USER'S GUIDE

LSI22903
PCI to Dual Channel
Ultra160 SCSI Low Profile
Host Adapter

Version 1.1

November 2000

LSI LOGIC®

S14045.A

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:

- Reorient or relocate the receiving antenna.
- 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.

Shielded cables for SCSI connection external to the cabinet are used in the compliance testing of this Product. LSI Logic is not responsible for any radio or television interference caused by unauthorized modification of this equipment or the substitution or attachment of connecting cables and equipment other than those specified by LSI Logic. The correction of interferences caused by such unauthorized modification, substitution, or attachment will be the responsibility of the user.

The LSI Logic LSI22903 is tested to comply with FCC standards for home or office use.

This Class B digital apparatus meets all requirements of the Canadian Interference-Causing Equipment Regulations.

Cet appareil numérique de la classe B respecte toutes les exigences du Règlement sur le matériel brouilleur du Canada.

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Document DB15-000154-01, Second Edition (November 2000). This document describes the LSI Logic LSI22903 PCI to Dual Channel Ultra160 SCSI Low Profile PCI Host Adapter and will remain the official reference source for all revisions/releases of this product until rescinded by an update.

The PCI interface is compatible with the PCI Local Bus Specification, Revision 2.1, 2.2, and Low Profile PCI addendum. The SCSI interface is compatible with the ANSI draft standard X3T10.11/1142.

To receive product literature, visit us at http://www.lsilogic.com.

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Preface

This book is the primary reference and user's guide for the LSI Logic LSI22903 PCI to Dual Channel Ultra160 SCSI Low Profile Host Adapter. It contains a complete functional description for the LSI22903 and includes complete physical and electrical specifications for the LSI22903.

Audience

This document assumes that you have some familiarity with SCSI protocol and related support devices and will benefit persons installing and using the LSI22903.

Organization

This document has the following chapters and appendix:

- Chapter 1, **Using the LSI22903**, defines the interfaces and characteristics of the LSI22903.
- Chapter 2, **Installing the LSI22903**, provides both quick and detailed installation instructions.
- Chapter 3, **Technical Specifications**, describes the physical and operational environments of the LSI22903.
- 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 10, LSI Logic Corporation, Order Number S14007.A

LSI53C1010-66 PCI to Dual Channel Ultra3 SCSI Multifunction Controller Technical Manual, Version 1.0, Order Number S14049

Revision Record

Revision	Date	Remarks
1.0	7/00	Final version.
1.1	11/00	All product names changed from SYM to LSI.

Contents

Tables

Chapter 1
Using the LSI22903

This chapter describes the LSI22903 PCI to Dual Channel Ultra160 SCSI Low Profile PCI Host Adapter interface to PCI computer systems and includes these topics:

1.1 General Description

The LSI Logic LSI22903 provides two SCSI-3, Ultra160 SCSI interfaces 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 LSI22903 provides two independent Ultra160 SCSI channels. The external channel on the LSI22903 supports Low Voltage Differential (LVD) and Single-Ended (SE) SCSI, while the internal channel supports LVD SCSI only. The LSI22903 is a SCSI solution for an 1U and 2U size server. This board supports fast/Ultra/Ultra2 SCSI devices as well as the newest Ultra160 SCSI devices on the appropriate connections.

The 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 Kbytes Flash device. The on-board

controller for the LSI22903 is the LSI53C1010 PCI to Dual Channel Ultra3 SCSI Multifunction Controller chip.

In addition to this guide there are two other references that you will find useful. The *PCI Storage Device Management System SDMS 4.0 User's Guide* contains product information and installation instructions. The *LSI53C1010-66 PCI to Dual Channel Ultra3 SCSI Multifunction Controller Technical Manual* contains complete hardware documentation for the on-board controller. Using both these documents will help you gain the full benefits of the LSI22903.

1.2 Features

This section provides an overview of the PCI Interface, the SCSI Interface, and Board Characteristics for the LSI22903.

1.2.1 PCI Interface

The PCI interface operates as a 32-bit or 64-bit DMA bus master, where the connection is made through the J1 edge connector.

Important: The PCI portion of the LSI22903 must receive its power from the host system PCI +3.3 V power rail. This implementation is PCI 2.2 compliant.

The PCI interface includes these features:

- Complies with PCI 2.2 specification
- Supports a 64-bit/66 MHz PCI interface for 528 Mbytes/s bandwidth that:
  - Supports 64-bit DMA bus mastership with 64-bit addressing
  - Operates at 66 MHz
  - Supports dual address cycle generation for all SCRIPTS™ instructions
  - Presents a single electrical load to the PCI Bus (True PCI Multifunction Device)
- Bursts 4/8, 8/16, 16/32, 32/64, or 64/128 Qword/Dword transfers across the PCI bus

- Supports 32-bit or 64-bit word data bursts with variable burst lengths
- Bursts up to 528 Mbytes/s (@ 66 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
- Bursts SCRIPTS opcode fetches across the PCI bus
- Supports universal 3.3 V and 5 V PCI bus voltage
- Complies with PCI Bus Power Management Specification Rev 1.1
- Complies with PC99

1.2.2 SCSI Interface

The SCSI interface is made through connector J2 for Channel A and J4 for Channel B. Connector J2 is a 68-pin VHDCI right angle receptacle that protrudes through the Low Profile PCI or Standard ISA/EISA bracket. Connector J4 is a 68-pin high density receptacle, either right angle nonlatching or vertical without latches, for internal SCSI connection. See Figure 2.1 for the location of these connectors.

The SCSI interface includes these features:

- Provides two independent wide Ultra160 SCSI channels
- Provides two connectors:
  68-pin VHDCI for the external Channel A (LVD/SE)
  68-pin high density for the internal Channel B (LVD)
- Supports SE and LVD signaling: 16-bit SE or LVD interfaces
- Supports LVD/SE termination for external Channel A and LVD termination for internal Channel B
- Supports fast, Ultra, Ultra2, and Ultra160 data transfer capability
  - Ultra160 SCSI LVD synchronous transfers at up to 160 Mbytes/s
- Supports three termination control options:
  - Keep termination always on
  - Use a manual shunt on each channel to disable termination

  - Provide software control using GPIO3 and/or manual shunt 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 storage for each channel
- Includes 8 Kbytes internal RAM for SCRIPTS instruction storage for each channel
- Provides a SCSI activity LED connector (J3) for both channels

1.2.3 Board Characteristics

This board provides a low cost Low Profile PCI (LPPCI) solution for computer manufacturers that require BIOS support for their add-in SCSI host adapters. The board characteristics are:

- PCI board dimensions
  Approximately 6.60 x 2.53 inches
- Universal 64-bit PCI card edge connector
- Low Profile PCI and Standard ISA/EISA bracket

1.2.4 SCSI Activity LED Interface

The LSI22903 LED interface is a four-wire arrangement that allows the user to connect an LED harness to the board. The GPIO0_FETCH line for each channel is driven low to complete the circuit when a harness with an LED is attached. The connector on the LSI22903 is J3 for both channels. See Table 3.5 on page 3-8 for the signal name and pin numbers for this LED interface.

1.3 Ultra160 SCSI Benefits

Ultra160 SCSI delivers data up to two times faster than Ultra2 SCSI. 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 LSI53C1010 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.

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

1.3.1 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.

1.3.2 Asynchronous Information Protection (AIP)

AIP is also supported by the LSI53C1010, protecting 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 LSI53C1010. Fully integrated in the SDMS software solution, SURElink software provides Domain Validation at boot time, as well as throughout system operation. SURElink software extends to the Desktop Management Interface (DMI) based System Management components of SDMS software, providing the network administrator remote management capability.

SURElink software Domain Validation provides three levels of integrity checking: Basic (level 1), Enhanced (level 2), and Margined (level 3). The basic check consists of an inquiry command to detect gross problems. The enhanced check sends a known data pattern using the read and write buffer commands to detect additional problems. Margined check verifies that the physical parameters have some degree of margin. By varying LVD drive strength and REQ/ACK timing characteristics, level 3 verifies that no errors occur on the transfers. These altered signals are only used during the diagnostic check and not during normal system operation. Should errors occur with any of these checks, the system can drop back to a lower transmission speed, on a per-target basis, to ensure robust system operation.

1.5 LVD Link™ Benefits

The LSI22903 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. LVD provides the reliability of HVD SCSI without the added cost of external differential transceivers. Ultra160 SCSI with LVD allows a longer SCSI cable and more devices on the bus, with the same cables defined in the SCSI-3 Parallel Interface standard for Fast-20 (Ultra SCSI). LVD provides a long-term migration path to even faster SCSI transfer rates without compromising signal integrity, cable length, or connectivity.

The LVD Link transceivers reduce the power needed to drive the SCSI bus, so that the I/O drivers can be integrated directly into the chip. LVD Link technology lowers the amplitude of noise reflections and allows higher transmission frequencies.

The LVD Link transceivers operate in LVD and SE mode. They also allow the chip to detect a High Voltage Differential (HVD) signal when the chip is mistakenly connected to external HVD transceivers. When connected, the LSI53C1010 chip automatically detects signal type, based on the voltage detected. It automatically switches to the SE or LVD mode, as appropriate.

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

1.6 TolerANT® Technology Benefits

The LSI22903 features TolerANT technology, which includes active negation on the SCSI drivers and input signal filtering on the SCSI receivers. Active negation causes the SCSI Request, Acknowledge, Data, and Parity signals to be actively driven HIGH rather than passively pulled up by terminators. Active negation is enabled by setting bit 7 in the SCSI Test Three (STEST3) register. Refer to the *LSI53C1010 PCI to Dual Channel Ultra3 SCSI Multifunction Controller Technical Manual* for specific register information.

TolerANT receiver technology improves data integrity in unreliable cabling environments, where other devices would be subject to data corruption. TolerANT receivers filter the SCSI bus signals to eliminate unwanted transitions, without the long signal delay associated with RC-type input filters. This improved driver and receiver technology helps eliminate double clocking of data, the single biggest reliability issue with SCSI operations. TolerANT input signal filtering is a built-in feature of this and all LSI Logic SCSI devices.

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 LVD Link transceivers, TolerANT technology provides excellent signal quality and data reliability in real world cabling environments. TolerANT technology is compatible with both the Alternative One and Alternative Two termination schemes proposed by the American National Standards Institute.

Chapter 2
Installing the LSI22903

This chapter provides instructions on how to install the LSI22903 and includes these topics:

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 a more detailed guidance for installing the LSI22903, 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 LSI22903 from its packing and examine it for any damage.

An example of this host adapter board is shown in Figure 2.1. A more detailed drawing is located in Figure 3.1.

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.

A 32-bit slot may be used, but full performance requires a 64-bit slot. Refer to the user's manual supplied with your computer to confirm the location of the PCI slots. The LSI22903 requires a PCI slot that allows bus master operation. See Figure 2.2.

Step 6. Remove the blank bracket panel on the back of the computer aligned with the PCI slot you intend to use.

Save the bracket screw for securing the installed board.

Step 7. 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.

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 orientation is correct. The board is keyed and will only go in one way.

Step 8. Secure the bracket with the bracket screw before making the internal and external SCSI bus connections.

Step 9. If you are connecting any internal SCSI devices, plug a 68-pin connector on the *end* of the internal SCSI ribbon cable into connector J4 (see Figure 2.1).

Be sure you match pin 1 on both connectors.

Step 10. Chain the internal SCSI devices on this cable.

Step 11. Connect the LED cable if desired.

This is designed to drive an off-board system LED and indicates activity on the SCSI bus. The off-board LED will operate at the same time as the on-board SCSI Activity LED.

Step 12. Replace the cabinet cover as described in the user's manual for your computer.

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.

Step 15. Verify that the SCSI bus is properly terminated and there are no duplicate SCSI IDs.

2.2 Detailed Installation Procedure

This section provides step-by-step instructions for installing the LSI22903, 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." If you are not confident that you can perform the tasks as described here, LSI Logic suggests getting assistance.

2.2.1 Before You Start

Before starting, look through the following task list to get an overall idea of the steps to perform.

- Selecting a PCI slot.
  - Includes opening your PC cabinet.
- Inserting the host adapter.
- Connecting SCSI peripherals.
- Terminating the SCSI bus.
- Setting SCSI IDs.
- Setting Interrupts.
- Completing the Installation, which includes:
  - Closing your PC cabinet.
  - Making any configuration changes (covered in the *PCI Storage Device Management System SDMS 4.0 User's Guide*).
  - Installing software.

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 they are referred to as a SCSI bus.

Each SCSI host adapter that you install can act as host for up to 15 peripheral devices (depending on the SCSI bus speed), 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 LSI22903 from its packing and verify it is not damaged.

An example of this host adapter board is shown in Figure 2.1. A more detailed drawing is located in Figure 3.1.

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.

A 32-bit slot may be used, but full performance requires a 64-bit slot. Refer to the user's manual supplied with your computer to confirm the location of the PCI slots. Also, the LSI22903 requires a PCI slot that allows bus master operation. 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 LSI22903 in your PC mainboard.

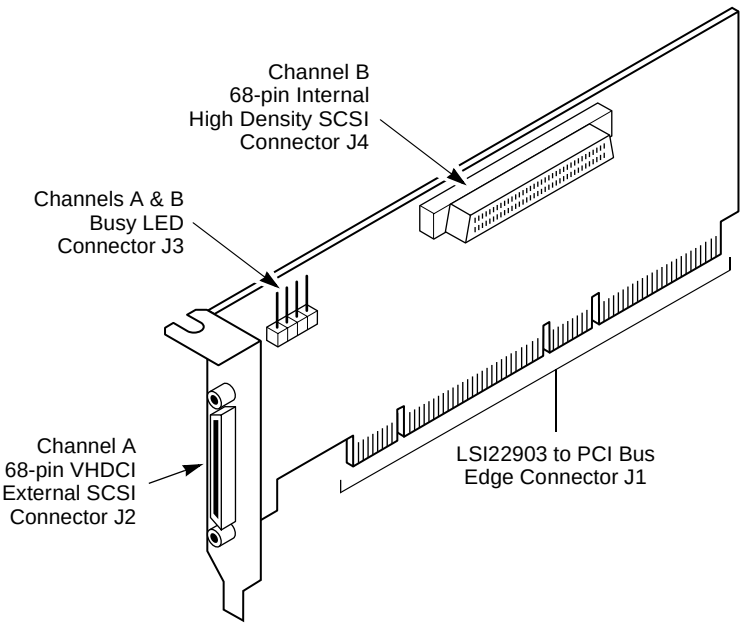
Step 1. Remove the blank bracket panel on the back of the computer aligned with the PCI slot you intend to use.

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. See Figures 2.1 and 2.2.

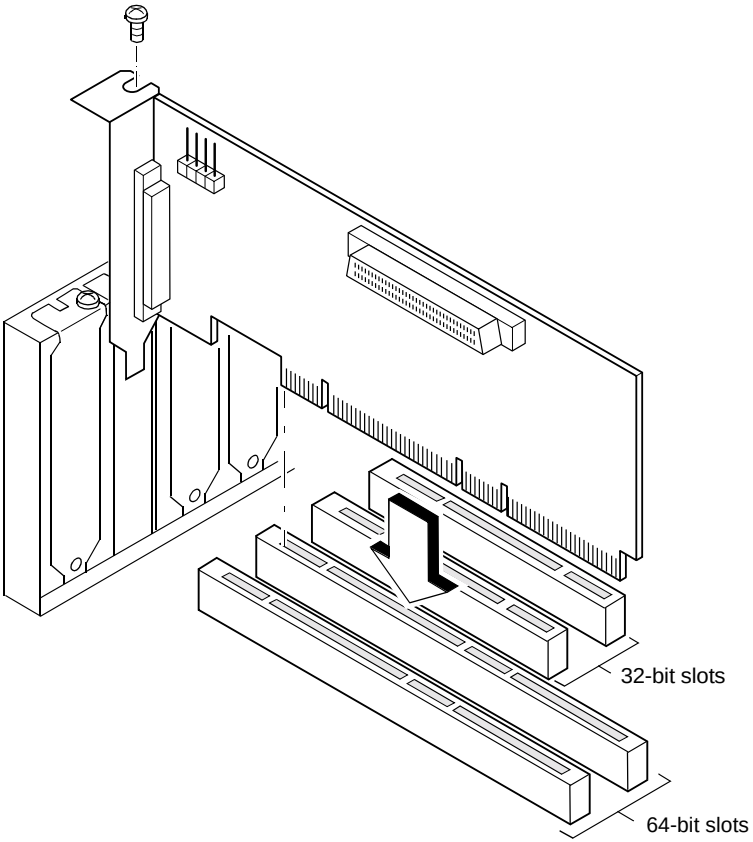
Figure 2.1 Hardware Connections for the LSI22903



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 (see Figure 2.2) before making the internal and external SCSI bus connections.

Figure 2.2 Inserting the Host Adapter

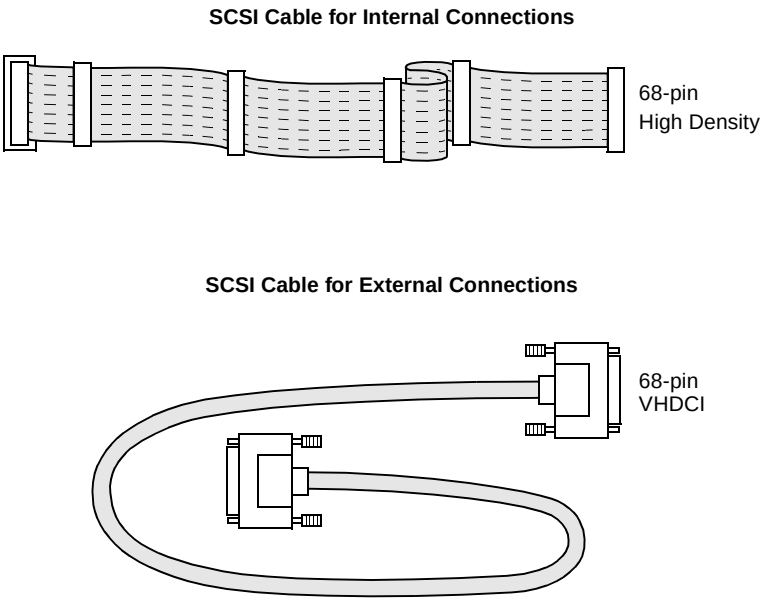


2.2.4 Connecting SCSI Peripherals

All internal SCSI bus connections to the LSI22903 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.

All external SCSI bus connections to the LSI22903 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. Some internal cables come with an LVD/SE emulator on one end. This end should be furthest from the host adapter.

Figure 2.3 SCSI Cables

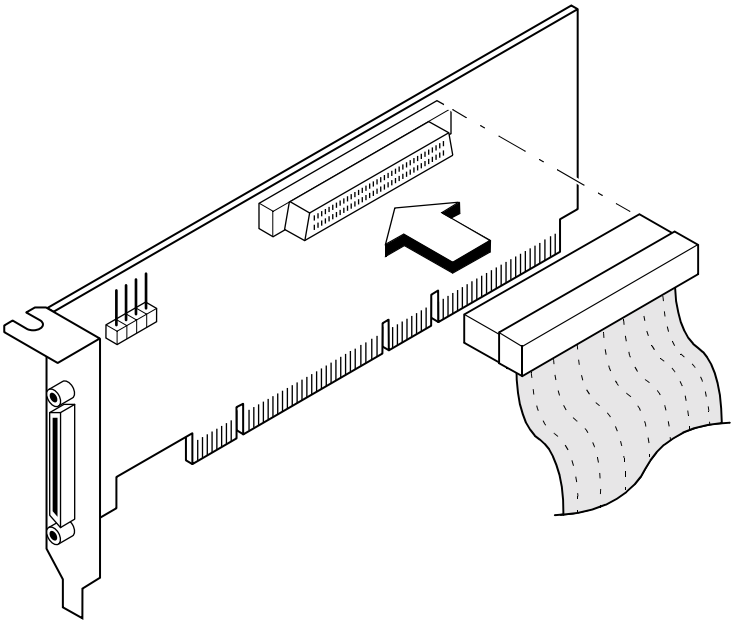


2.2.4.1 Making Internal SCSI Bus Connections

This section provides step-by-step instructions for making internal SCSI bus connections. If you only have external connections, skip to Section 2.2.4.2, “Making External SCSI Bus Connections.”

Step 1. Plug a 68-pin connector on the *end* of the internal SCSI ribbon cable into connector J4. See the example in Figure 2.4.

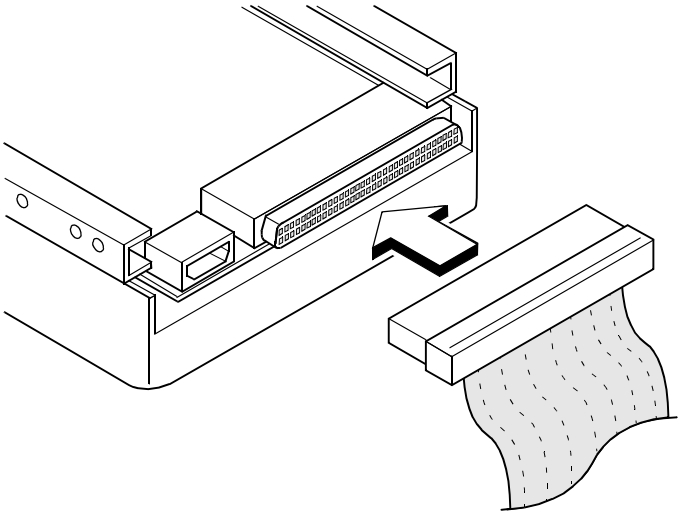
Figure 2.4 Internal SCSI Ribbon Cable to Host Adapter



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 cable adjacent to pin 1 is colored. An example of this connection appears in Figure 2.5.

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. See the example in Figure 2.6.

An example of multiple internal SCSI devices chained together is shown in Figure 2.7. Make sure to match pin 1 on all connections.

Figure 2.6 Connecting Additional Internal SCSI Devices

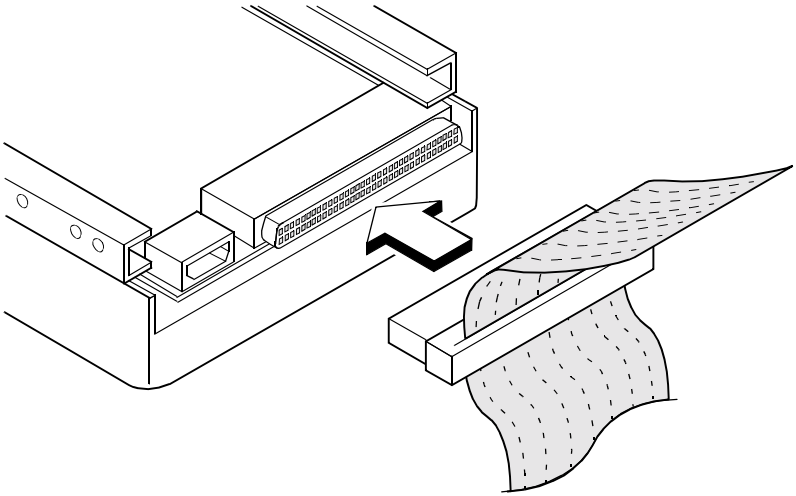
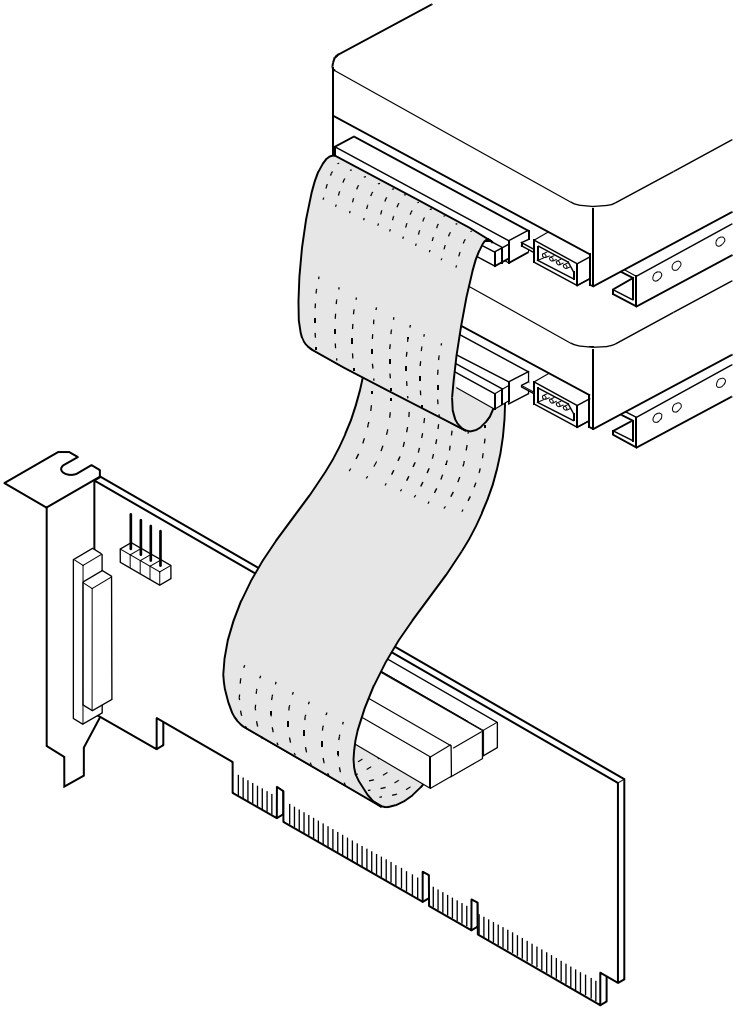


Figure 2.7 Multiple Internal SCSI Devices Chained Together



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.

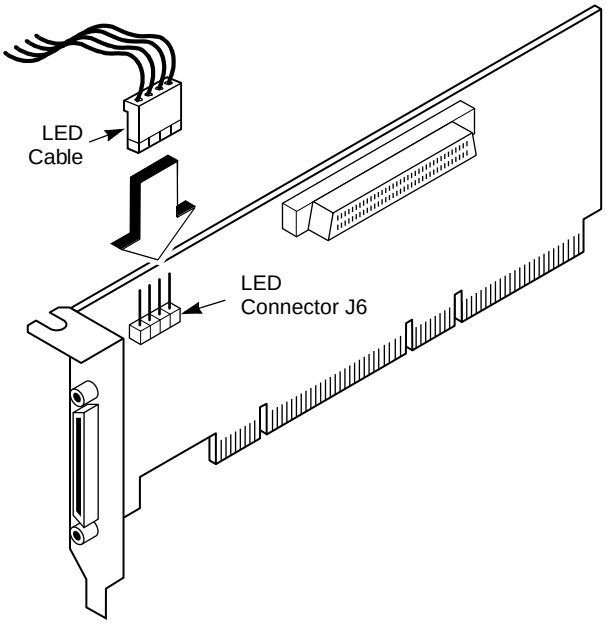
Step 4. Connect the LED cable to J3 on your SCSI host adapter, as shown in Figure 2.8.

The Busy LED connector J3 is not keyed. The J3 connector is a 4-pin one row right angle header for both Channel A and Channel B. 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 will indicate activity on the SCSI bus. There is also an LED on the LSI22903 that indicates activity on the SCSI bus.

See Table 3.5 on page 3-8 for connector pinout information.

Figure 2.8 SCSI LED Connector



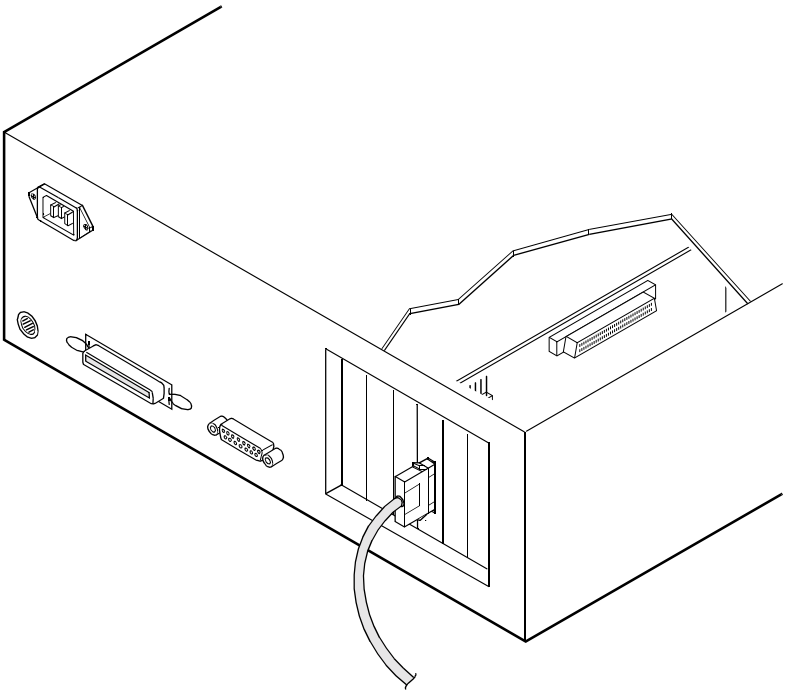
2.2.4.2 Making External SCSI Bus Connections

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 shows where this connection is made.

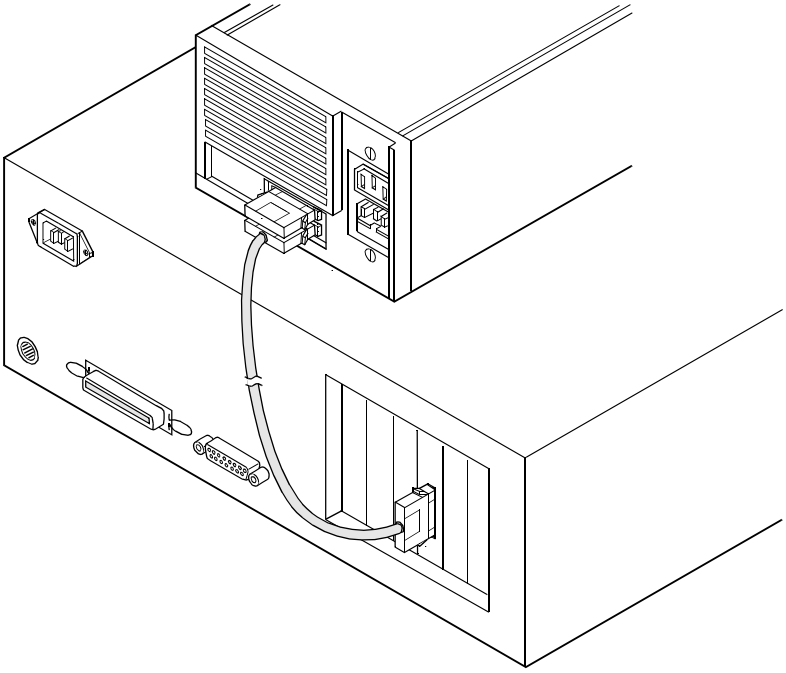
Figure 2.9 External Cable to Host Adapter



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.

An example of this connection is shown in Figure 2.10.

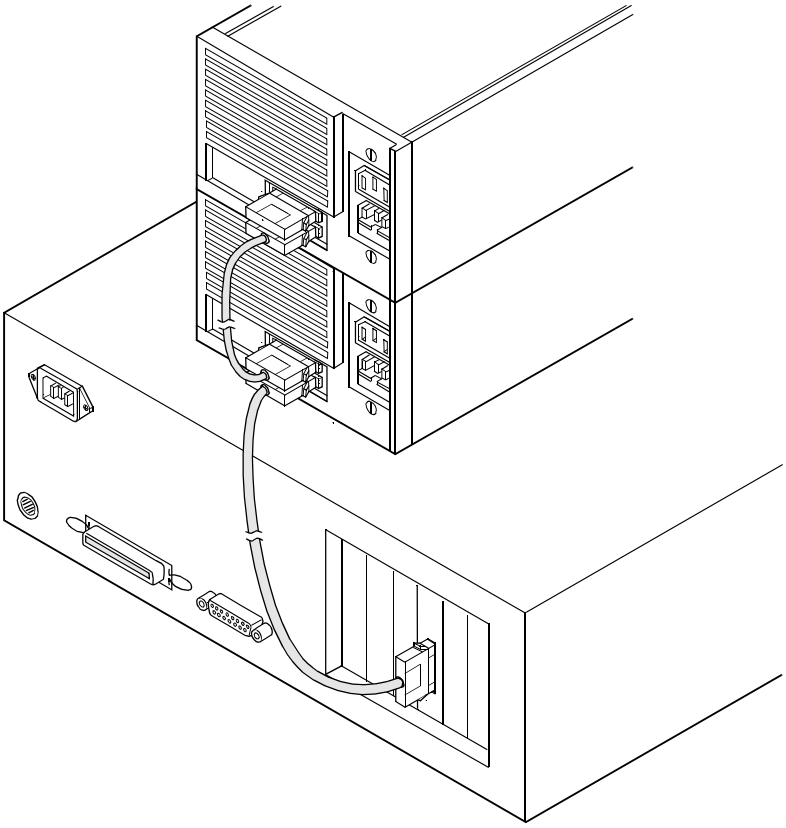
Figure 2.10 External Cable to External SCSI Device



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

See the example in Figure 2.11.

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 three build options, each allowing a different termination mode. The three options are:

- Termination is always on.
- Termination can be disabled by placing a manual shunt over both posts on each channel. When the shunt is off, the terminator is active. When the shunt is on both posts, the terminator for that channel is disabled.
- Termination can be enabled or disabled for a specific channel using software control with GPIO3 and/or the manual shunt method.

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 LSI22903 automatically controls SCSI bus termination for two different bus configurations, depending on the use of the SCSI channel (see Figure 2.1). The two bus configurations are:

- Termination on
- Termination off

You can disable termination in two ways:

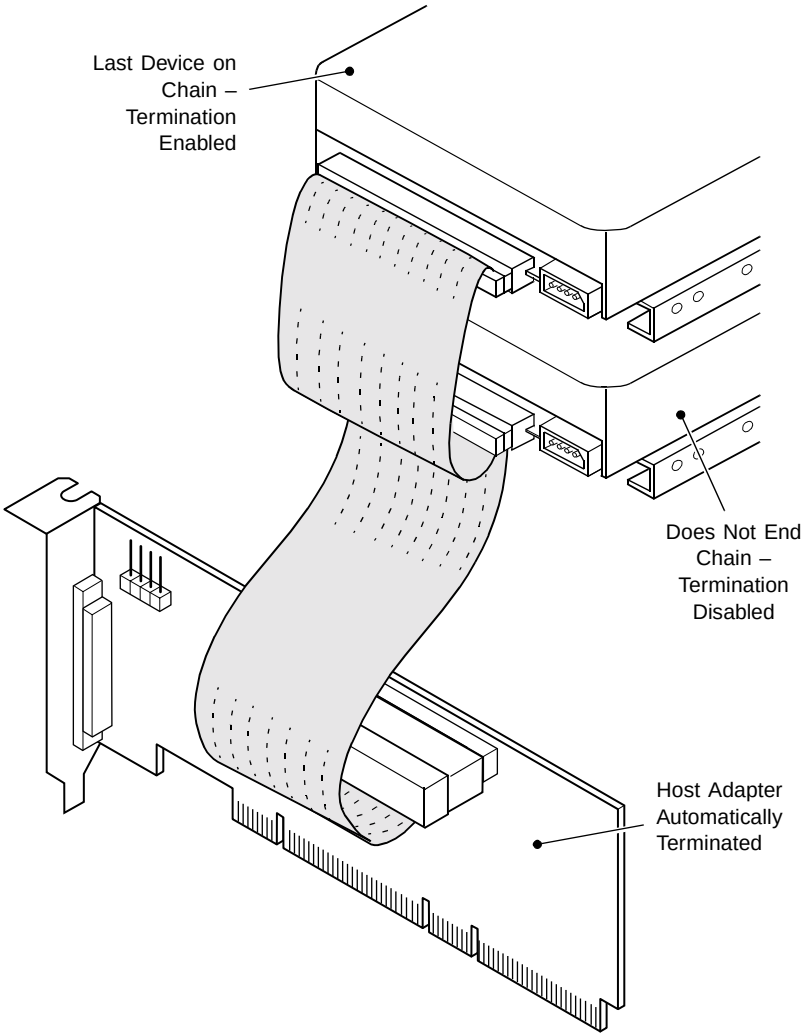
- Use BIOS software control, where the BIOS termination option is changed from Automatic to Off.
- Manually place Channel A shunt DIS_A and Channel B shunt DIS_B on both posts of their respective jumpers.

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.

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

Figure 2.12 Internal SCSI Device Termination

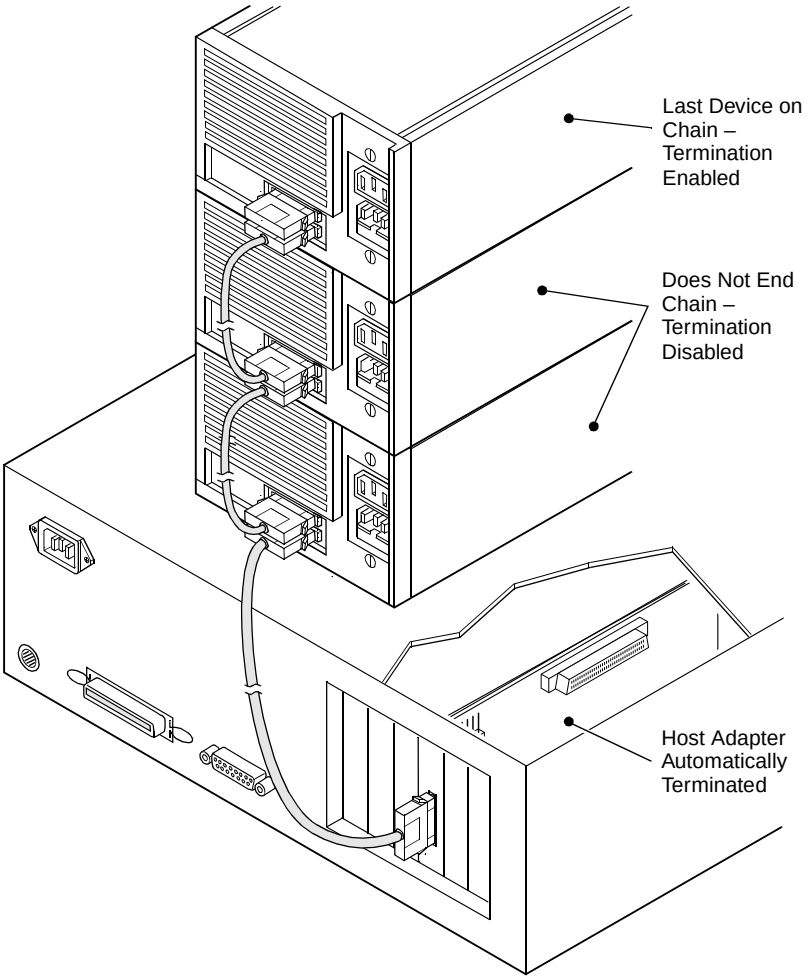


2.2.5.2 External SCSI Terminations

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.

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

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 LSI Logic 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 is provided as a place to keep this record.

Table 2.1 SCSI ID Record

SCSI ID	SCSI Device Channel A	SCSI Device Channel B
15		
14		
13		
12		
11		
10		
9		
8		
7	LSI22903 (default)	LSI22903 (default)
6		
5		
4		
3		
2		
1		
0		

2.2.7 Setting Interrupts

Normally, you do not change the default interrupt routing for the LSI22903, since performance is usually increased by having two separate interrupts. However, if your system does not support two separate interrupts, the INTA/INTB jumper (see Figure 3.1 on page 3-2) is provided to change the interrupt routing. Table 2.2 explains the jumper settings.

Table 2.2 Setting Interrupts

Jumper Setting	Condition
Jumper Out (default) 	SCSI Channel B is routed to INTB[1] on the PCI bus.
Jumper In 	SCSI Channel B is rerouted at power up to INTA[1] on the PCI bus.

1. Active LOW signal.

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. To change the configuration of your host adapter, refer to the *PCI Storage Device Management System SDMS 4.0 User's Guide*.

Step 5. 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.

Chapter 3
Technical Specifications

This chapter discusses the physical environment associated with the LSI22903. It includes a mechanical drawing of this board, which is shown in Figure 3.1. It includes these topics:

3.1 Physical Environment

This section discusses the physical, electrical, thermal, and safety characteristics of the LSI22903. Additionally, this board is compliant with electromagnetic standards set by the FCC.

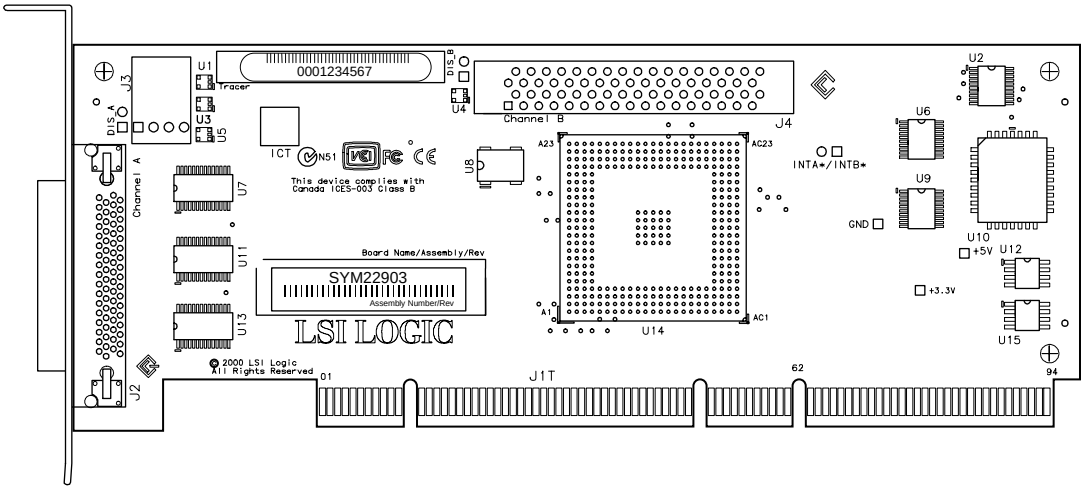
3.1.1 Physical Characteristics

The dimensions of the LSI22903 are approximately 6.60 x 2.53 inches. PCI connection is made through edge connector J1. The component height on the top and bottom of the LSI22903 follows the PCI Local Bus Specification, Revision 2.2 standard.

Internal 16-bit SCSI connection is made through the 68-pin high density connector J4 for Channel B. External SCSI connection is made through the 68-pin VHDCI connector J2 for Channel A.

The J2 connector extends through the LPPCI or ISA/EISA bracket, which is attached to the face of the connector outside of the cabinet where the LSI22903 is installed. The J3 connector is used to connect the Busy LED. It is a 4-pin one row right angle header for both Channel A and Channel B.

Figure 3.1 LSI22903 Mechanical Drawing



3.1.2 Electrical Characteristics

The LSI22903 maximum power requirements that include SCSI TERMPWR under normal operation are:

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 V DC	±5%	0.80 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 board is designed to operate in an environment, which is defined by the following parameters:

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

The board is designed for a storage and transit environment, which is defined by the following parameters:

- 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 United States, Canadian, European, Japanese, and Australian markets and 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 LSI22903 is designed for use in PCI computer systems with either a standard ISA/EISA or LPPCI 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 is provided to allow BIOS code and open boot code support through PCI and a serial EEPROM for each channel.

3.2.1 The PCI Interface

The PCI interface operates as a 32-bit or 64-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 LSI22903 uses 3.3 V pins to run the LSI53C1010 and some other parts. The LSI22903 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	Signal Name	Pin
–12 V	1	C_BE2[2]	33	RESERVED[2]	63
TCK	2	GND	34	GND	64
GND	3	IRDY[2]	35	C_BE6[2]	65
TDO	4	+3.3 V	36	C_BE4[2]	66
+5 V	5	DEVSEL[2]	37	GND	67
+5 V	6	GND[2]	38	AD63	68
INTB[2]	7	LOCK[2]	39	AD61	69
INTD[2]	8	PERR[2]	40	3 V/5 V	70
GND(PRSNT1[2])	9	+3.3 V	41	AD59	71
RESERVED	10	SERR[2]	42	AD57	72
GND(PRSNT2[2])	11	+3.3 V	43	GND	73
KEYWAY	12	C_BE1[2]	44	AD55	74
KEYWAY	13	AD14	45	AD53	75
RESERVED	14	GND	46	GND	76
GND	15	AD12	47	AD51	77
CLK	16	AD10	48	AD49	78
GND	17	M66EN	49	3 V/5 V	79
REQ[2]	18	KEYWAY	50	AD47	80
3 V/5 V	19	KEYWAY	51	AD45	81
AD31	20	AD08	52	GND	82
AD29	21	AD07	53	AD43	83
GND	22	+3.3 V	54	AD41	84
AD27	23	AD05	55	GND	85
AD25	24	AD03	56	AD39	86
+3.3 V	25	GND	57	AD37	87
C_BE3[2]	26	AD01	58	3 V/5 V	88
AD23	27	3 V/5 V	59	AD35	89
GND	28	ACK64[2]	60	AD33	90
AD21	29	+5 V	61	GND	91
AD19	30	+5 V	62	RESERVED	92
+3.3 V	31	KEYWAY	XX	RESERVED	93
AD17	32	KEYWAY	XX	GND	94

1. Shaded lines are not connected.
2. Active LOW signal.

Table 3.3 PCI Connector J1 (Back)[1]

Signal Name	Pin	Signal Name	Pin	Signal Name	Pin
TRST[2]	1	+3.3 V	33	GND	63
+12 V	2	FRAME[2]	34	C_BE7[2]	64
TMS	3	GND	35	C_BE5[2]	65
TDI	4	TRDY[2]	36	3 V/5 V	66
+5 V	5	GND	37	PAR64	67
INTA[2]	6	STOP[2]	38	AD62	68
INTC[2]	7	+3.3 V	39	GND	69
+5 V	8	SDONE	40	AD60	70
RESERVED	9	SBO[2]	41	AD58	71
3 V/5 V	10	GND	42	GND	72
RESERVED	11	PAR	43	AD56	73
KEYWAY	12	AD15	44	AD54	74
KEYWAY	13	+3.3 V	45	3 V/5 V	75
RESERVED	14	AD13	46	AD52	76
RST[2]	15	AD11	47	AD50	77
3 V/5 V	16	GND	48	GND	78
GNT[2]	17	AD09	49	AD48	79
GND	18	KEYWAY	50	AD46	80
RESERVED	19	KEYWAY	51	GND	81
AD30	20	C_BE0[2]	52	AD44	82
+3.3 V	21	+3.3 V	53	AD42	83
AD28	22	AD06	54	3 V/5 V	84
AD26	23	AD04	55	AD40	85
GND	24	GND	56	AD38	86
AD24	25	AD02	57	GND	87
IDSEL	26	AD00	58	AD36	88
+3.3 V	27	3 V/5 V	59	AD34	89
AD22	28	REQ64[2]	60	GND	90
AD20	29	+5 V	61	AD32	91
GND	30	+5 V	62	RESERVED	92
AD18	31	KEYWAY	XX	GND	93
AD16	32	KEYWAY	XX	RESERVED	94

1. Shaded lines are not connected.
2. Active LOW signal.

3.2.2 The SCSI Interface

The SCSI interface operates as two 16-bit, synchronous or asynchronous buses, and supports Ultra160 SCSI protocols and 16-bit arbitration. The interface is made through connector J2 for Channel A, which is LVD/SE. The interface is made through connector J4 for Channel B, which is LVD only.

The J2 connector is a 68-pin VHDCI right angle receptacle that protrudes through the Low Profile ISA/EISA bracket. The J4 connector is a 68-pin high-density vertical receptacle for internal SCSI connections.

LVD/SE SCSI termination is provided for the external connection, and LVD SCSI only termination is provided for the internal connection. SCSI TERMPWR is also supplied by the board. 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	GND	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

Table 3.4 SCSI Interface (Cont.)

Signal Name	Pin	Signal Name	Pin	Signal Name	Pin
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 LSI22903 LED interface is a four-wire arrangement that allows you to connect an LED harness to the board. The GPIO0_FETCH line for each channel 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 connector on the LSI22903 is J3 for both channels. 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
B_LED–	3
B_LED+	4

3.3 Subsystem ID and Subsystem Vendor ID

The Subsystem ID and System Vendor ID for the LSI22903 are provided in Table 3.6. The ID numbers are contained in the LSI22903 EEPROM. During system initialization, the IDs are loaded into the Subsystem Vendor ID and Subsystem ID registers in the on-board controller chip, the LSI53C1010. For more information on the operation of these registers, refer to the *LSI53C1010-66 PCI to Dual Channel Ultra3 SCSI Multifunction Controller Technical Manual*.

Table 3.6 Subsystem ID and Subsystem Vendor ID

Subsystem	ID
Subsystem Vendor ID	1000
Subsystem ID	1030

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.
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 the 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.

DMA Direct Memory Access.

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.

DT Clocking In Double Transition (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 Electronically 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.
LVD Link	Low Voltage Differential Link allows greater Ultra2 SCSI device connectability and longer SCSI cables. LVD Link lowers the amplitude of noise reflections and allows higher transmission frequencies. Detailed information may be found in Section 1.5, "LVD Link™ Benefits," page 1-6.
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 (Electronically 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 current 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.

Index

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