

USER'S GUIDE

LSI20160 Single Channel Ultra160 SCSI to PCI Host Adapter

Version 1.0

December 2001



Electromagnetic Compatibility Notices

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

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- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

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This document describes the LSI Logic LSI20160 Single Channel Ultra160 SCSI to PCI Host Adapter and will remain the official reference source for all revisions/releases of this product until rescinded by an update.

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Preface

This book is the primary reference and user's guide for the LSI Logic LSI20160 Single Channel Ultra160 SCSI to PCI Host Adapter. It contains a complete functional description for the LSI20160 board as well as complete physical and electrical specifications.

Audience

This document assumes that you have some familiarity with SCSI protocol and related support devices and will benefit persons installing and using the LSI20160.

Organization

This document has the following chapters and appendix:

- [Chapter 1, Describing the LSI20160](#), defines the interfaces and characteristics of the LSI20160.
- [Chapter 2, Installing the LSI20160](#), provides both quick and detailed installation instructions.
- [Chapter 3, Technical Specifications](#), describes the physical and operational environments of the LSI20160.
- [Appendix A, Glossary of Terms and Abbreviations](#), provides definitions of various terminology that is referenced throughout this user's guide.

Related Publications

*PCI Storage Device Management System SDMS™ 4.0 User's Guide,
Version 11, Order Number S14007.B*

*LSI53C1000 PCI to Ultra160 SCSI Controller Technical Manual,
Version 2.1, Order Number S14050.A*

Revision History

Revision	Date	Remarks
1.0	12/01	Final version.

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Chapter 1

Describing the LSI20160

This chapter describes the LSI20160 Single Channel Ultra160 SCSI to PCI Host Adapter interface to PCI computer systems and includes these topics:

- [Section 1.1, “General Description,” page 1-1](#)
 - [Section 1.2, “Features,” page 1-2](#)
 - [Section 1.3, “Ultra160 SCSI Benefits,” page 1-4](#)
 - [Section 1.4, “SureLINK™ Ultra160 SCSI Domain Validation Benefits,” page 1-5](#)
 - [Section 1.5, “LVDlink™ Technology Benefits,” page 1-5](#)
 - [Section 1.6, “TolerANT® Technology Benefits,” page 1-6](#)
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1.1 General Description

The LSI Logic LSI20160 provides one SCSI-3, Ultra160 SCSI interface to PCI computer systems that require BIOS support on the add-in SCSI adapter. Installing this adapter in your PCI system allows connection of SCSI devices over a SCSI bus.

The LSI20160 provides one Ultra160 SCSI channel. The LSI20160 supports Low Voltage Differential (LVD) and Single-Ended (SE) SCSI. This board supports Fast/Ultra/Ultra2 SCSI devices as well as the newest Ultra160 SCSI devices.

The LSI Logic Storage Device Management System (SDMS™) software operates the board. The design of the board does not prevent other SCSI software from being used with it. BIOS support for this host adapter is incorporated on the board in a 128 Kbyte Flash device. The onboard controller for the LSI20160 is the LSI53C1000 PCI to Ultra160 SCSI Controller.

The LSI53C1000 contains a SCSI SCRIPTS™ processor that permits both DMA and SCSI commands to be fetched from host memory or internal SCRIPTS RAM. Algorithms written in SCSI SCRIPTS control the actions of the SCSI and DMA cores. The SCRIPTS processor executes complex SCSI bus sequences independently of the host CPU.

In addition to this guide there is another reference that you will find useful. The LSI Logic *PCI Storage Device Management System SDMS 4.0 User's Guide* contains product information and installation instructions.

1.2 Features

This section provides an overview of the PCI interface, the SCSI interface, and board characteristics for the LSI20160.

1.2.1 PCI Interface

The PCI interface operates as a 32-bit DMA bus master, where the connection is made through the J1 edge connector.

The PCI interface includes these features:

- Complies with *PCI Local Bus Specification, Revision 2.2*
- Complies with PC99
- Complies with *PCI Bus Power Management Specification, Revision 1.1*
- Supports 32-bit 33 MHz word data bursts with variable burst lengths
- Bursts 4/8, 8/16, 16/32, or 32/64 Qword/Dword transfers across the PCI bus
- Bursts up to 264 Mbytes/s (@ 33 MHz) with zero wait-state bus master data
- Supports the PCI Cache Line Size (CLS) register
- Prefetches up to 8 Dwords of SCRIPTS instructions
- Supports PCI Write and Invalidate, Read Line, and Read Multiple commands
- Supports universal 3.3 V and 5 V PCI bus signaling environment

1.2.2 SCSI Interface

The SCSI interface is made through connectors J2 and J4. [Figure 2.1](#) shows the location of these connectors. The SCSI interface includes these features:

- Provides one wide Ultra160 SCSI channel
- Provides two connectors:
 - 68-pin VHDCI for the external connection
 - 68-pin high density for the internal connection
- Supports SE and LVD signaling: 16-bit SE or LVD interfaces
- Supports LVD/SE termination
- Supports Fast, Ultra, Ultra2, and Ultra160 data transfer capability
 - Ultra160 SCSI LVD synchronous transfers at up to 160 Mbytes/s
- Supports Domain Validation, Double Transition (DT) data transfers, and Cyclic Redundancy Check (CRC)
- Supports variable block size and scatter/gather data transfers
- Protects nondata phases with Asynchronous Information Protection (AIP)
- Supports two termination control options:
 - Use manual shunts on connector J2 and J4 to disable termination
 - Provide software control using GPIO3 to enable or disable the terminators
- Supplies SCSI termination power (TERMPWR) source with autoresetting circuit breaker
- Includes SCSI Plug and Play
- Provides Flash EEPROM for BIOS configuration storage
- Includes 8 Kbytes internal RAM for SCRIPTS instruction storage
- Provides a SCSI activity LED connector (J3)

1.2.3 Board Characteristics

The board characteristics are

- PCI board dimensions
Approximately 4.721 x 2.536 inches
- Universal 32-bit PCI card edge connector
- Standard bracket available

1.2.4 SCSI Activity LED Interface

The J3 connector is a four-wire arrangement on the LSI20160 that represents the SCSI activity LED interface. [Table 3.5](#) on [page 3-8](#) lists the signal name and pin numbers for this LED interface.

1.3 Ultra160 SCSI Benefits

Ultra160 SCSI is an extension of the SPI-3 draft standard that allows faster synchronous SCSI data transfer rates than Ultra2 SCSI. When enabled, Ultra160 SCSI performs 80 megatransfers per second resulting in approximately double the synchronous data transfer rates of Ultra2 SCSI. The LSI53C1000 performs 16-bit, Ultra160 SCSI synchronous data transfers as fast as 160 Mbytes/s. This advantage is most noticeable in heavily loaded systems or large block size applications such as video on-demand and image processing.

1.3.1 Double Transition (DT) Clocking

The Ultra160 data transfer speed is accomplished using DT clocking. DT clocking refers to transferring data on both rising and falling edges of the request and acknowledge signals. Double-edge clocking doubles data transfer speeds without increasing the clock rate.

1.3.2 Cyclic Redundancy Check (CRC)

Ultra160 SCSI includes CRC which offers higher levels of data reliability by ensuring complete integrity of transferred data. CRC is a 32-bit scheme, referred to as CRC-32. CRC is guaranteed to detect all single bit errors, any two bits in error, or any combination of errors within a single 32-bit range.

1.3.3 Asynchronous Information Protection (AIP)

The LSI53C1000 also supports AIP, which protects all nondata phases, including command, status, and messages. CRC, along with AIP, provides end-to-end protection of the SCSI I/O.

1.4 SureLINK™ Ultra160 SCSI Domain Validation Benefits

SureLINK software represents the very latest SCSI interconnect management solution. It ensures robust and low risk Ultra160 SCSI implementations by extending the Domain Validation guidelines documented in the ANSI T10 SPI-3 specifications. Domain Validation verifies that the system is capable of transferring data at Ultra160 speeds, allowing it to renegotiate to lower speed and bus width if necessary.

SureLINK software is the control for the manageability enhancements in the LSI53C1000. Fully integrated in the SDMS software solution, SureLINK software provides Domain Validation at boot time, as well as throughout system operation.

1.5 LVDlink™ Technology Benefits

The LSI20160 supports LVD for SCSI, a signaling technology that increases the reliability of SCSI data transfers over longer distances than are supported by SE SCSI. The low current output of LVD allows the I/O transceivers to be integrated directly onto the chip. LVDlink technology lowers the amplitude of noise reflections and allows higher transmission frequencies. LVD provides a long-term migration path to even faster SCSI transfer rates without compromising signal integrity, cable length, or connectivity.

Important: All bus devices must be LVD or SE. If a High Voltage Differential (HVD) device is detected, the board puts the SCSI bus in the high impedance state and shuts down.

1.6 TolerANT[®] Technology Benefits

The LSI20160 features TolerANT technology, which includes active negation on the SCSI drivers and input signal filtering on the SCSI receivers. The benefits of TolerANT technology include increased immunity to noise when the signal is going HIGH, better performance due to balanced duty cycles, and improved fast SCSI transfer rates. In addition, TolerANT SCSI devices do not cause glitches on the SCSI bus at power up or power down, so other devices on the bus are also protected from data corruption.

When it is used with the LVDlink transceivers, TolerANT technology provides excellent signal quality and data reliability in real world cabling environments. TolerANT input signal filtering is a built-in feature of the LSI53C1000 device as well as all LSI Logic SCSI devices.

Chapter 2

Installing the LSI20160

This chapter provides instructions on how to install the LSI20160 and includes these topics:

- [Section 2.1, "Quick Installation Procedure,"](#) page 2-1
- [Section 2.2, "Detailed Installation Procedure,"](#) page 2-2
- [Section 2.3, "Completing the Installation,"](#) page 2-20

2.1 Quick Installation Procedure

This section provides an overview of the installation procedure. If you are an experienced computer user with prior host adapter installation and SCSI bus setup experience, this section may sufficiently describe the procedure for you. If you prefer more detailed guidance for installing the LSI20160, proceed to [Section 2.2, "Detailed Installation Procedure."](#)

For safe and proper installation, check the user's manual supplied with your computer and perform the following steps.

- Step 1. *Ground yourself* before handling the host adapter board.
- Step 2. Remove the LSI20160 from its packing and examine it for any damage.
[Figure 2.1](#) shows an example of this host adapter board.
- Step 3. Switch off and unplug the system.
- Step 4. Open your PC cabinet.
- Step 5. Locate the PCI slots on your computer.
- Step 6. Insert the LSI20160 into the selected PCI slot.
- Step 7. Connect the internal and external SCSI peripherals.

- Step 8. Connect the LED cable to J3 on your SCSI host adapter, if you wish to connect the LED to the SCSI LED connector.
- Step 9. Terminate the SCSI bus.
The SCSI bus requires proper termination and no duplicate SCSI IDs.
- Step 10. Set the peripheral SCSI IDs.
- Step 11. Make any configuration changes.
- Step 12. Close your PC cabinet cover.
- Step 13. Make all external SCSI bus connections.
- Step 14. Refer to the *PCI Storage Device Management System SDMS 4.0 User's Guide* (or the guide for the software you will use) to load the driver software for your particular operating system.
-

2.2 Detailed Installation Procedure

This section provides step-by-step instructions for installing the LSI20160, and connecting it to your SCSI peripherals. If you are experienced in these tasks, you may prefer to use the preceding [Section 2.1, "Quick Installation Procedure."](#)

2.2.1 Before You Start

Before starting, read through the steps defined within the detailed installation procedure. If you are not confident that you can perform the tasks as described in this section, LSI Logic suggests getting assistance.

The SCSI host adapter acts on your computer's behalf as the host to your suite of SCSI peripherals. Each chain of SCSI peripheral devices and their host adapter work together and are referred to as a SCSI bus.

Each SCSI host adapter that you install can act as host for up to 15 peripheral devices, not including the adapter itself.

2.2.2 Selecting a PCI Slot

For safe and proper installation, check the user's manual supplied with your computer and perform the following steps.

Step 1. *Ground yourself* before removing the host adapter board from its package.

Step 2. Remove the LSI20160 from its packing and verify it is not damaged.

[Figure 2.1](#) shows an example of this host adapter board.

Step 3. Switch off and unplug the system.

Step 4. Remove the cabinet cover on your computer to access the PCI slots.

Caution: *Ground yourself* by touching a metal surface before handling boards. Static charges on your body can damage electronic components. Handle plug-in boards by the edge; do not touch board components or gold connector contacts. The use of a static ground strap is recommended.

Step 5. Locate the PCI slots on your computer.

Refer to the user's manual supplied with your computer to confirm the location of the PCI slots. Also, the LSI20160 requires a PCI slot that allows bus master operation and provides 3.3 Volts. [Figure 2.2](#) is a representative drawing of a computer mainboard.

2.2.3 Inserting the Host Adapter

Perform the following steps to install the LSI20160 in your PC mainboard.

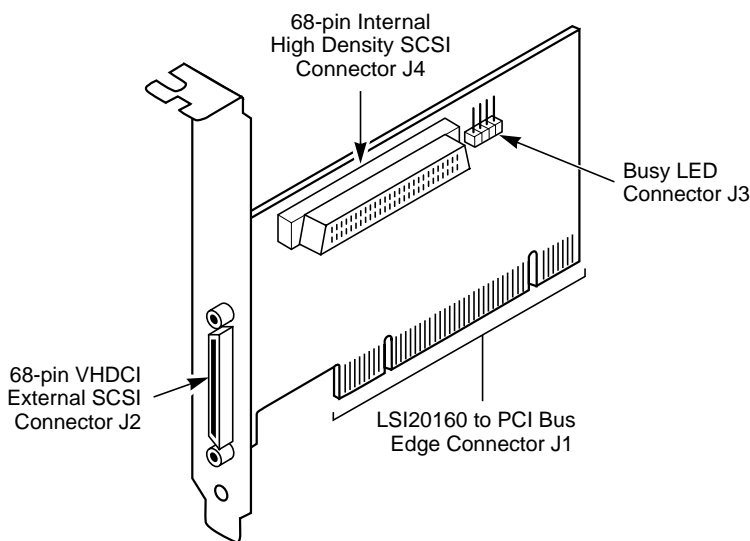
- Step 1. Remove the blank bracket panel on the back of the computer aligned with the PCI slot you intend to use.

Save the bracket screw.

- Step 2. Carefully insert the edge connector J1 of the host adapter into the PCI slot.

Make sure the edge connector is properly aligned before pressing the board into place. The bracket around connector J2 should fit where the blank bracket panel was removed. Refer to Figures 2.1 and 2.2.

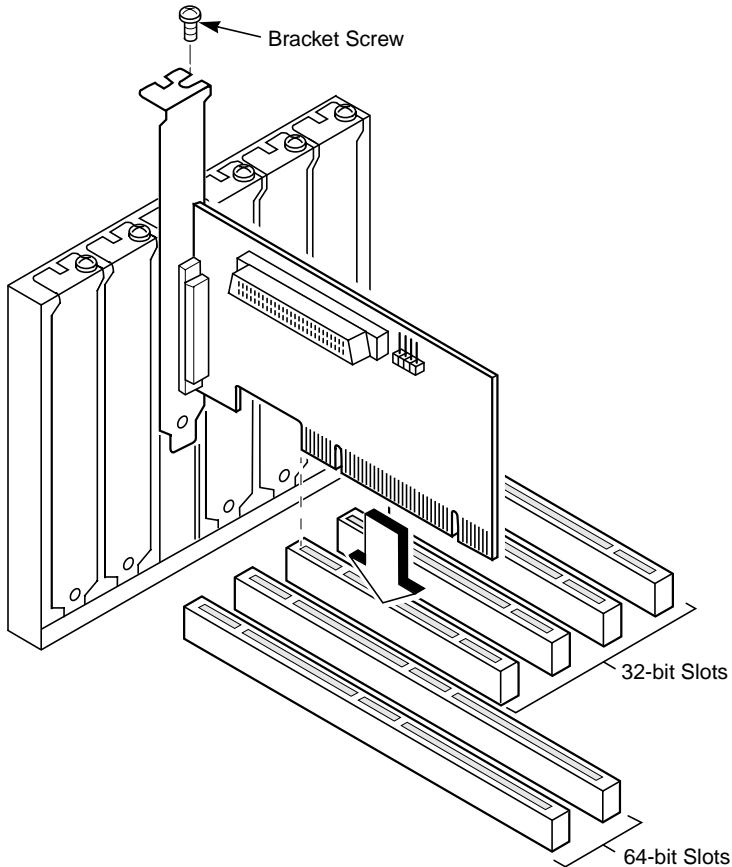
Figure 2.1 Hardware Connections for the LSI20160



Note: You may notice that the components on a PCI host adapter face the opposite way from non-PCI adapter boards you have in your system. This is correct. The board is keyed to go in only one way.

Step 3. Secure the bracket with the bracket screw before making the internal and external SCSI bus connections. [Figure 2.2](#) shows an example on how to insert your host adapter.

Figure 2.2 Inserting the Host Adapter

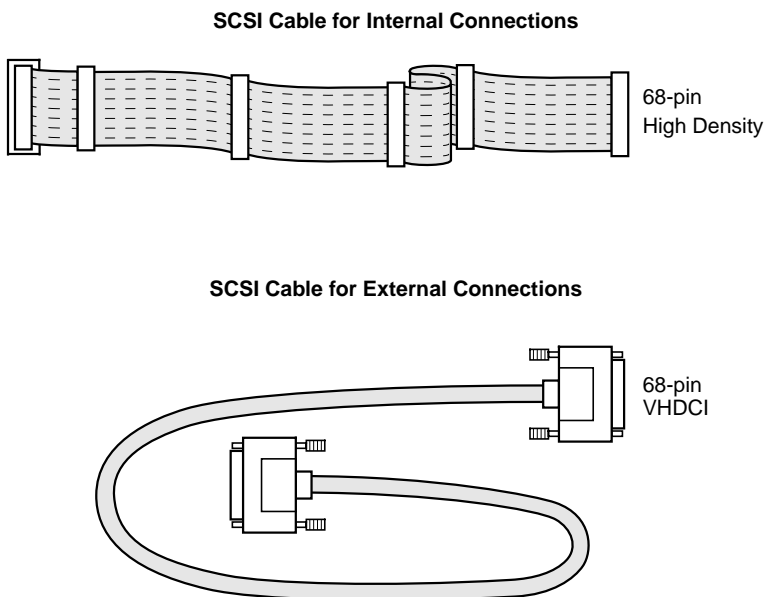


2.2.4 Connecting SCSI Peripherals

All internal SCSI bus connections to the LSI20160 can be made with an unshielded, 68-conductor ribbon cable (see [Figure 2.3](#)). One side of this cable is marked with a color to indicate the pin-1 side. The connectors on this cable are keyed to ensure proper pin-1 connection. Some internal cables come with an LVD/SE terminator on one end. This end should be furthest from the host adapter.

All external SCSI bus connections to the LSI20160 are made with shielded, 68-conductor cables (see [Figure 2.3](#)). The connectors on this cable are always keyed to ensure proper pin-1 connection.

Figure 2.3 SCSI Cables

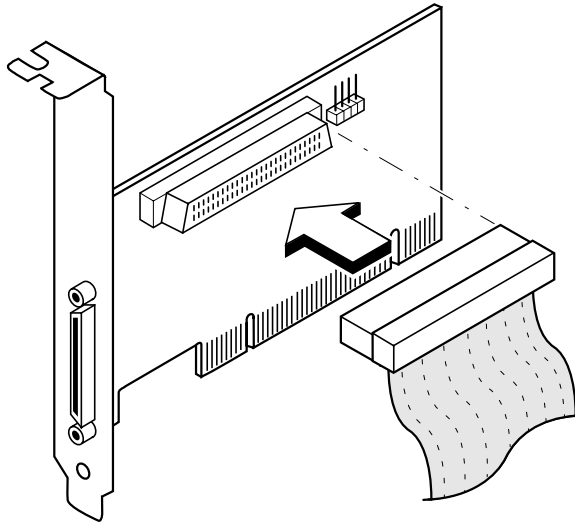


2.2.4.1 Making Internal SCSI Bus Connections

This section provides step-by-step instructions for making internal SCSI bus connections. If you only have external connections, skip to [Section 2.2.4.3, “Making External SCSI Bus Connections.”](#)

- Step 1. Plug a 68-pin connector on the end of the internal SCSI ribbon cable into connector J4. [Figure 2.4](#) illustrates how to make this connection.

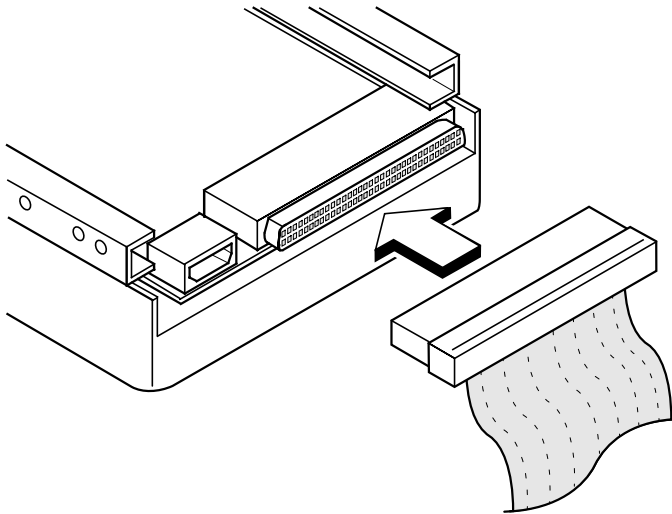
Figure 2.4 Internal SCSI Ribbon Cable to Host Adapter



Step 2. Plug the 68-pin connector on the other end of the internal SCSI ribbon cable into the SCSI connector on the internal SCSI device.

Pin 1 must match on all connections. The lead in the cable adjacent to pin 1 is colored. [Figure 2.5](#) illustrates a connection to an internal SCSI device.

Figure 2.5 Internal SCSI Ribbon Cable to Internal SCSI Device Connection



If you have more than one internal SCSI device, you must have a cable with at least as many connectors as devices.

Step 3. Plug in any additional internal SCSI devices, as required. Refer to the example in [Figure 2.6](#).

[Figure 2.7](#) illustrates the connection of multiple internal SCSI devices chained together. Make sure to match pin 1 on all connections.

Figure 2.6 Connecting Additional Internal SCSI Devices

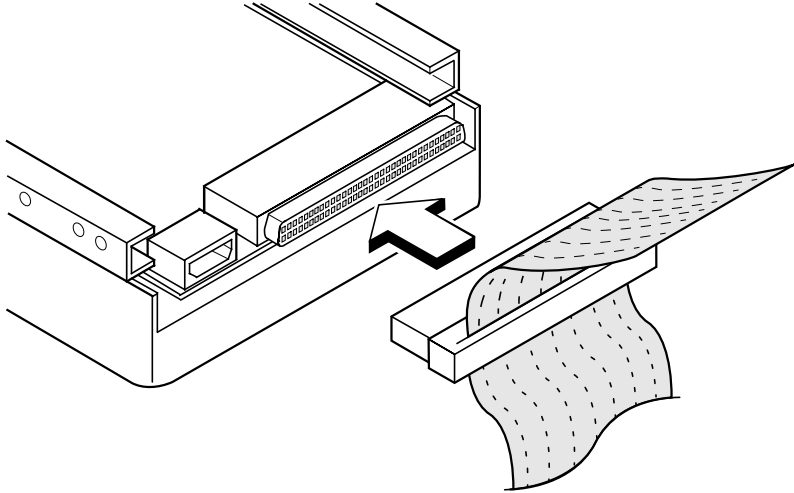
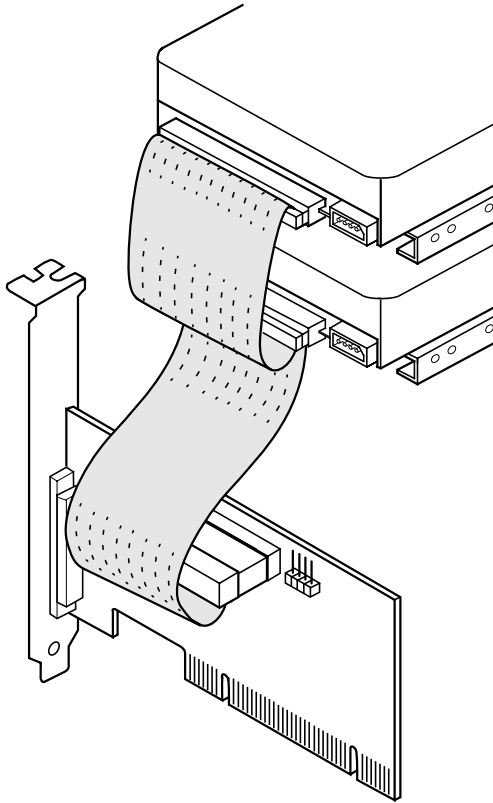


Figure 2.7 Multiple Internal SCSI Devices Chained Together



2.2.4.2 Making Activity LED Connection

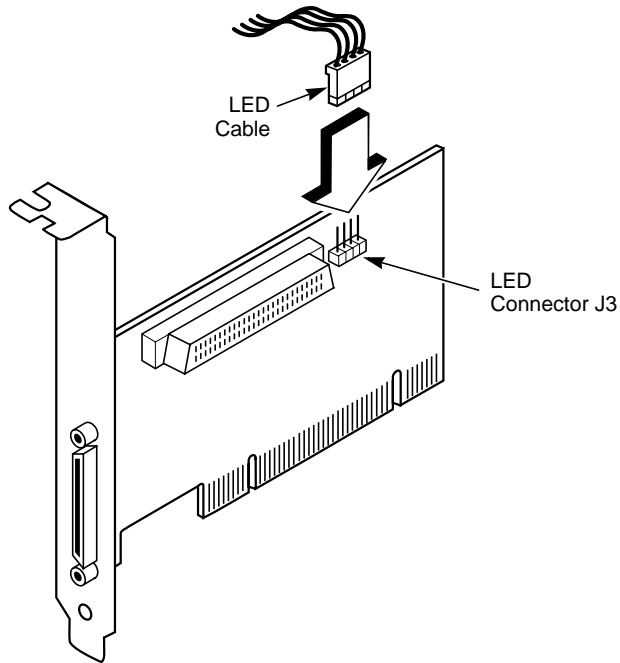
Most PC cabinets are designed with a front panel LED to indicate bus activity. It may already be connected to an existing IDE controller. If you want, you can connect the LED to the SCSI LED connector.

Connect the LED cable to J3 on your SCSI host adapter, as shown in [Figure 2.8](#).

The Busy LED connector J3 is not keyed. The J3 connector is a 4-pin one row right angle header. Some LED cables have only two wires. In this case, place the connector on one end of J3. If the LED does not light during SCSI bus activity, you may have to rotate the LED cable 180° on J3 or move it to the other end of the jack.

After the correct connection is established, the front panel LED indicates activity on the SCSI bus. Refer to [Table 3.5](#) on [page 3-8](#) for connector pinout information.

Figure 2.8 SCSI LED Connector



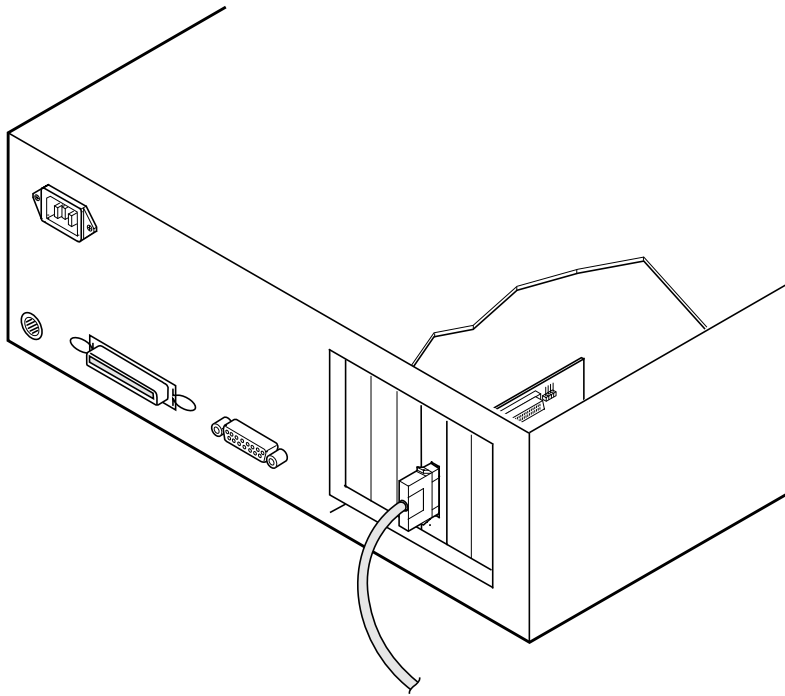
2.2.4.3 Making External SCSI Bus Connections

This section provides step-by-step instructions for making external SCSI bus connections.

- Step 1. Plug the 68-pin VHDCI connector on one end of a shielded external high density cable (see [Figure 2.3](#)) into the host adapter connector J2.

This connector is exposed on the back panel of your computer. [Figure 2.9](#) illustrates where this connection is made.

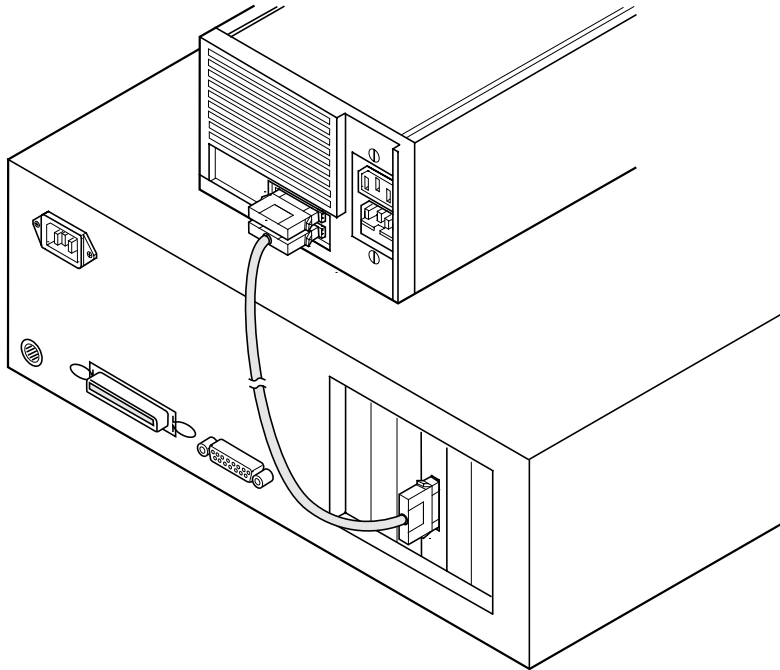
Figure 2.9 External Cable to Host Adapter



Step 2. Plug the 68-pin connector on the other end of the shielded external SCSI cable into the SCSI connector on your external SCSI device.

[Figure 2.10](#) illustrates a connection to an external SCSI device.

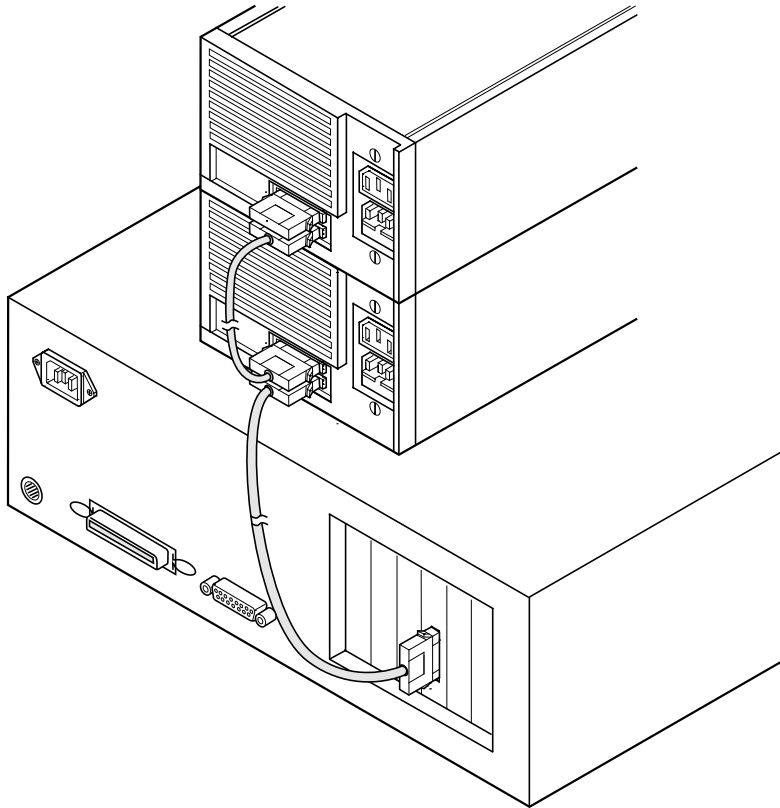
Figure 2.10 External Cable to External SCSI Device



Step 3. Chain any additional SCSI devices together with shielded external SCSI cables.

Figure 2.11 shows an example of multiple external SCSI devices that are chained together.

Figure 2.11 Multiple External SCSI Devices Chained Together



2.2.5 SCSI Bus Termination

The devices making up the SCSI bus are connected serially (chained together) with SCSI cables. The first and last physical SCSI devices connected on the ends of the SCSI bus must have their terminators active. All other SCSI devices on the bus must have their terminators removed or disabled.

Termination control has two options which allow a different termination mode:

- Termination can be disabled by placing a manual shunt over the post. When the shunt is off, the terminator is active. When the shunt is on the post, the terminator is disabled.
- Termination can be enabled or disabled for a specific channel using software control with GPIO3.

LVD peripheral devices are normally terminated with external terminators, but are sometimes set with jumpers or with a switch on the peripheral. Refer to the peripheral manufacturer's instructions and to the user's manual for your computer for information on how to identify the terminator setting of each device and how to change it.

The LSI20160 automatically controls SCSI bus termination for two different bus configurations (see [Figure 2.1](#)). The two bus configurations are

- Termination on
- Termination off

You can disable termination in two ways:

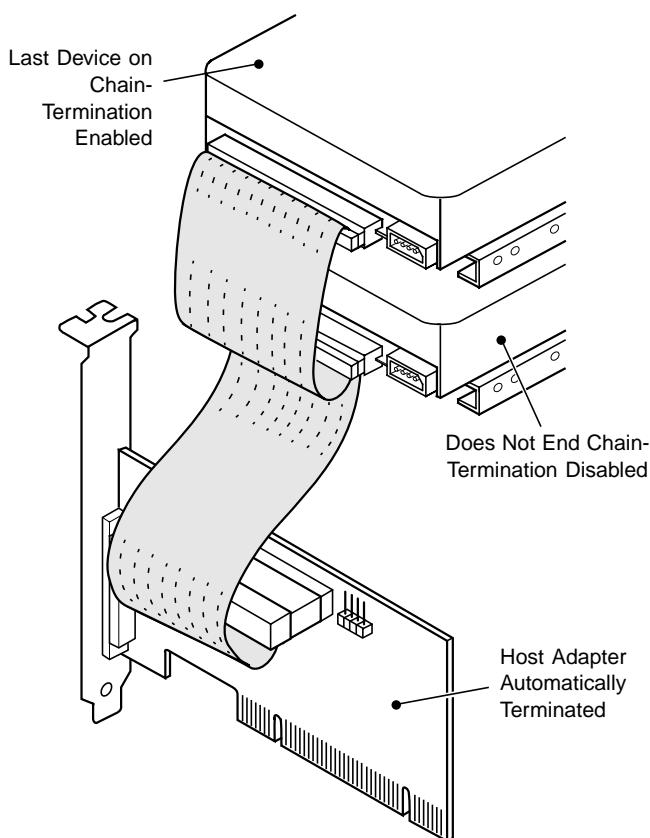
- Use BIOS software control, where the BIOS termination option is changed from Automatic to Off.
- Manually place a shunt on the post of the respective jumpers, J2DIS and J4DIS.

2.2.5.1 Internal SCSI Terminations

If you are making internal SCSI device connections on your host adapter, you must terminate the last internal device on the SCSI bus. You must disable the termination on all other devices. Termination on your host adapter is automatically enabled in this case if there are no external SCSI devices connected through J2.

Figure 2.12 shows an example of how termination is determined for this SCSI bus configuration.

Figure 2.12 Internal SCSI Device Termination

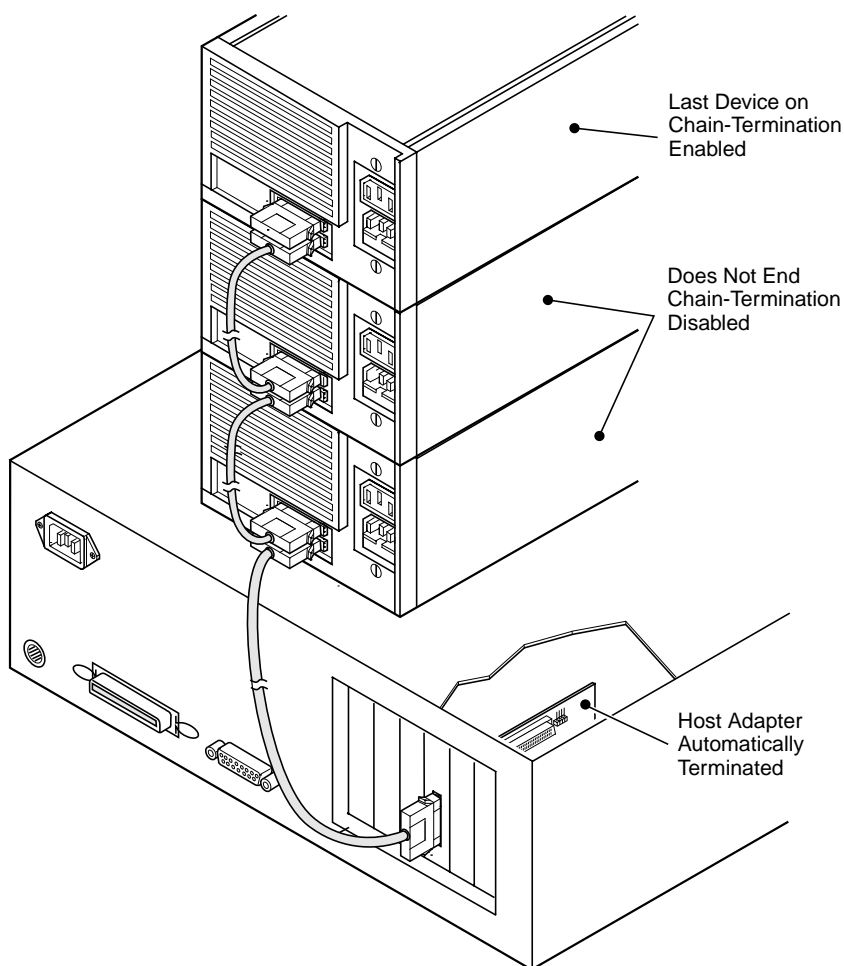


2.2.5.2 External SCSI Terminations

If you are making external SCSI device connections on your host adapter, you must terminate the last external device on the SCSI bus. Termination on all other devices must be disabled. Termination on your host adapter is automatically enabled in this case if there are no internal devices connected through J4.

Figure 2.13 shows an example of how termination is determined for this SCSI bus configuration on your host adapter.

Figure 2.13 External SCSI Device Termination



2.2.6 Setting SCSI IDs

You must set each SCSI device and the host adapter to a separate SCSI ID. The IDs are 0 through 7 for an 8-bit bus and 0 through 15 for a 16-bit bus. SCSI ID 7 is the preset host adapter setting, giving it the highest priority on the SCSI bus. If you plan to boot your computer from a hard disk drive on the SCSI bus, that drive should have SCSI ID 0, or the lowest SCSI ID on the bus. The *PCI Storage Device Management System SDMS 4.0 User's Guide* explains how to set your host adapter ID using the SCSI BIOS Configuration Utility.

The peripheral device SCSI IDs are usually set with jumpers or with a switch on the peripheral. Refer to the peripheral manufacturer's instructions and to the user's manual for your computer to determine the ID of each device and how to change it. No duplication of SCSI IDs is allowed on a SCSI bus.

- Step 1. Determine the SCSI ID of each device on the SCSI bus. Note any duplications.
- Step 2. Make any necessary changes to the SCSI IDs and record the IDs for future reference. Correct any duplications at this time. [Table 2.1](#) on [page 2-19](#) is provided as a place to keep this record.

Table 2.1 SCSI ID Record

SCSI ID	SCSI Device
15	
14	
13	
12	
11	
10	
9	
8	
7	LSI20160 (default)
6	
5	
4	
3	
2	
1	
0	

2.3 Completing the Installation

Before replacing the cover on your computer, review this installation procedure check list. This can save you effort later.

Verify Installation Procedures	Done
Host adapter connection in PCI bus slot secure	
Internal SCSI bus connections secure (pin-1 continuity)	
External SCSI bus connections secure	
Proper SCSI bus termination established	
Unique SCSI IDs set and recorded for each device	

- Step 1. Replace the cabinet cover on your computer.
- Step 2. Plug in all power cords, and switch on power to all devices and your computer.
- Step 3. Wait for your computer to boot up.
- Step 4. Refer to the LSI Logic *PCI Storage Device Management System SDMS 4.0 User's Guide* (or the guide for the software you will use) to load the driver software for your particular operating system and to change the configuration of your host adapter, if needed.

Chapter 3

Technical Specifications

This chapter discusses the physical environment associated with the LSI20160. It includes a mechanical drawing of this board, which is shown in [Figure 3.1](#). It also includes these topics:

- [Section 3.1, “Physical Environment,” page 3-1](#)
- [Section 3.2, “Operational Environment,” page 3-4](#)
- [Section 3.3, “Subsystem ID and Subsystem Vendor ID,” page 3-9](#)

3.1 Physical Environment

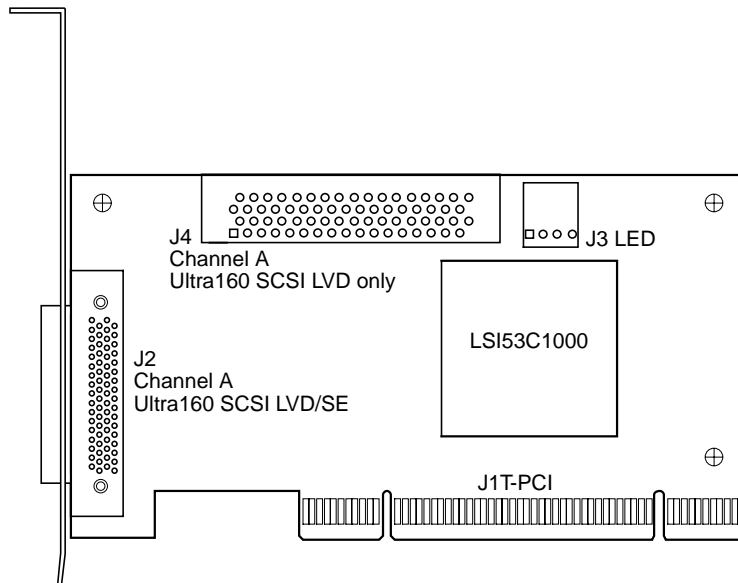
This section discusses the physical, electrical, thermal, and safety characteristics of the LSI20160. Additionally, this board is compliant with electromagnetic standards set by the FCC.

3.1.1 Physical Characteristics

The dimensions of the LSI20160 are 4.721 x 2.536 inches. Edge connector J1 makes the PCI connection. The component height on the top and bottom of the LSI20160 follows the PCI specification.

Connector J4 is a 68-pin high density connector that makes the internal SCSI connection. Connector J2 is a 68-pin VHDCI connector that makes the external SCSI connection. The J2 connector extends through the standard bracket, which is attached to the face of the connector outside of the cabinet where the LSI20160 is installed. Connector J3 provides connection to the computer's drive activity LED. It is a 4-pin, one-row, right-angle header.

Figure 3.1 LSI20160 Mechanical Drawing



Note:

- J1: PCI 32-bit universal type board edge connector.
- J2: 68-pin VHDCI connector for external SCSI connection.
- J4: 68-pin high density internal SCSI connection.
- J3: 4-pin low density unshrouded right-angle LED connector.
- Subsystem Vendor ID is 1000.
- Subsystem ID is 1060.

3.1.2 Electrical Characteristics

The LSI20160 maximum power requirements that include SCSI TERMPWR under normal operation are shown in [Table 3.1](#):

Table 3.1 Maximum Power Requirements

+5 V DC	5%	1.3 A	Over the operating range 0–55 °C (with SCSI TERMPWR, supplied to external connection)
+5 V DC	5%	0.40 A	Over the operating range 0–55 °C (without SCSI TERMPWR, supplied to external connection)
+3.3 V DC	5%	1.00 A	Over the operating range 0–55 °C

The PCI PRSNT1 and PRSNT2 pins are set to indicate a 7.5 W maximum configuration.

Under abnormal conditions, such as a short on SCSI TERMPWR, + 5 V current may be higher. At temperatures of at least 25 °C, a current of 8 A is sustained no longer than 0.5 seconds before the self-resetting TERMPWR short circuit protection device opens.

3.1.3 Thermal, Atmospheric Characteristics

The thermal, atmospheric characteristics of the LSI20160 are:

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

The following parameters define the storage and transit environment for the LSI20160:

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

3.1.4 Electromagnetic Compliance

This board is tested to and meets class B regulatory requirements for the United States, Canadian, European, Japanese, and Australian markets. This board carries the appropriate markings (FCC, CE, VCCI, C-Tick) indicating such compliance.

3.1.5 Safety Characteristics

The bare board meets or exceeds the requirements of UL flammability rating 94 V0. The bare board is also marked with the supplier's name or trademark, type, and UL flammability rating. Since this board is installed in a PCI bus slot, all voltages are below the SELV 42.4 V limit.

3.2 Operational Environment

The LSI20160 is designed for use in PCI computer systems with a standard bracket type. The SDMS software operates the board, but the design of the board does not prevent the use of other software. An on-board Flash memory device allows you to use BIOS code and open boot code support through PCI and a serial EEPROM.

3.2.1 The PCI Interface

The PCI interface operates as a 32-bit DMA bus master. The connection is made through edge connector J1, which provides connections on both the front and back of the board. The signal definitions and pin numbers conform to the *PCI Local Bus Specification, Revision 2.2* standard. The signal assignments appear in [Table 3.2](#), [Table 3.3](#), and [Table 3.4](#).

Note: The LSI20160 uses 3.3 V pins to run the LSI53C1000 and some other parts. The LSI20160 requires 3.3 V from the PCI + 3.3 V power rail for proper operation.

Table 3.2 PCI Connector J1 (Front)¹

Signal Name	Pin	Signal Name	Pin
-12 V	1	AD17	32
TCK	2	C_BE2 ²	33
GND	3	GND	34
TDO	4	IRDY ²	35
+5 V	5	+3.3 V	36
+5 V	6	DEVSEL ²	37
INTB ²	7	GND ²	38
INTD ²	8	LOCK ²	39
GND(PRSNT1 ²)	9	PERR ²	40
RESERVED	10	+3.3 V	41
GND(PRSNT2 ²)	11	SERR ²	42
KEYWAY	12	+3.3 V	43
KEYWAY	13	C_BE1 ²	44
RESERVED	14	AD14	45
GND	15	GND	46
CLK	16	AD12	47
GND	17	AD10	48
REQ ²	18	M66EN (LVD)	49
3 V/5 V	19	KEYWAY	50
AD31	20	KEYWAY	51
AD29	21	AD08	52
GND	22	AD07	53
AD27	23	+3.3 V	54
AD25	24	AD05	55
+3.3 V	25	AD03	56
C_BE3 ²	26	GND	57
AD23	27	AD01	58
GND	28	3 V/5 V	59
AD21	29	ACK64 ²	60
AD19	30	+5 V	61
+3.3 V	31	+5 V	62

1. Shaded lines are not connected.

2. Active LOW signal.

Table 3.3 PCI Connector J1 (Back)¹

Signal Name	Pin	Signal Name	Pin
TRST ²	1	AD16	32
+12 V	2	+3.3 V	33
TMS	3	FRAME ²	34
TDI	4	GND	35
+5 V	5	TRDY ²	36
INTA ²	6	GND	37
INTC ²	7	STOP ²	38
+5 V	8	+3.3 V	39
RESERVED	9	SDONE	40
3 V/5 V	10	SBO ²	41
RESERVED	11	GND	42
KEYWAY	12	PAR	43
KEYWAY	13	AD15	44
RESERVED	14	+3.3 V	45
RST ²	15	AD13	46
3 V/5 V	16	AD11	47
GNT ²	17	GND	48
GND	18	AD09	49
RESERVED	19	KEYWAY	50
AD30	20	KEYWAY	51
+3.3 V	21	C_BE0 ²	52
AD28	22	+3.3 V	53
AD26	23	AD06	54
GND	24	AD04	55
AD24	25	GND	56
IDSEL	26	AD02	57
+3.3 V	27	AD00	58
AD22	28	3 V/5 V	59
AD20	29	REQ64 ²	60
GND	30	+5 V	61
AD18	31	+5 V	62

1. Shaded lines are not connected.

2. Active LOW signal.

3.2.2 The SCSI Interface

The SCSI interface conforms to ANSI X 3T10.11/1142. The SCSI interface operates as 16-bit, synchronous or asynchronous, SE or LVD, and supports Ultra160 SCSI protocols. Arbitration is supported for 8-bit (at lower SCSI speeds) and 16-bit. Active SE or LVD SCSI termination is provided automatically. The LSI20160 supplies the SCSI termination power.

Connector J2 makes the external connection, which provides LVD/SE SCSI termination. Connector J4 makes the internal connection, which only provides LVD SCSI termination.

Table 3.4 shows the signal assignments for J2 and J4.

Table 3.4 SCSI Interface

Signal Name	Pin	Signal Name	Pin	Signal Name	Pin
SD12+	1	SACK+	24	SD7-	47
SD13+	2	SRST+	25	SDP-	48
SD14+	3	SMSG+	26	GND	49
SD15+	4	SSEL+	27	Cable_prnt	50
SDP1+	5	SC_D+	28	TERMPWR	51
SD0+	6	SREQ+	29	TERMPWR	52
SD1+	7	SI_O+	30	N/C	53
SD2+	8	SD8+	31	GND	54
SD3+	9	SD9+	32	SATN-	55
SD4+	10	SD10+	33	GND	56
SD5+	11	SD11+	34	SBSY-	57
SD6+	12	SD12-	35	SACK-	58
SD7+	13	SD13-	36	SRST-	59
SDP+	14	SD14-	37	SMSG-	60
GND	15	SD15-	38	SSEL-	61
DIFFSENS	16	SDP1-	39	SC_D-	62
TERMPWR	17	SD0-	40	SREQ-	63
TERMPWR	18	SD1-	41	SI_O-	64
N/C	19	SD2-	42	SD8-	65
GND	20	SD3-	43	SD9-	66
SATN+	21	SD4-	44	SD10-	67
GND	22	SD5-	45	SD11-	68
SBSY+	23	SD6-	46		

3.2.3 The LED Interface

The LSI20160 LED interface is a four-wire arrangement that allows you to connect an LED harness to the board. The GPIO0_FETCH line has a maximum output low voltage of 0.4 V and minimum output low current of 16 mA. It is driven low to complete the circuit when a harness with an LED is attached. The J3 connector provides the LED connection on the LSI20160. [Table 3.5](#) lists the signal and pin numbers for the LED interface.

Table 3.5 LED Connector J3 Pinout

Signal Name	Pin
A_LED+	1
A_LED–	2
A_LED–	3
A_LED+	4

3.3 Subsystem ID and Subsystem Vendor ID

Table 3.6 provides the Subsystem ID and System Vendor ID for the LSI20160. The serial EEPROM on this board contains the ID numbers. During system initialization, the system loads the ID numbers into the Subsystem Vendor ID and Subsystem ID registers of the LSI20160 SCSI Controller (the LSI53C1000). For more information on the operation of the Subsystem Vendor ID and Subsystem ID registers, refer to the *LSI53C1000 PCI to Ultra160 SCSI Controller Technical Manual*.

Table 3.6 Subsystem ID and Subsystem Vendor ID

Subsystem	ID
Subsystem Vendor ID	1000
Subsystem ID	1060

Appendix A

Glossary of Terms and Abbreviations

160/m	An industry initiative extension of the Ultra160 SCSI specification that requires support of Double Transition Clocking, Domain Validation, and Cyclic Redundancy Check (CRC).
Active Termination	The electrical connection required at each end of the SCSI bus, composed of active voltage regulation and a set of termination resistors. Ultra, Ultra2, and Ultra160 SCSI require active termination.
Address	A specific location in memory, designated either numerically or by a symbolic name.
AIP	Asynchronous Information Protection provides error checking for asynchronous, nondata phases of the SCSI bus.
Asynchronous Data Transfer	One of the ways data is transferred over the SCSI bus. It is slower than synchronous data transfer.
BIOS	Basic Input/Output System. Software that provides basic read/write capability. Usually kept as firmware (ROM based). The system BIOS on the mainboard of a computer is used to boot and control the system. The SCSI BIOS on your host adapter acts as an extension of the system BIOS.
Bit	A binary digit. The smallest unit of information a computer uses. The value of a bit (0 or 1) represents a two-way choice, such as on or off, true or false, and so on.
Bus	A collection of unbroken signal lines across which information is transmitted from one part of a computer system to another. Connections to the bus are made using taps on the lines.

Bus Mastering	A high-performance way to transfer data. The host adapter controls the transfer of data directly to and from system memory without interrupting the computer's microprocessor. This is the fastest way for multitasking operating systems to transfer data.
Byte	A unit of information consisting of eight bits.
CISPR	A special international committee on radio interference (Committee, International and Special, for Protection in Radio).
Configuration	Refers to the way a computer is setup; the combined hardware components (computer, monitor, keyboard, and peripheral devices) that make up a computer system; or the software settings that allow the hardware components to communicate with each other.
CRC	Cyclic Redundancy Check is an error detection code used in Ultra160 SCSI. Four bytes are transferred with the data to increase the reliability of data transfers. CRC is used on the Double Transition (DT) Data-In and DT Data-Out phases.
CPU	Central Processing Unit. The "brain" of the computer that performs the actual computations. The term Microprocessor Unit (MPU) is also used.
DMA Bus Master	A feature that allows a peripheral to control the flow of data to and from system memory by blocks, as opposed to PIO (Programmed I/O) where the processor is in control and the flow is by byte.
Device Driver	A program that allows a microprocessor (through the operating system) to direct the operation of a peripheral device.
Differential SCSI	A hardware configuration for connecting SCSI devices. It uses a pair of lines for each signal transfer (as opposed to Single-Ended SCSI which references each SCSI signal to a common ground).
DMI	Desktop Management Interface.
Domain Validation	Domain Validation is a software procedure in which a host queries a device to determine its ability to communicate at the negotiated Ultra160 data rate.
Double Transition (DT) Clocking	In DT Clocking data is sampled on both the asserting and deasserting edge of the REQ/ACK signal. DT Clocking may only be implemented on an LVD SCSI bus.

Dword	A double word is a group of four consecutive bytes or characters that are stored, addressed, transmitted, and operated on as a unit. The lower two address bits of the least significant byte must equal zero in order to be Dword aligned.
EEPROM	Electrically Erasable Programmable Read Only Memory. A memory chip typically used to store configuration information. See NVRAM.
EISA	Extended Industry Standard Architecture. An extension of the 16-bit ISA bus standard. It allows devices to perform 32-bit data transfers.
External SCSI Device	A SCSI device installed outside the computer cabinet. These devices are connected in a continuous chain using specific types of shielded cables.
Fast-20	The SCSI Trade Association (STA) supports the use of "Ultra SCSI" over the term "Fast-20". Please see Ultra SCSI.
Fast-40	The SCSI Trade Association (STA) supports the use of "Ultra2 SCSI" over the term "Fast-40". Please see Ultra2 SCSI.
Fast SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 10 Mbytes/s over an 8-bit SCSI bus and up to 20 Mbytes/s over a 16-bit SCSI bus.
FCC	Federal Communications Commission.
File	A named collection of information stored on a disk.
Firmware	Software that is permanently stored in ROM. Therefore, it can be accessed during boot time.
Hard Disk	A disk made of metal and permanently sealed into a drive cartridge. A hard disk can store very large amounts of information.
Host	The computer system in which a SCSI host adapter is installed. It uses the SCSI host adapter to transfer information to and from devices attached to the SCSI bus.
Host Adapter	A circuit board or integrated circuit that provides a SCSI bus connection to the computer system.
Internal SCSI Device	A SCSI device installed inside the computer cabinet. These devices are connected in a continuous chain using an unshielded ribbon cable.

IRQ	Interrupt Request Channel. A path through which a device can get the immediate attention of the computer's CPU. The PCI bus assigns an IRQ path for each SCSI host adapter.
ISA	Industry Standard Architecture. A type of computer bus used in most PCs. It allows devices to send and receive data up to 16 bits at a time.
Kbyte	Kilobyte. A measure of computer storage equal to 1024 bytes.
Local Bus	A way to connect peripherals directly to computer memory. It bypasses the slower ISA and EISA buses. PCI is a local bus standard.
Logical Unit	A subdivision, either logical or physical, of a SCSI device (actually the place for the device on the SCSI bus). Most devices have only one logical unit, but up to eight are allowed for each of the eight possible devices on a SCSI bus.
LUN	Logical Unit Number. An identifier, zero to seven, for a logical unit.
LVDlink	Low Voltage Differential link allows greater Ultra2 SCSI device connectability and longer SCSI cables. LVDlink lowers the amplitude of noise reflections and allows higher transmission frequencies. Detailed information may be found in Section 1.5, "LVDlink™ Technology Benefits," page 1-5.
Mainboard	A large circuit board that holds RAM, ROM, the microprocessor, custom integrated circuits, and other components that make a computer work. It also has expansion slots for host adapters and other expansion boards.
Main Memory	The part of a computer's memory which is directly accessible by the CPU (usually synonymous with RAM).
Mbyte	Megabyte. A measure of computer storage equal to 1024 kilobytes.
Motherboard	See Mainboard. In some countries, the term Motherboard is not appropriate.
Multitasking	The executing of more than one command at the same time. This allows programs to operate in parallel.
Multithreading	The simultaneous accessing of data by more than one SCSI device. This increases the data throughput.

NVRAM	NonVolatile Random Access Memory. Actually an EEPROM (Electrically Erasable Read Only Memory chip) used to store configuration information. See EEPROM.
Operating System	A program that organizes the internal activities of the computer and its peripheral devices. An operating system performs basic tasks such as moving data to and from devices, and managing information in memory. It also provides the user interface.
Parity Checking	A way to verify the accuracy of data transmitted over the SCSI bus. The parity bit in the transfer is used to make the sum of all the 1 bits either odd or even (for odd or even parity). If the sum is not correct, the information may be retransmitted or an error message may appear.
Passive Termination	The electrical connection required at each end of the SCSI bus, composed of a set of resistors. It improves the integrity of bus signals.
PC99	A set of design standards that developers must comply with to be Windows NT compatible.
PCI	Peripheral Component Interconnect. A local bus specification that allows connection of peripherals directly to computer memory. It bypasses the slower ISA and EISA buses.
Peripheral Devices	A piece of hardware (such as a video monitor, disk drive, printer, or CD-ROM) used with a computer and under the computer's control. SCSI peripherals are controlled through a SCSI host adapter.
Pin-1 Orientation	The alignment of pin 1 on a SCSI cable connector and the pin-1 position on the SCSI connector into which it is inserted. External SCSI cables are always keyed to insure proper alignment, but internal SCSI ribbon cables sometimes are not keyed.
PIO	Programmed Input/Output. A way the CPU can transfer data to and from memory using the computer's I/O ports. PIO is usually faster than DMA, but requires CPU time.
Port Address	Also Port Number. The address through which commands are sent to a host adapter board. This address is assigned by the PCI bus.
Port Number	See Port Address.
Queue Tags	A way to keep track of multiple commands that allow for increased throughput on the SCSI bus.

RAM	Random Access Memory. The computer's primary working memory in which program instructions and data are stored and are accessible to the CPU. Information can be written to and read from RAM. The contents of RAM are lost when the computer is turned off.
RISC Core	LSI Logic SCSI chips contain a RISC (Reduced Instruction Set Computer) processor, programmed through SCRIPTS microcode.
ROM	Read Only Memory. Memory from which information can be read but not changed. The contents of ROM are not erased when the computer is turned off.
SCAM	SCSI Configured AutoMatically. A method to automatically allocate SCSI IDs using software when SCAM compliant SCSI devices are attached.
SCSI	Small Computer System Interface. A specification for a high-performance peripheral bus and command set. The original standard is referred to as SCSI-1.
SCSI-2	The SCSI specification which adds features to the original SCSI standard.
SCSI-3	The SCSI specification which adds features to the SCSI-2 standard.
SCSI Bus	A host adapter and one or more SCSI peripherals connected by cables in a linear chain configuration. The host adapter may exist anywhere on the chain, allowing connection of both internal and external SCSI devices. A system may have more than one SCSI bus by using multiple host adapters.
SCSI Device	Any device that conforms to the SCSI standard and is attached to the SCSI bus by a SCSI cable. This includes SCSI host adapters and SCSI peripherals.
SCSI ID	A way to uniquely identify each SCSI device on the SCSI bus. Each SCSI bus has eight available SCSI IDs numbered 0 through 7 (or 0 through 15 for Wide SCSI). The host adapter usually gets the highest ID (7 or 15) giving it priority to control the bus.
SCSI SCRIPTS	A SCSI programming language that works with the SCRIPTS processor. The SCRIPTS processor fetches SCRIPTS instructions from system memory to control processor operation.

SCRIPTS Processor	The SCRIPTS processor allows users to fine tune SCSI operations with regard to unique vendor commands or new SCSI specifications. The SCRIPTS processor fetches SCRIPTS instructions from system memory to control processor operation.
SDMS	Storage Device Management System. An LSI Logic software product that manages SCSI system I/O.
Single-Ended SCSI	A hardware specification for connecting SCSI devices. It references each SCSI signal to a common ground. This is the most common method (as opposed to differential SCSI which uses a separate ground for each signal).
STA	SCSI Trade Association. A group of companies that cooperate to promote SCSI parallel interface technology as a viable mainstream I/O interconnect for commercial computing.
SureLINK	The domain validation method developed and used by LSI Logic. SureLINK provides three levels of integrity checking: Basic (level 1), Enhanced (level 2), and Margined (level 3).
Synchronous Data Transfer	One of the ways data is transferred over the SCSI bus. Transfers are clocked with fixed frequency pulses. This is faster than asynchronous data transfer. Synchronous data transfers are negotiated between the SCSI host adapter and each SCSI device.
System BIOS	Controls the low-level POST (Power-On Self-Test), and basic operation of the CPU and computer system.
TolerANT	A technology developed and used by LSI Logic to improve data integrity, data transfer rates, and noise immunity through the use of active negation and input signal filtering.
Ultra SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 20 Mbytes/s over an 8-bit SCSI bus and up to 40 Mbytes/s over a 16-bit SCSI bus. SCSI Trade Association (STA) supports using the term "Ultra SCSI" over the older term "Fast-20".
Ultra2 SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 40 Mbytes/s over an 8-bit SCSI bus, and up to 80 Mbytes/s over a 16-bit SCSI bus. SCSI Trade Association (STA) supports using the term "Ultra2 SCSI" over the term "Fast-40".

Ultra160 SCSI	A standard for SCSI data transfers. It allows a transfer rate of up to 160 Mbytes/s over a 16-bit SCSI bus.
VCCI	Voluntary Control Council for Interference.
VDE	Verband Deucher Elektroniker (Association of German Electrical Engineers).
VHDCI	Very High Density Cable Interconnect.
Virtual Memory	Space on a hard disk that can be used as if it were RAM.
Wide SCSI	A SCSI-2 feature allowing 16-bit or 32-bit transfers on the SCSI bus. This dramatically increases the transfer rate over the standard 8-bit SCSI bus.
Wide Ultra SCSI	The SCSI Trade Association (STA) term for SCSI bus width 16-bits, SCSI bus speed maximum data rate 40 Mbytes/s.
Wide Ultra2 SCSI	The SCSI Trade Association (STA) term for SCSI bus width 16-bits, SCSI bus speed maximum data rate 80 Mbytes/s.
Word	A two byte (or 16-bit) unit of information.

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