Dual Direction
Single-lane (x1)	5Gb/s	10Gb/s
Quad-lane (x4)	20Gb/s	40Gb/s
Eight-lane (x8)	40Gb/s	80Gb/s

3.2 SATA + SAS

The LSI SAS 2116 controller chip contains the SATA + SAS functionality for the LSI SAS 9201-16e HBA. The following table shows the LSI SAS 9201-16e HBA 6Gb/s SAS performance.

Table 2 6Gb/s SAS Bandwidths

Half Duplex	Full Duplex
Narrow port (one lane), 600MB/s	Narrow port (one lane), 1200MB/s
Wide port (four lanes), 2400MB/s	Wide port (four lanes), 4800MB/s

4 Operating System Support

The LSI SAS 9201-16e HBA supports all major operating systems: Windows®, Linux® Red Hat®, Linux SUSE® Enterprise Server (SLES), Solaris™, and VMware®. Refer to http://go.lsi.com/hbas for details on the software versions and device driver support. For Solaris support, contact the LSI Technical Support team.

5 LSI SAS 9201-16e HBA Characteristics

5.1 Flash

The LSI SAS 9201-16e HBA has onboard Flash ROM for firmware and BIOS. The LSI SAS 9201-16e HBA provides one 4 M x 16-bit Flash ROM for storing the firmware and the BIOS.

5.2 Connectors

This section describes the different connectors on the LSI SAS 9201-16e HBA. See Figure 1 for connector locations.

PCIe Connector (EC1). The LSI SAS 9201-16e HBA supports a x8 interface. The PCIe connection is through the edge connector, EC1, which provides connections on both the top (EC1B) and bottom (EC1A) of the board. The signal definitions and pin numbers conform to the PCIe specification.

SAS Connectors (J6, J7, J8, and J9). The LSI SAS 9201-16e HBA supports SAS connections through four connectors which are SFF-8088 mini-SAS, external, right-angle connectors.

Activity LED Headers (J3 and J4). The LSI SAS 9201-16e HBA has two 4-pin, right-angle, 0.1-in. pitch headers for driving external activity LEDs. The LEDs on header J3 correspond to activity on Port C and Port D. Header J4 corresponds to activity on Port A and Port B.

Table 3 LSI SAS 9201-16e LED Header Pinout

Pin	J3 Header Function	J4 Header Function
1	3.3 V	3.3 V
2	Port C	Port A
3	Port D	Port B
4	3.3 V	3.3 V

UART Connector (J5). The UART connector debug port requires a special cable and LSI support to gather detailed Input/Output Controller (IOC) status.

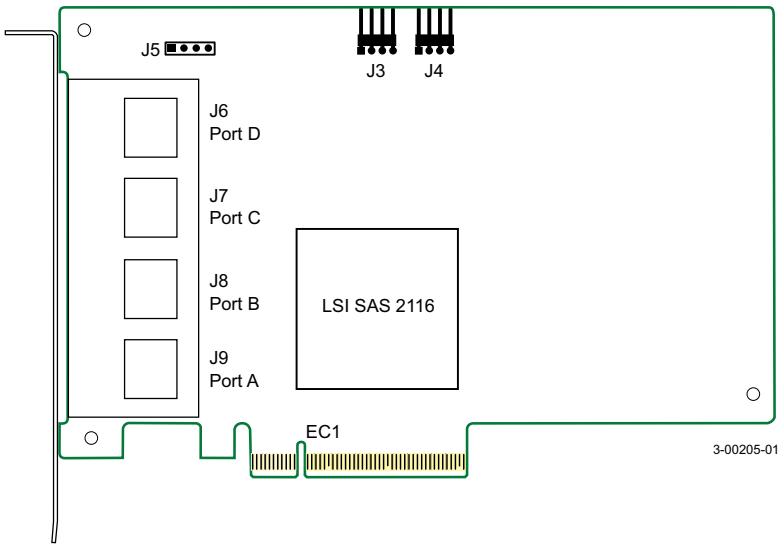
Table 4 LSI SAS 9201-16e UART Pinout

Pin	Function
1	UART_TX
2	Gnd
3	UART_RX
4	3.3 V

5.3 Physical Characteristics

The LSI SAS 9201-16e HBA is a 6.6-in. x 4.2-in. board. The component height on the top and bottom of the LSI SAS 9201-16e HBA is in accordance with the PCIe specification. The following figure shows the board connectors.

Figure 1 LSI SAS 9201-16e Board Layout



- EC1: PCIe x8-lane board edge connector
- J3 and J4: 4-pin, right angle, 0.1-in. pitch, pin headers for driving external activity LEDs
- J5: UART connection
- J6, J7, J8, and J9: SFF-8088 mini-SAS, external, right-angle connectors

6 Electrical and Environmental Specifications

The design and implementation of the LSI SAS 9201-16e HBA minimizes electromagnetic emissions, susceptibility to radio frequency energy, and the effects of electrostatic discharge. The board carries the CE mark, C-Tick mark, Canadian Compliance Statement, Korean KCC, Taiwan BSMI, Japan VCCI, and FCC Class B, and is marked with the FCC Self-Certification logo. The board also meets the requirements of CISPR Class B.

6.1 Electrical Characteristics

The maximum power requirements for the LSI SAS 9201-16e HBA under normal operation are as follows:

- PCIe 12.0 V = 1.46 A
- Power

Table 5 LSI SAS 9201-16e HBA Power Values

Cable Type	Nominal (W)	Worst Case (W)
Passive Cable	15.36	24.94
Active Cable	18.10	28.94

- Operation range = 0 °C to 55 °C (32 °F to 131 °F)

6.2 Thermal and Atmospheric Characteristics

The atmospheric characteristics for the LSI SAS 9201-16e HBA are as follows:

- Temperature range: 0 °C to 55 °C (32 °F to 131 °F) (dry bulb)
- Relative humidity range: 5 percent to 90 percent noncondensing
- Maximum dew point temperature: 32 °C (89.6 °F)

The following parameters define the storage and transit environment for the LSI SAS 9201-16e HBA:

- Temperature range: –45 °C to +105 °C (–49 °F to +221 °F) (dry bulb)
- Relative humidity range: 5 percent to 90 percent noncondensing

6.3 Safety Characteristics

All LSI SAS 9201-16e 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 below the SELV 42.4-V limit.

7 Hardware Installation

Detailed installation instructions for the LSI SAS 9201-16e HBA follow.

1. **Unpack the HBA, and inspect it for damage.** Unpack the HBA in a static-free environment. Remove the HBA from the antistatic bag, and carefully inspect it for damage. If you notice any damage, or if any component is missing, contact LSI or your reseller support representative.

   ATTENTION Make a backup of your data before changing your system configuration, or you might risk data loss.

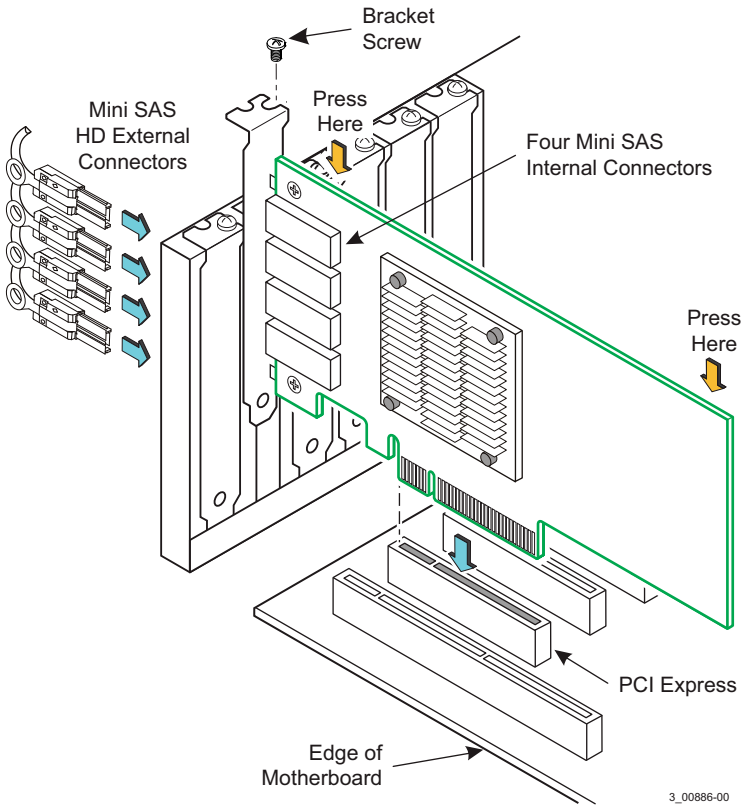
2. **Prepare the computer.** Turn off the computer, and disconnect the power cord from the back of the power supply.
3. **Remove the cover from the chassis.**

   CAUTION Disconnect the computer from the power supply and from any networks before you install the HBA, or you risk damaging the system.

4. **Insert the HBA in an available PCIe slot.** Locate an empty PCIe slot. Remove the blank bracket panel on the back of the computer that aligns with the empty PCIe slot. Save the bracket screw, if applicable.

   Align the HBA to the PCIe slot. Press down gently, but firmly, to properly seat the HBA in the slot. The following figure shows how to insert the HBA in a PCIe slot.

Figure 2 Installing an LSI PCIe-to-SAS x8 HBA in a PCI Express Slot



NOTE The shape, size, and locations of components on your HBA and its bracket might vary from this illustration. The LSI SAS 9201-16e HBA requires a x8 PCIe slot.

5. **Secure the HBA bracket to the system's chassis.** Install the bracket screw, if applicable, or engage the system retention mechanism to secure the HBA to the system's chassis.
6. **Connect serial cables between the HBA and any external enclosures.** Figure 1 shows the locations of the HBA connectors.
7. **Replace the cover, and any power cords and power up the system.** Replace the system's cover, reconnect any power cords, and reconnect any network cables. Turn on the power.

The hardware installation of your LSI SAS 9201-16e HBA is complete.

8 Revision History

8.1 Version 1.1, October 2014

Made the following changes:

- Updated Operating System Support URL.
- Converted the book to the new template.

8.2 Version 1.0, September 2011

Initial release of the document.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