USER'S GUIDE

LSI22915A
PCI to Dual Channel Ultra160 SCSI Host Adapter

Version 1.2

April 2001

LSI LOGIC®

S14068

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 LSI22915A 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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This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

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Document DB15-000155-02, Third Edition (April 2001).
This document describes the LSI Logic Corporation LSI22915A PCI to Dual Channel Ultra160 SCSI Host Adapter and will remain the official reference source for all revisions/releases of this product until rescinded by an update.

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 LSI22915A. It contains a complete functional description for the LSI22915A 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 LSI22915A.

Organization

This document has the following chapters and appendix:

- Chapter 1, **Describing the LSI22915A**, defines the interfaces and characteristics of the LSI22915A.
- Chapter 2, **Installing the LSI22915A**, provides both quick and detailed installation instructions.
- Chapter 3, **Technical Specifications**, describes the physical and operational environments of the LSI22915A.
- 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, LSI Logic Corporation, Order Number S14007.B

LSI53C1010-66 PCI to Dual Channel Ultra160 SCSI Multifunction Controller Technical Manual, Version 2.1, LSI Logic Corporation, Order Number S14049

Revision Record

Revision	Date	Remarks
1.0	6/00	Final version.
1.1	10/00	All product names changed from SYM to LSI.
1.2	4/01	Updated to reflect new mechanical drawing, name change, and features.

Contents

Tables

Chapter 1
Describing the LSI22915A

This chapter describes the LSI22915A PCI to Dual Channel Ultra160 SCSI Host Adapter interface to PCI computer systems and includes these topics:

1.1 Introduction

The LSI22915A provides two Ultra160 SCSI interfaces to the PCI system in your computer. It is tailored to systems which require on-board BIOS support. Installing this adapter in your PCI system allows connection of up to 30 SCSI devices.

The LSI22915A provides a 16-bit Low Voltage Differential (LVD) and Single-Ended (SE) SCSI solution for your computer. This board also supports legacy Fast, Ultra, and Ultra2 SCSI devices.

The LSI22915A acts on your computer’s behalf as the controller of 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 controller for up to 30 peripheral devices (depending on the SCSI bus speed), not including the adapter itself.

Storage Device Management System (SDMS™) software operates the board. However, the design of the board does not preclude use of other SCSI software. BIOS support for this host adapter is incorporated on the board in a 128 Kbyte Flash EEPROM device.

This guide, along with the *PCI Storage Device Management System SDMS 4.0 User's Guide,* contains product information and installation instructions to help you gain the full benefits of the LSI22915A.

1.2 Features

This section provides a high level overview of the PCI interface, the SCSI interface, and board characteristics for the LSI22915A.

1.2.1 PCI Interface

The PCI interface connection is made through edge connector J1. Refer to Figure 2.1 on how to make this connection. The PCI interface includes these features:

- Full 64-bit (66 MHz) DMA bus master
- Zero wait-state bus master data bursts
- PCI Universal 3.3 V/5 V bus support
- Compliance with PC 99 Specification
- Compliance with *PCI Local Bus Specification, Revision 2.2*

1.2.2 SCSI Interface

The SCSI interfaces on the LSI22915A operate as two 16-bit, synchronous or asynchronous, SE or LVD, and support Ultra160 SCSI protocols and 16-bit arbitration. The interface is made through connectors J1 and J3 for Channel A and J7 and J4 for Channel B. The SCSI interface includes these features:

- Two separate SCSI channels
- 16-bit SE/LVD
- Automatically enabled termination
- Fast, Ultra, Ultra2, and Ultra160 data transfer capability

- SCSI termination power (TERMPWR) source with autoresetting circuit breaker and TERMPWR shorted LED for each channel
- SCSI Plug and Play
- SCSI Configured AutoMatically (SCAM)
- Flash EEPROM for BIOS storage
- Serial NonVolatile Random Access Memory (NVRAM) on each channel for user configuration utility and SCAM information storage
- SCSI activity LED for each channel

1.2.3 Board Characteristics

The board characteristics of the LSI22915A are:

- PCI board dimensions:

  4.2 by 8.4 inches (106.68 mm by 213.36 mm)
- Universal 64-bit PCI card edge connector
- Four SCSI connectors:
  - Two 68-pin Very High Density Cable Interconnect (VHDCI), one for each external channel
  - Two 68-pin high density (HD), one for each internal channel
- ISA/EISA bracket

1.2.4 SCSI Activity LED Interface

The LSI22915A LED interface is a four-wire arrangement that allows you to connect an LED harness to the board. The connector on the LSI22915A is HDR2 for both channels. See Table 3.5 for the signal name and pin numbers for this LED interface.

Four individual LEDs per channel are on the LSI22915A so you can decode the operating state of the board. The four activity LEDs are:

- SCSI Activity – Green LED, left edge of board
- TERMPWR SHORTED – Yellow LED, left edge of board
- LVD Mode – Green LED, left edge of board in LVD Mode
- TERMPWR GOOD – Green LED, left edge of board when TERMPWR is above +3 V

1.2.5 Ultra160 SCSI Benefits

Ultra160 SCSI is an extension of the SCSI Parallel Interface-3 (SPI-3) draft standard that allows faster synchronous SCSI data transfer rates than Ultra2 SCSI. When enabled, Ultra160 SCSI performs 80 mega transfers 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.

Important: To utilize Ultra160 SCSI performance, you must have only LVD devices on the bus. Do not mix any SE devices with LVD devices or the entire bus will drop to SE, limiting bus performance to Ultra SCSI levels.

1.2.6 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.

1.2.7 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.

1.2.8 Asynchronous Information Protection (AIP)

The LSI53C1010 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.

1.3 SureLINK™ Ultra160 SCSI Domain Validation Benefits

SureLINK Domain Validation 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 Domain Validation is the control for the manageability enhancements in the LSI53C1010 PCI to Dual Channel Ultra160 SCSI controller. Fully integrated in the SDMS software solution, SureLINK technology provides Domain Validation at boot time, as well as throughout system operation.

1.4 LVDlink™ Technology Benefits

The LSI22915A supports LVD, 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 an HVD device is detected, the board puts the SCSI bus in the high impedance state and shuts down.

1.5 TolerANT® Technology Benefits

The LSI53C1010 feature 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 noise immunity when the signal transitions to 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. This protects other devices on the bus 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 technology is compatible with both the Alternative One and Alternative Two termination schemes proposed by the American National Standards Institute.

Chapter 2
Installing the LSI22915A

This chapter provides instructions on how to install the LSI22915A and includes these topics:

2.1 Quick Installation Procedure

This section is provided for the experienced computer user with prior host adapter installation and SCSI bus setup experience. If you prefer more detailed guidance for installing the LSI22915A, please follow the instructions in 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.

Note: The use of a static ground strap is recommended.

Step 2. Remove the LSI22915A from the packing and check that it is not damaged.

Figure 2.1 shows an example of this host adapter board.

Step 3. Switch off and unplug your system.

Step 4. Open your PC cabinet.

Step 5. Locate the slots for installing a PCI plug-in board.

Step 6. Insert the LSI22915A board into the selected PCI slot.

Step 7. Connect the internal and external SCSI peripherals.

Step 8. Connect the LED cable to HDR2 on your SCSI host adapter, if you wish to connect the LED to the SCSI LED connector.

Step 9. Terminate the SCSI bus.

Step 10. Set the peripheral SCSI IDs.

The SCSI bus requires proper termination and no duplicate SCSI IDs.

Step 11. Make any configuration changes.

Step 12. Close your PC cabinet cover.

The host adapter installation is complete.

Step 13. 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 detailed instructions for installing the LSI22915A and connecting it to your SCSI peripherals. If after reviewing this procedure, you are not confident that you can perform the tasks as described here, LSI Logic suggests getting assistance.

2.2.1 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.

Note: 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 2. Remove the LSI22915A from the packing and check that it is not damaged.

Figure 3.1 provides an illustration of this host adapter.

Step 3. Switch off the computer and unplug power cords for all components in your system.

Step 4. Remove the cover from your computer per the instructions in the user's manual for your system to access the PCI slots.

Step 5. Locate the slots for PCI plug-in board installation.

Important: The LSI22915A requires a PCI slot that allows bus master operation. Refer to the user's manual for your computer to confirm the location of the PCI slots.

2.2.2 Inserting the Host Adapter

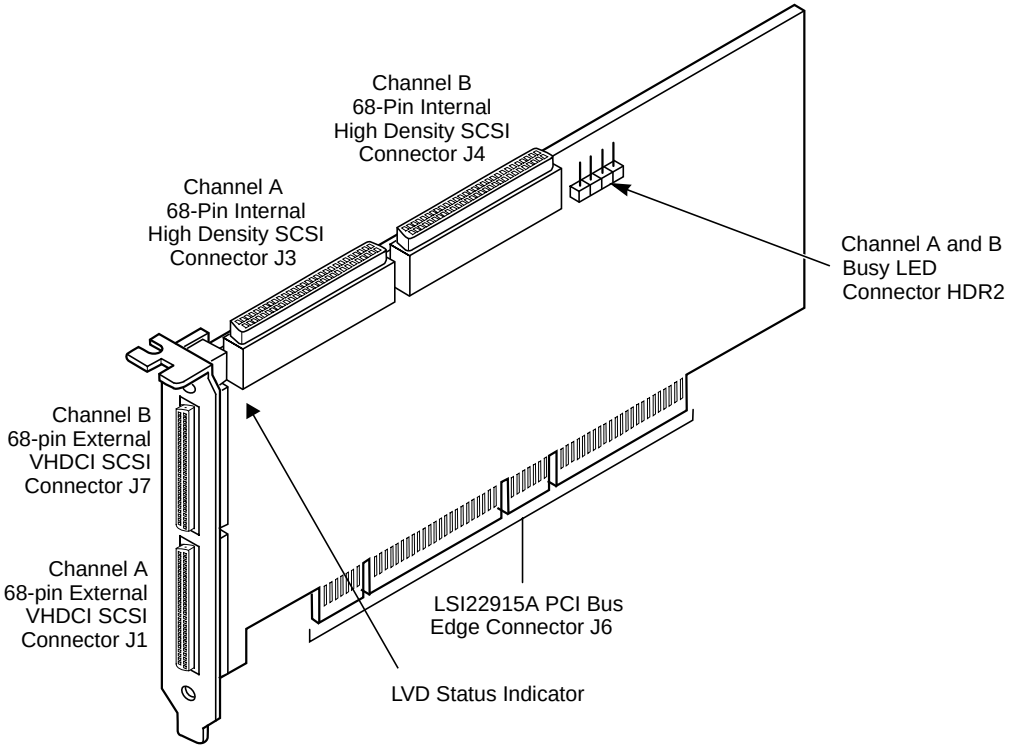
Step 1. Remove the blank bracket panel on the back of the computer aligned with the PCI slot you intend to use.

Save the bracket screw.

Step 2. Carefully insert edge connector J6 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 connectors J1 and J7 should fit where you removed the blank panel. Refer to Figures 2.1 and 2.2.

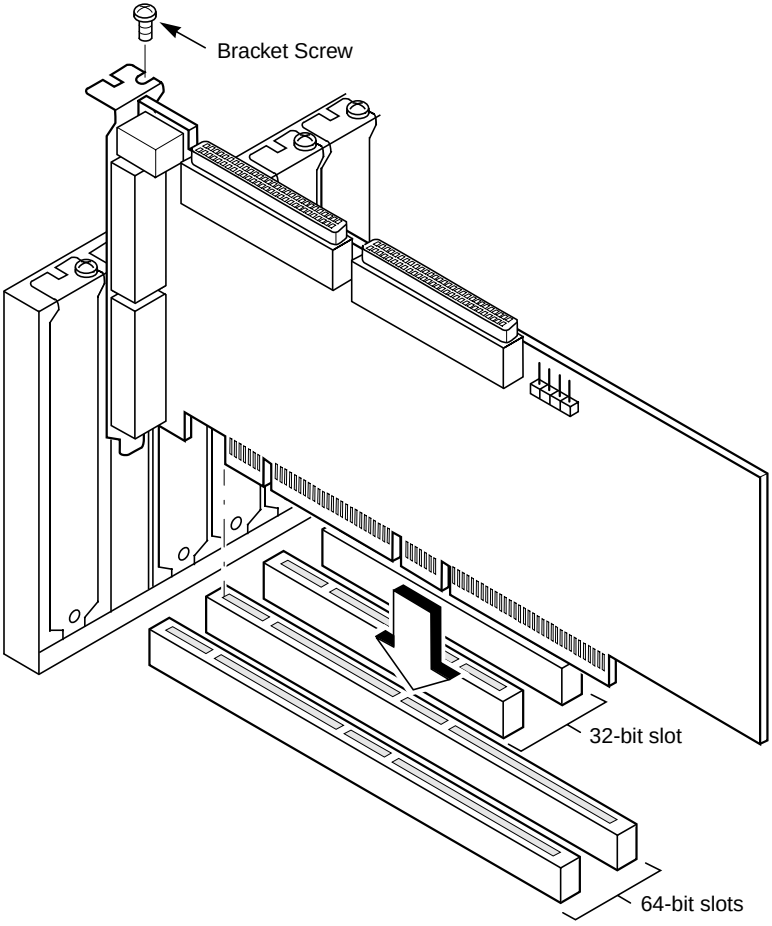
Figure 2.1 Hardware Connections for the LSI22915A



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 can only be inserted one way.

Step 3. Secure the board with the bracket screw before making the internal and external SCSI bus connections. Refer to Figure 2.2.

Figure 2.2 Inserting the Host Adapter

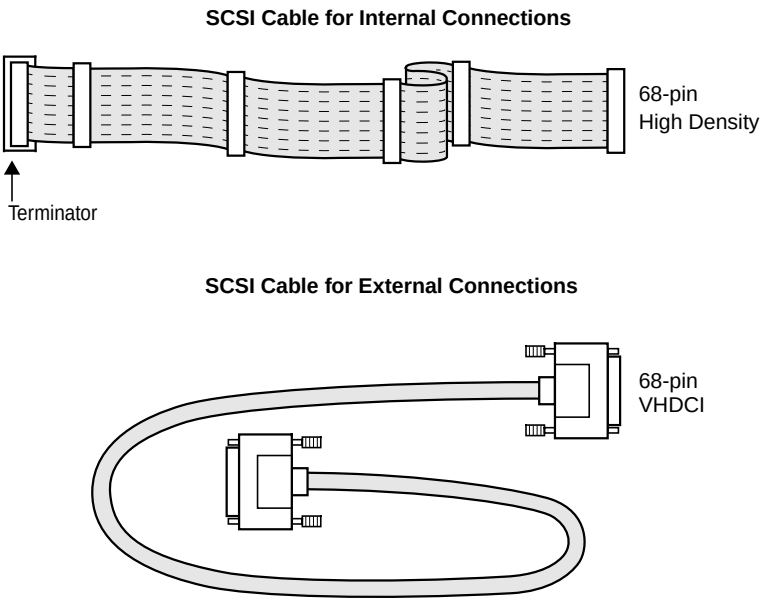


2.2.3 Connecting the SCSI Peripherals

All internal SCSI bus connections to the LSI22915A are made with an unshielded, 68-conductor ribbon cable. 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 a SE/LVD on one end. This end should be furthest from the host adapter.

All external SCSI bus connections to the LSI22915A are made with shielded, 68-conductor cables. The connectors on this cable are always keyed to ensure proper pin-1 connection. Figure 2.3 illustrates both types of SCSI cables.

Figure 2.3 SCSI Cables



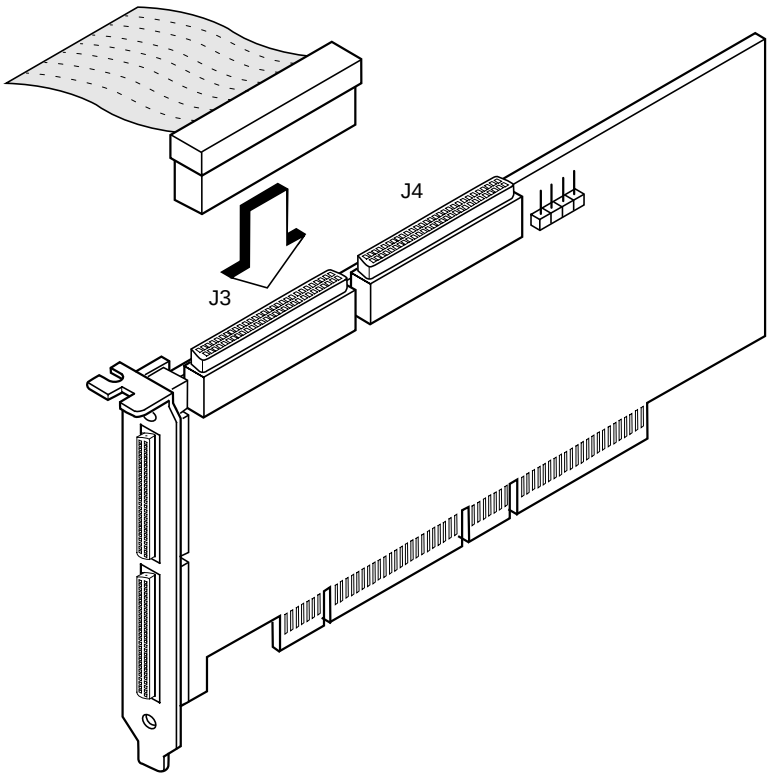
2.2.4 Making Internal SCSI Bus Connections

This section provides step-by-step instructions about making internal SCSI bus connections. If you only have external connections, skip to Section 2.2.5, “Making External SCSI Bus Connections,” page 2-12.

Step 1. Plug one end of the 68-pin internal SCSI ribbon cable into either connector J4 or J6. Figure 2.4 illustrates how to make this connection.

Important: You must match pin 1 on this and all subsequent connections.

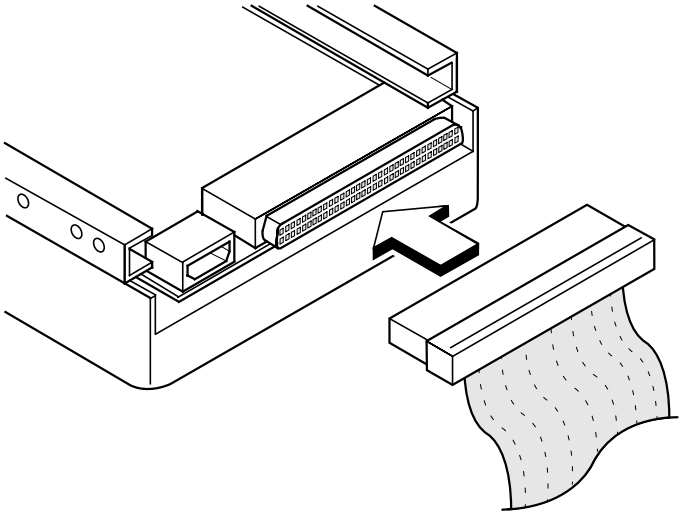
Figure 2.4 Internal SCSI Ribbon Cable to Host Adapter



Step 2. If you have only two internal devices to connect, plug the other end of the internal SCSI ribbon cable into the SCSI connector on your internal SCSI device. Figure 2.5 illustrates how to make this connection.

Note: For nonterminated internal SCSI devices, a terminated cable will be required. This connector must be on the *end* of the SCSI cable.

Figure 2.5 Connecting SCSI Ribbon Cable to Internal SCSI Device



If you have more than one internal device to connect, use an internal SCSI ribbon cable with the required number of connectors attached along its length and proceed to the next step. If you have only one internal device, proceed to page 2-11.

Step 3. Plug the cable into each additional device as illustrated in Figure 2.6.

Figure 2.7 shows an example of a chained connection. Make sure to match pin 1 on all connections.

Figure 2.6 Connecting Additional Internal SCSI Devices

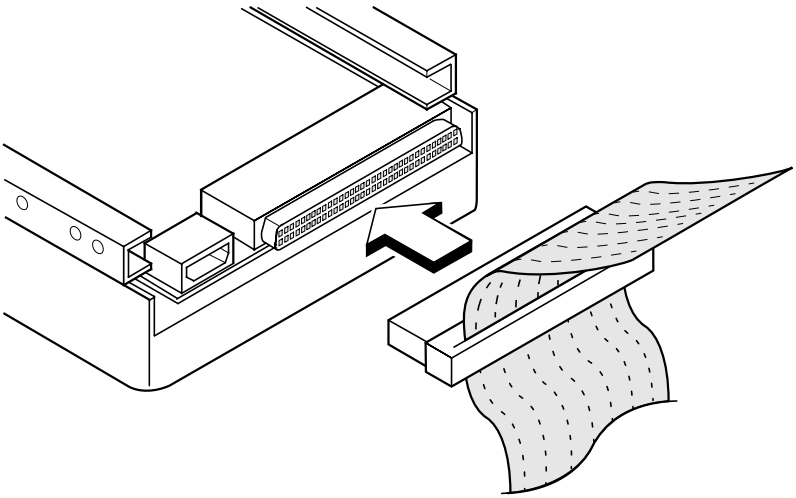
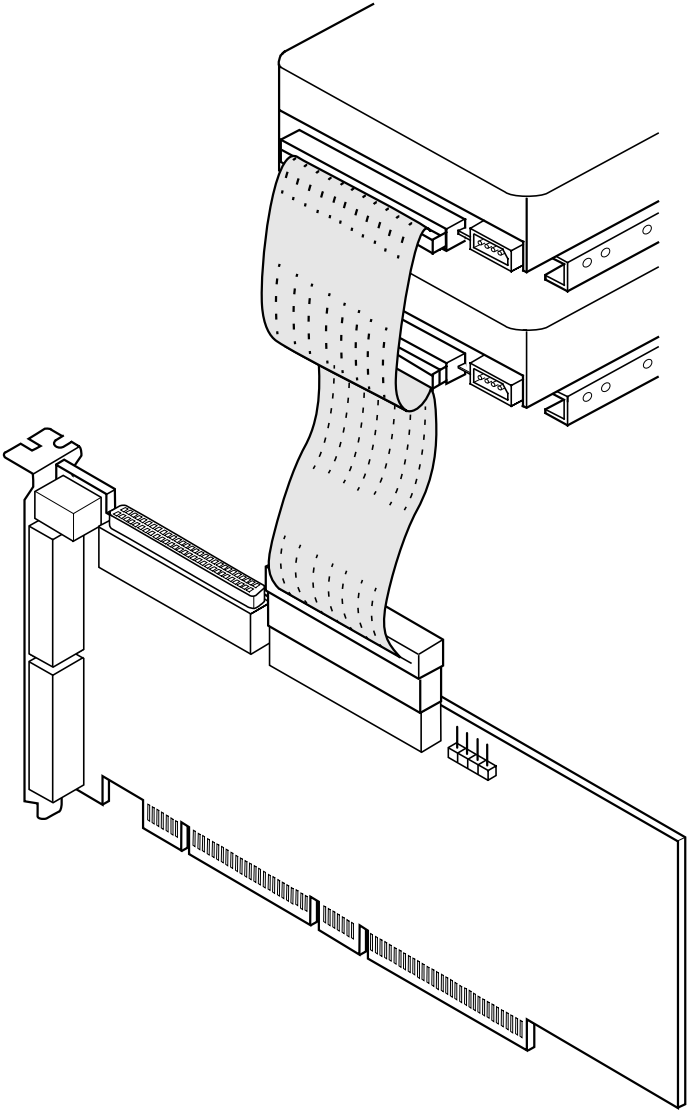


Figure 2.7 Multiple Internal SCSI Devices Chained Together



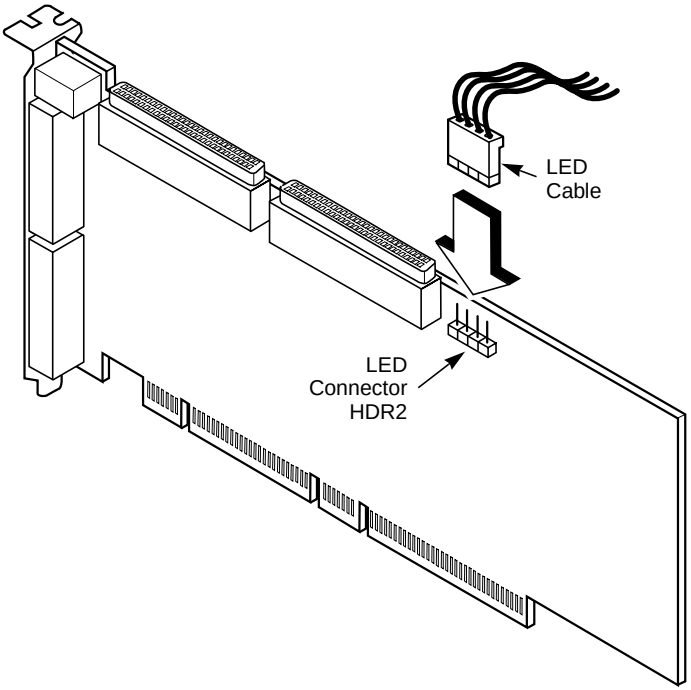
Most PC cabinets are designed with a front panel LED. If you wish to enable this feature, follow the next step.

Step 4. Connect the LED cable to connector J5 on the host adapter, as shown in Figure 2.8.

When properly connected, the front panel LED lights up when there is activity on the SCSI bus.

The LED Connector HDR2 is not keyed. The orientation of the LED cable should not matter as long as all four pins are connected. If the LED does not light during SCSI bus activity from this host adapter, you may have to rotate the LED cable connector 180° on HDR2. If your connector has only two wires, refer to Table 3.5 for connector pinout information.

Figure 2.8 SCSI LED Connector

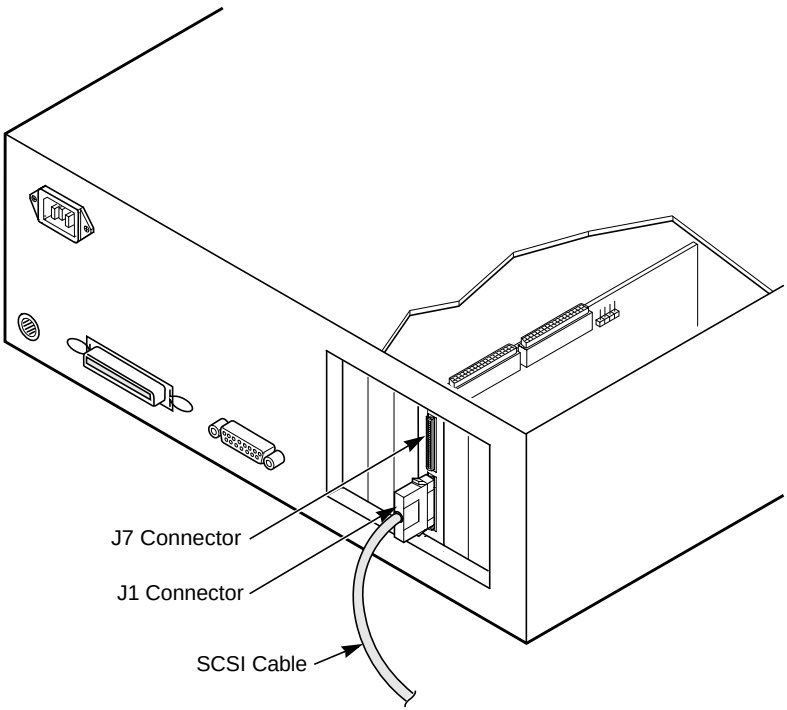


2.2.5 Making External SCSI Bus Connections

This section provides step-by-step instructions for making external SCSI bus connections. To connect external SCSI devices to the LSI22915A, follow these steps:

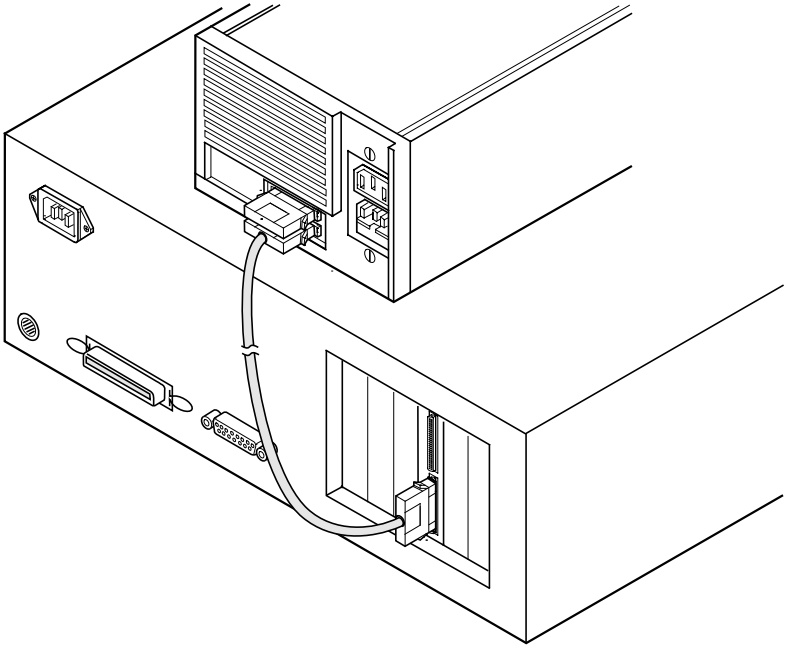
Step 1. Plug the 68-pin HD connector on one end of a shielded external SCSI cable into the host adapter connector J7 or J1. Figure 2.9 illustrates this connection.

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 how to make this connection.

Figure 2.10 External Cable to External SCSI Device

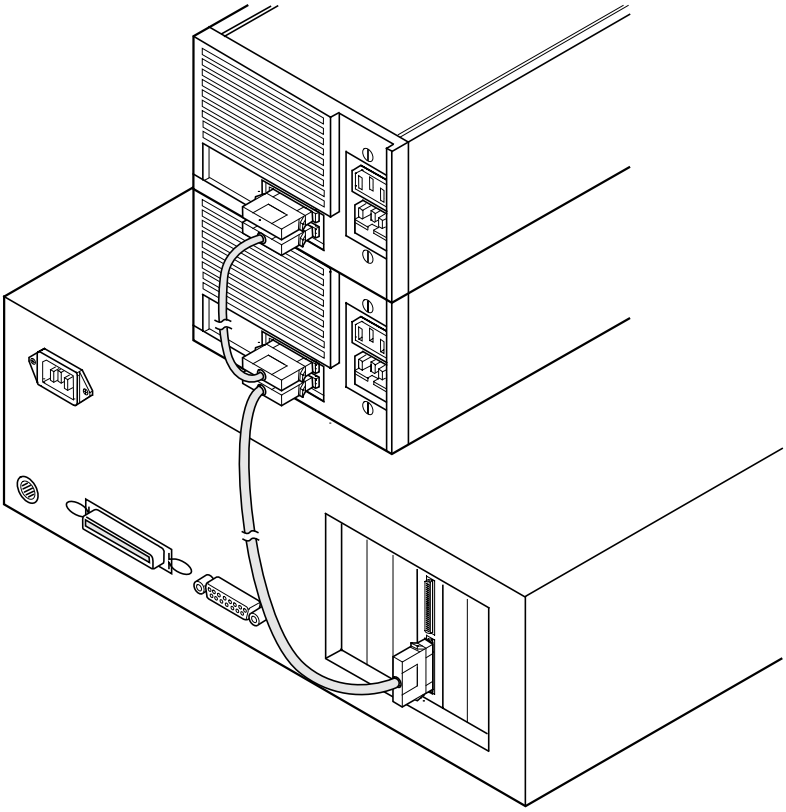


If this is the only external SCSI device on your system, proceed to Section 2.2.6, “SCSI Bus Termination,” page 2-15, for termination instructions. If you have multiple SCSI devices, proceed to Step 3.

Step 3. Chain multiple devices together with shielded external SCSI cables.

Figure 2.11 shows an example of these chained connections..

Figure 2.11 Multiple External SCSI Devices Chained Together



2.2.6 SCSI Bus Termination

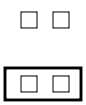
The devices making up the SCSI bus are connected serially (chained together) with SCSI cables. The first and last physical SCSI devices connected on the ends of the SCSI bus must have their terminators active. All other SCSI devices on the bus must have their terminators removed or disabled. Remember that your LSI22915A is also on the SCSI bus and its termination is automatically enabled when it is connected to the end of the bus.

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 computer's user's manual for information on how to identify the terminator setting of each device and how to change it.

Caution: The auto-enable/disable sensing feature on your LSI22915A may enable termination erroneously if it is directly cabled to another SCSI device or host adapter using the same sensing method. The LSI22915A senses SCSI devices by detecting the ground signal on conductor 50 of a
68-conductor SCSI cable.

Two locations for shunts are on the board for autotermination override: A_TERM for Channel A, and B_TERM for Channel B. Refer to Figure 3.1 for shunt location. Figure 2.12 illustrates how the shunt controls autotermination.

Figure 2.12 Autotermination Shunt



Autotermination enabled (no jumper installed)

Termination disabled (jumper installed)

The LSI22915A automatically controls SCSI bus termination for three different bus configurations, depending on how it is connected. The three bus configurations are:

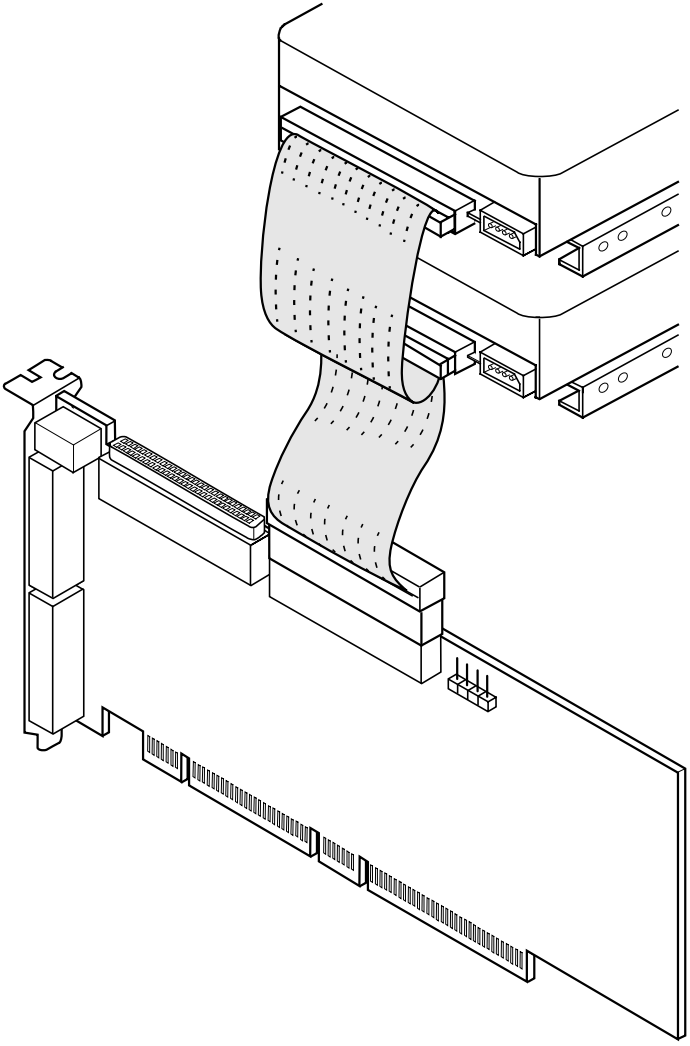
- Section 2.2.6.1, “Internal SCSI Connections”
- Section 2.2.6.2, “External SCSI Connections”
- Section 2.2.6.3, “Internal and External SCSI Connections”

2.2.6.1 Internal SCSI Connections

If you have only 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 2.13 illustrates how termination is established for this SCSI bus configuration.

Figure 2.13 Internal SCSI Device Termination

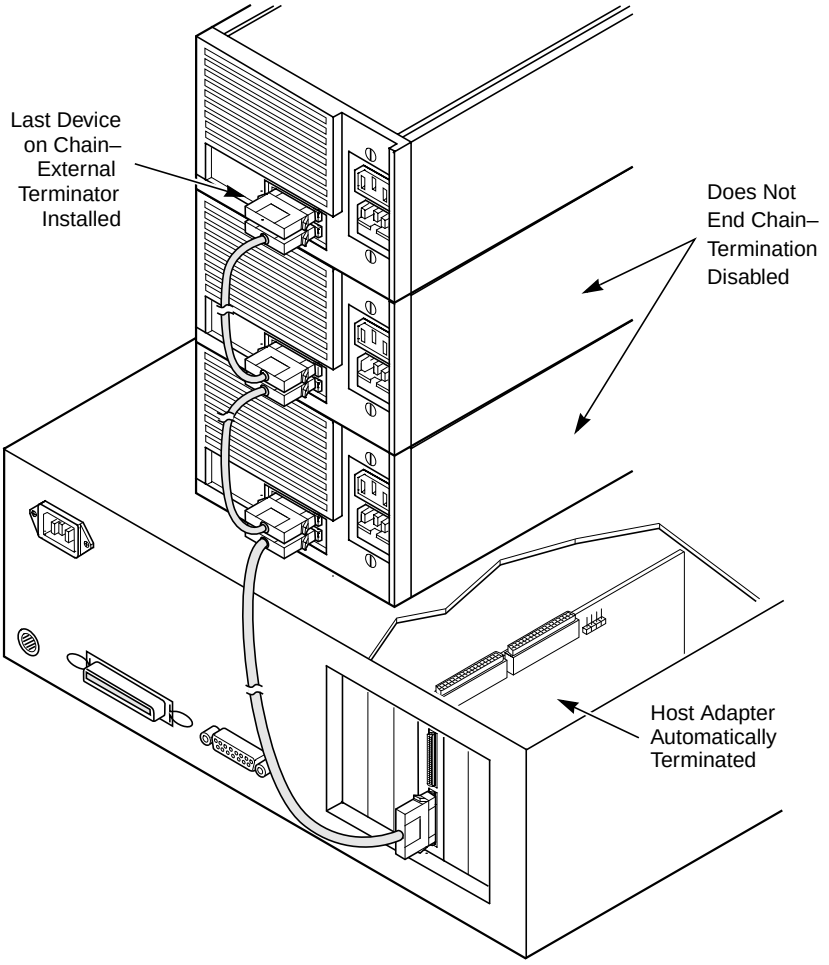


2.2.6.2 External SCSI Connections

If you have only external SCSI device connections on your host adapter, you must terminate the last external 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 2.14 illustrates how termination is established for this SCSI bus configuration.

Figure 2.14 External SCSI Device Termination

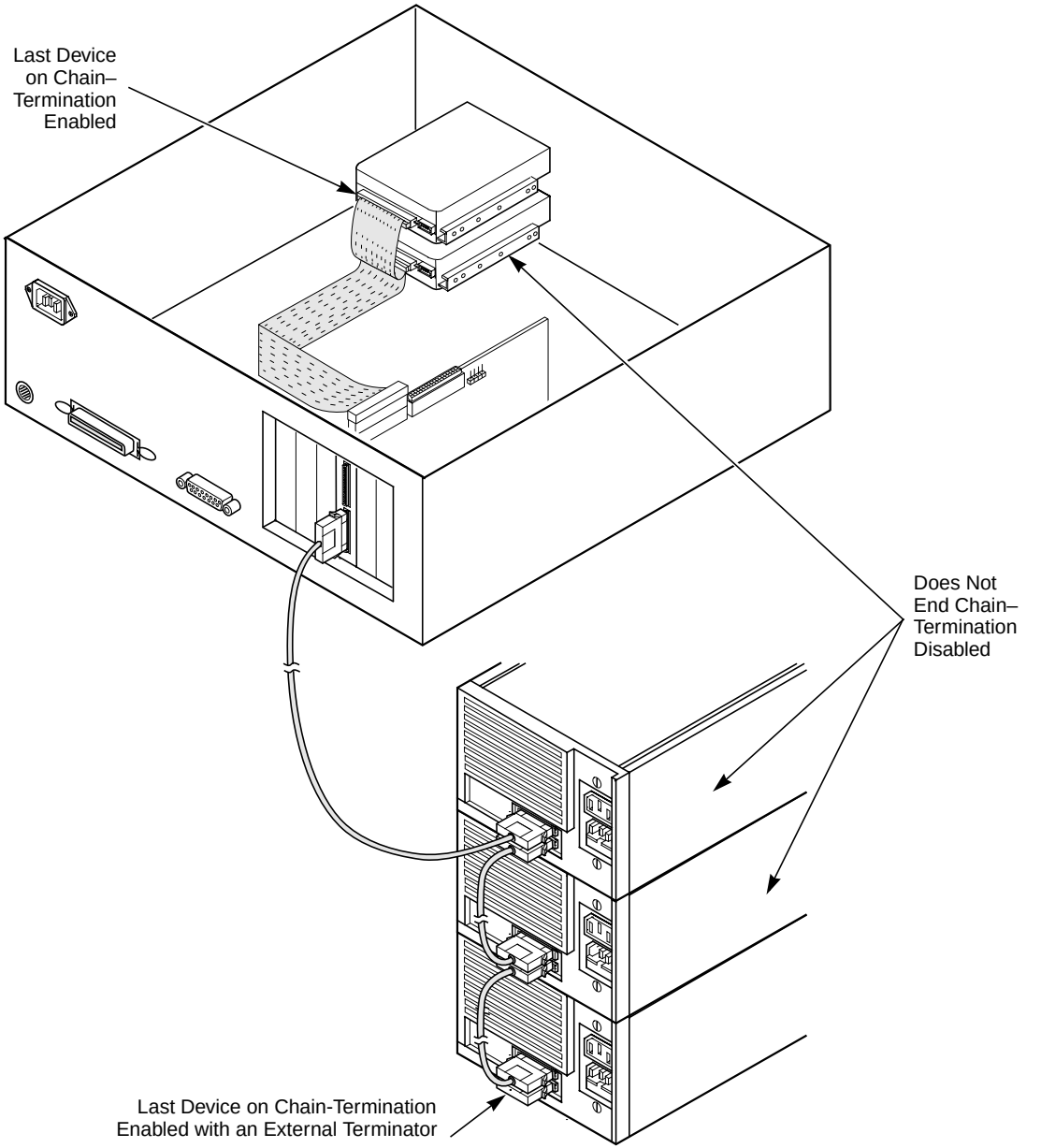


2.2.6.3 Internal and External SCSI Connections

If you have both internal and external SCSI device connections to the host adapter, then terminate the last internal and external devices on the SCSI bus. You must disable the termination on all other devices. Termination on your host adapter is automatically disabled in this case.

Figure 2.15 illustrates how termination is established for this SCSI bus configuration.

Figure 2.15 Internal and External SCSI Device Termination



Note: If you have an internal connection to another LSI22915A , or any connection to a device that uses the same sensing method for automatic termination as your LSI22915A, override the termination for that channel by adding a shunt or through software control.

2.2.7 Setting SCSI IDs

Set each SCSI device and the host adapter to a separate SCSI ID, 0 through 15. SCSI ID 7 is the preset host adapter setting, giving it the highest priority on the 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. Normally, you do not change the SCSI ID setting. If you wish to do so, refer to the *PCI Storage Device Management System SDMS 4.0 User's Guide,* which 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 computer's user's manual 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, noting any duplications.

Step 2. Make any necessary changes to the SCSI IDs and record the IDs for future reference, as shown in Table 2.1.

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	LSI22915A (default)	LSI22915A (default)
6		
5		
4		
3		
2		
1		
0		

2.2.8 Setting Interrupts

Normally, you do not change the default interrupt routing for the LSI22915A, since performance is usually increased by having two separate interrupts. However, if your system does not support two separate interrupts, INTA/INTB 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 by following the steps listed. 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.

Step 3. Switch power on to all devices and to your computer.

Step 4. Wait for your computer to boot up.

Step 5. Refer to the *PCI Storage Device Management System SDMS 4.0 User's Guide* (or to the guide for the software you plan to 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 technical specifications of the LSI22915A. 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 LSI22915A. It should be noted that this board is compliant with electromagnetic standards set by the FCC.

3.1.1 Physical Characteristics

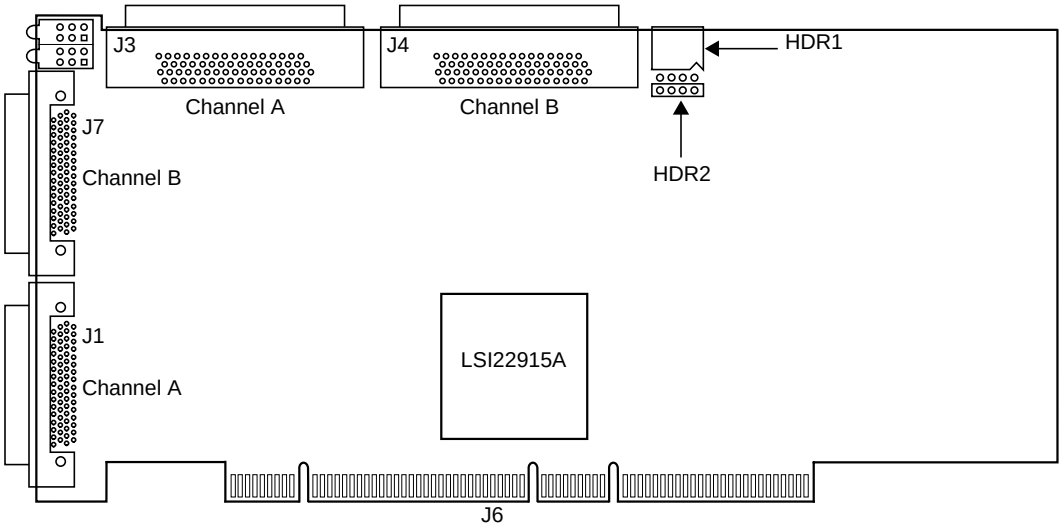
The dimensions of the LSI22915A are approximately 4.2 x 8.4 inches (106.68 mm by 213.36 mm). PCI connection is made through edge connector J6. The component height on the top and bottom of the LSI22915A follows the *PCI Local Bus Specification Revision 2.2* standard.

Internal 16-bit SCSI connection is made through the 68-pin high density connector J3 for Channel A or J4 for Channel B. External SCSI connection is made through the 68-pin VHDCI connector J7 for Channel B or J1 for Channel A.

The J1 and J7 connectors extend through the ISA/EISA bracket, which is attached to the face of the connector outside of the cabinet where the LSI22915A is installed. The HDR2 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 LSI22915A Mechanical Drawing



3.1.2 Electrical Characteristics

The LSI22915A maximum power requirements, which include SCSI TERMPWR (termination power), under normal operation are listed in Table 3.1.

Table 3.1 Maximum Power Requirements

+5 V DC	5%	3.0 A	Over the operating range 5–55 °C

The PCI PRSNT1 and PRSNT2 pins are set to indicate a 15 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 4 A is sustained no longer than 30 seconds before the self-resetting TERMPWR short circuit protection device opens.

3.1.3 Thermal, Atmospheric Characteristics

The thermal, atmospheric characteristics of the LSI22915A host adapter board are:

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

The following parameters define a storage and transit environment for the LSI22915A host adapter board:

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

3.1.4 Electromagnetic Compliance

The LSI22915A minimizes electromagnetic emissions, susceptibility, and the effects of electrostatic discharge. The board carries the CE mark, and VCCI meets the requirements of FCC, CISPR Class B, and Canada ICES-003 Class B. It is also marked with the FCC Self Certification logo.

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. Because this board is installed in a PCI bus slot, all voltages are below the SELV 42.4 V limit.

3.2 Operational Environment

The LSI22915A is designed for use in PCI computer systems with an ISA/EISA bracket type. The SDMS software operates the board, but the design of the board does not prevent the use of other software.

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 +3.3 V pins are tied together and decoupled with high frequency bypass capacitors to ground. No current from these 3.3 V pins is used on the board. The PCI portion of the LSI53C1010 chip is powered from the 3 V/5 V pins.

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	GND	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, SE or LVD bus, and supports Ultra160 SCSI protocols and 16-bit arbitration. The interface is made through connectors J1 and J3 for Channel A and J7 and J4 for Channel B.

Connectors J1 and J7 are 68-pin VHDCI right-angle receptacles that protrude through the ISA/EISA bracket. Connectors J3 and J4 are 68-pin high density latching right-angle receptacles for internal SCSI connections.

The LSI22915A provides automatic active differential SCSI termination. The board also supplies SCSI TERMPWR. Table 3.4 shows the signal assignments for J1, J3, J4, and J7.

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	CPRSNT[1]	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		

1. CPRSNT is used to sense the connection of a standard SCSI device by sensing SCSI standard GND on this pin.

3.2.3 SCSI Activity LED Interface

The LED interface is a four-wire arrangement that allows you to connect an LED harness to the board. J5 is the connector for both channels. Table 3.5 lists the signal and pin numbers for this SCSI host adapter.

Table 3.5 Connector Pinout

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

Four individual LEDs per channel are on the LSI22915A so you can decode the operating state of the board. The four activity LEDs are:

- SCSI Activity – Green LED, left edge of board
- TERMPWR SHORTED – Yellow LED, left edge of board
- LVD Mode – Green LED, left edge of board in LVD Mode
- TERMPWR GOOD – Green LED, left edge of board when TERMPWR is above +3 V

3.3 Subsystem ID and Subsystem Vendor ID

The Subsystem ID and Subsystem Vendor ID for the LSI22915A are provided in Table 3.6. The ID numbers are contained in the LSI22915A 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 Ultra160 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 set up; 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 Direct Memory Access.

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).

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.
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.
LUN	Logical Unit Number. An identifier, zero to seven, for a logical unit.
LVDlink	Low Voltage Differential Link allows greater Ultra3 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 1.4, “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.
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.
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.

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.

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.

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.

VHDCI Very High Density Cable Interconnect.

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.

Index

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Idaho Springs
B. M. Tel: 303.567.0703

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Wallingford
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Tel: 800.638.5988
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W. E. Tel: 801.974.9953

Illinois
North/South
A. E. Tel: 847.797.7300
Tel: 314.291.5350
Chicago
B. M. Tel: 847.413.8530
W. E. Tel: 800.853.9953
Schaumburg
I. E. Tel: 847.885.9700

Indiana
Fort Wayne
I. E. Tel: 219.436.4250
W. E. Tel: 888.358.9953
Indianapolis
A. E. Tel: 317.575.3500

Iowa
W. E. Tel: 612.853.2280
Cedar Rapids
A. E. Tel: 319.393.0033

Kansas
W. E. Tel: 303.457.9953
Kansas City
A. E. Tel: 913.663.7900
Lenexa
I. E. Tel: 913.492.0408

Kentucky
W. E. Tel: 937.436.9953
Central/Northern/ Western
A. E. Tel: 800.984.9503
Tel: 800.767.0329
Tel: 800.829.0146

Louisiana
W. E. Tel: 713.854.9953
North/South
A. E. Tel: 800.231.0253
Tel: 800.231.5775

Maine
A. E. Tel: 800.272.9255
W. E. Tel: 781.271.9953

Maryland
Baltimore
A. E. Tel: 410.720.3400
W. E. Tel: 800.863.9953
Columbia
B. M. Tel: 800.673.7461
I. E. Tel: 410.381.3131

Massachusetts
Boston
A. E. Tel: 978.532.9808
W. E. Tel: 800.444.9953
Burlington
I. E. Tel: 781.270.9400
Marlborough
B. M. Tel: 800.673.7459
Woburn
B. M. Tel: 800.552.4305

Michigan
Brighton
I. E. Tel: 810.229.7710
Detroit
A. E. Tel: 734.416.5800
W. E. Tel: 888.318.9953
Clarkston
B. M. Tel: 877.922.9363

Minnesota
Champlin
B. M. Tel: 800.557.2566
Eden Prairie
B. M. Tel: 800.255.1469
Minneapolis
A. E. Tel: 612.346.3000
W. E. Tel: 800.860.9953
St. Louis Park
I. E. Tel: 612.525.9999

Mississippi
A. E. Tel: 800.633.2918
W. E. Tel: 256.830.1119

Missouri
W. E. Tel: 630.620.0969
St. Louis
A. E. Tel: 314.291.5350
I. E. Tel: 314.872.2182

Montana
A. E. Tel: 800.526.1741
W. E. Tel: 801.974.9953

Nebraska
A. E. Tel: 800.332.4375
W. E. Tel: 303.457.9953

Nevada
Las Vegas
A. E. Tel: 800.528.8471
W. E. Tel: 702.765.7117

New Hampshire
A. E. Tel: 800.272.9255
W. E. Tel: 781.271.9953

New Jersey
North/South
A. E. Tel: 201.515.1641
Tel: 609.222.6400
Mt. Laurel
I. E. Tel: 856.222.9566
Pine Brook
B. M. Tel: 973.244.9668
W. E. Tel: 800.862.9953
Parsippany
I. E. Tel: 973.299.4425
Wayne
W. E. Tel: 973.237.9010

New Mexico
W. E. Tel: 480.804.7000
Albuquerque
A. E. Tel: 505.293.5119

U.S. Distributors by State (Continued)

New York
Hauppauge
I. E. Tel: 516.761.0960
Long Island
A. E. Tel: 516.434.7400
W. E. Tel: 800.861.9953
Rochester
A. E. Tel: 716.475.9130
I. E. Tel: 716.242.7790
W. E. Tel: 800.319.9953
Smithtown
B. M. Tel: 800.543.2008
Syracuse
A. E. Tel: 315.449.4927

North Carolina
Raleigh
A. E. Tel: 919.859.9159
I. E. Tel: 919.873.9922
W. E. Tel: 800.560.9953

North Dakota
A. E. Tel: 800.829.0116
W. E. Tel: 612.853.2280

Ohio
Cleveland
A. E. Tel: 216.498.1100
W. E. Tel: 800.763.9953
Dayton
A. E. Tel: 614.888.3313
I. E. Tel: 937.253.7501
W. E. Tel: 800.575.9953
Strongsville
B. M. Tel: 440.238.0404
Valley View
I. E. Tel: 216.520.4333

Oklahoma
W. E. Tel: 972.235.9953
Tulsa
A. E. Tel: 918.459.6000
I. E. Tel: 918.665.4664

Oregon
Beaverton
B. M. Tel: 503.524.1075
I. E. Tel: 503.644.3300
Portland
A. E. Tel: 503.526.6200
W. E. Tel: 800.879.9953

Pennsylvania
Mercer
I. E. Tel: 412.662.2707
Philadelphia
A. E. Tel: 800.526.4812
B. M. Tel: 877.351.2355
W. E. Tel: 800.871.9953
Pittsburgh
A. E. Tel: 412.281.4150
W. E. Tel: 440.248.9996

Rhode Island
A. E. 800.272.9255
W. E. Tel: 781.271.9953

South Carolina
A. E. Tel: 919.872.0712
W. E. Tel: 919.469.1502

South Dakota
A. E. Tel: 800.829.0116
W. E. Tel: 612.853.2280

Tennessee
W. E. Tel: 256.830.1119
East/West
A. E. Tel: 800.241.8182
Tel: 800.633.2918

Texas
Arlington
B. M. Tel: 817.417.5993
Austin
A. E. Tel: 512.219.3700
B. M. Tel: 512.258.0725
I. E. Tel: 512.719.3090
W. E. Tel: 800.365.9953
Dallas
A. E. Tel: 214.553.4300
B. M. Tel: 972.783.4191
W. E. Tel: 800.955.9953
El Paso
A. E. Tel: 800.526.9238
Houston
A. E. Tel: 713.781.6100
B. M. Tel: 713.917.0663
W. E. Tel: 800.888.9953
Richardson
I. E. Tel: 972.783.0800
Rio Grande Valley
A. E. Tel: 210.412.2047
Stafford
I. E. Tel: 281.277.8200

Utah
Centerville
B. M. Tel: 801.295.3900
Murray
I. E. Tel: 801.288.9001
Salt Lake City
A. E. Tel: 801.365.3800
W. E. Tel: 800.477.9953

Vermont
A. E. Tel: 800.272.9255
W. E. Tel: 716.334.5970

Virginia
A. E. Tel: 800.638.5988
W. E. Tel: 301.604.8488
Haymarket
B. M. Tel: 703.754.3399
Springfield
B. M. Tel: 703.644.9045

Washington
Kirkland
I. E. Tel: 425.820.8100
Maple Valley
B. M. Tel: 206.223.0080
Seattle
A. E. Tel: 425.882.7000
W. E. Tel: 800.248.9953

West Virginia
A. E. Tel: 800.638.5988

Wisconsin
Milwaukee
A. E. Tel: 414.513.1500
W. E. Tel: 800.867.9953
Wauwatosa
I. E. Tel: 414.258.5338

Wyoming
A. E. Tel: 800.332.9326
W. E. Tel: 801.974.9953

Direct Sales Representatives by State (Components and Boards)

E. A. Earle Associates
E. L. Electrodyne - UT
GRP Group 2000
I. S. Infinity Sales, Inc.
ION ION Associates, Inc.
R. A. Rathsburg Associates, Inc.
SGY Synergy Associates, Inc.

Arizona
Tempe
E. A. Tel: 480.921.3305

California
Calabasas
I. S. Tel: 818.880.6480
Irvine
I. S. Tel: 714.833.0300
San Diego
E. A. Tel: 619.278.5441

Illinois
Elmhurst
R. A. Tel: 630.516.8400

Indiana
Cicero
R. A. Tel: 317.984.8608
Ligonier
R. A. Tel: 219.894.3184
Plainfield
R. A. Tel: 317.838.0360

Massachusetts
Burlington
SGY Tel: 781.238.0870

Michigan
Byron Center
R. A. Tel: 616.554.1460
Good Rich
R. A. Tel: 810.636.6060
Novi
R. A. Tel: 810.615.4000

North Carolina
Cary
GRP Tel: 919.481.1530

Ohio
Columbus
R. A. Tel: 614.457.2242
Dayton
R. A. Tel: 513.291.4001
Independence
R. A. Tel: 216.447.8825

Pennsylvania
Somerset
R. A. Tel: 814.445.6976

Texas
Austin
ION Tel: 512.794.9006
Arlington
ION Tel: 817.695.8000
Houston
ION Tel: 281.376.2000

Utah
Salt Lake City
E. L. Tel: 801.264.8050

Wisconsin
Muskego
R. A. Tel: 414.679.8250
Saukville
R. A. Tel: 414.268.1152

Sales Offices and Design Resource Centers

LSI Logic Corporation
Corporate Headquarters
1551 McCarthy Blvd
Milpitas CA 95035
Tel: 408.433.8000
Fax: 408.433.8989

NORTH AMERICA

California
Irvine
18301 Von Karman Ave
Suite 900
Irvine, CA 92612
♦ Tel: 949.809.4600
Fax: 949.809.4444

Pleasanton Design Center
5050 Hopyard Road, 3rd Floor
Suite 300
Pleasanton, CA 94588
Tel: 925.730.8800
Fax: 925.730.8700

San Diego
7585 Ronson Road
Suite 100
San Diego, CA 92111
Tel: 858.467.6981
Fax: 858.496.0548

Silicon Valley
1551 McCarthy Blvd
Sales Office
M/S C-500
Milpitas, CA 95035
♦ Tel: 408.433.8000
Fax: 408.954.3353
Design Center
M/S C-410
Tel: 408.433.8000
Fax: 408.433.7695

Wireless Design Center
11452 El Camino Real
Suite 210
San Diego, CA 92130
Tel: 858.350.5560
Fax: 858.350.0171

Colorado
Boulder
4940 Pearl East Circle
Suite 201
Boulder, CO 80301
♦ Tel: 303.447.3800
Fax: 303.541.0641

Colorado Springs
4420 Arrowswest Drive
Colorado Springs, CO 80907
Tel: 719.533.7000
Fax: 719.533.7020

Fort Collins
2001 Danfield Court
Fort Collins, CO 80525
Tel: 970.223.5100
Fax: 970.206.5549

Florida
Boca Raton
2255 Glades Road
Suite 324A
Boca Raton, FL 33431
Tel: 561.989.3236
Fax: 561.989.3237

Georgia
Alpharetta
2475 North Winds Parkway
Suite 200
Alpharetta, GA 30004
Tel: 770.753.6146
Fax: 770.753.6147

Illinois
Oakbrook Terrace
Two Mid American Plaza
Suite 800
Oakbrook Terrace, IL 60181
Tel: 630.954.2234
Fax: 630.954.2235

Kentucky
Bowling Green
1262 Chestnut Street
Bowling Green, KY 42101
Tel: 270.793.0010
Fax: 270.793.0040

Maryland
Bethesda
6903 Rockledge Drive
Suite 230
Bethesda, MD 20817
Tel: 301.897.5800
Fax: 301.897.8389

Massachusetts
Waltham
200 West Street
Waltham, MA 02451
♦ Tel: 781.890.0180
Fax: 781.890.6158

Burlington - Mint Technology
77 South Bedford Street
Burlington, MA 01803
Tel: 781.685.3800
Fax: 781.685.3801

Minnesota
Minneapolis
8300 Norman Center Drive
Suite 730
Minneapolis, MN 55437
♦ Tel: 612.921.8300
Fax: 612.921.8399

New Jersey
Red Bank
125 Half Mile Road
Suite 200
Red Bank, NJ 07701
Tel: 732.933.2656
Fax: 732.933.2643

Cherry Hill - Mint Technology
215 Longstone Drive
Cherry Hill, NJ 08003
Tel: 856.489.5530
Fax: 856.489.5531

New York
Fairport
550 Willowbrook Office Park
Fairport, NY 14450
Tel: 716.218.0020
Fax: 716.218.9010

North Carolina
Raleigh
Phase II
4601 Six Forks Road
Suite 528
Raleigh, NC 27609
Tel: 919.785.4520
Fax: 919.783.8909

Oregon
Beaverton
15455 NW Greenbrier Parkway
Suite 235
Beaverton, OR 97006
Tel: 503.645.0589
Fax: 503.645.6612

Texas
Austin
9020 Capital of TX Highway North
Building 1
Suite 150
Austin, TX 78759
Tel: 512.388.7294
Fax: 512.388.4171

Plano
500 North Central Expressway
Suite 440
Plano, TX 75074
♦ Tel: 972.244.5000
Fax: 972.244.5001

Houston
20405 State Highway 249
Suite 450
Houston, TX 77070
Tel: 281.379.7800
Fax: 281.379.7818

Canada
Ontario
Ottawa
260 Hearst Way
Suite 400
Kanata, ON K2L 3H1
♦ Tel: 613.592.1263
Fax: 613.592.3253

INTERNATIONAL

France
Paris
LSI Logic S.A.
Immeuble Europa
53 bis Avenue de l'Europe
B.P. 139
78148 Velizy-Villacoublay
Cedex, Paris
♦ Tel: 33.1.34.63.13.13
Fax: 33.1.34.63.13.19

Germany
Munich
LSI Logic GmbH
Orleansstrasse 4
81669 Munich
♦ Tel: 49.89.4.58.33.0
Fax: 49.89.4.58.33.108

Stuttgart
Mittlerer Pfad 4
D-70499 Stuttgart
♦ Tel: 49.711.13.96.90
Fax: 49.711.86.61.428

Italy
Milan
LSI Logic S.P.A.
Centro Direzionale Colleoni Palazzo
Orione Ingresso 1
20041 Agrate Brianza, Milano
♦ Tel: 39.039.687371
Fax: 39.039.6057867

Japan
Tokyo
LSI Logic K.K.
Rivage-Shinagawa Bldg. 14F
4-1-8 Kounan
Minato-ku, Tokyo 108-0075
♦ Tel: 81.3.5463.7821
Fax: 81.3.5463.7820

Osaka
Crystal Tower 14F
1-2-27 Shiromi
Chuo-ku, Osaka 540-6014
♦ Tel: 81.6.947.5281
Fax: 81.6.947.5287

Sales Offices and Design Resource Centers (Continued)

Korea
Seoul
LSI Logic Corporation of Korea Ltd
10th Fl., Haesung 1 Bldg.
942, Daechi-dong,
Kangnam-ku, Seoul, 135-283
Tel: 82.2.528.3400
Fax: 82.2.528.2250

The Netherlands
Eindhoven
LSI Logic Europe Ltd
World Trade Center Eindhoven
Building 'Rijder'
Bogert 26
5612 LZ Eindhoven
Tel: 31.40.265.3580
Fax: 31.40.296.2109

Singapore
Singapore
LSI Logic Pte Ltd
7 Temasek Boulevard
#28-02 Suntec Tower One
Singapore 038987
Tel: 65.334.9061
Fax: 65.334.4749

Sweden
Stockholm
LSI Logic AB
Finlandsgatan 14
164 74 Kista
♦ Tel: 46.8.444.15.00
Fax: 46.8.750.66.47

Taiwan
Taipei
LSI Logic Asia, Inc.
Taiwan Branch
10/F 156 Min Sheng E. Road
Section 3
Taipei, Taiwan R.O.C.
Tel: 886.2.2718.7828
Fax: 886.2.2718.8869

United Kingdom
Bracknell
LSI Logic Europe Ltd
Greenwood House
London Road
Bracknell, Berkshire RG12 2UB
♦ Tel: 44.1344.426544
Fax: 44.1344.481039

♦ Sales Offices with Design Resource Centers

International Distributors

Australia
New South Wales
Reptechnic Pty Ltd
3/36 Bydown Street
Neutral Bay, NSW 2089
♦ Tel: 612.9953.9844
Fax: 612.9953.9683

Belgium
Acal nv/sa
Lozenberg 4
1932 Zaventem
Tel: 32.2.7205983
Fax: 32.2.7251014

China
Beijing
LSI Logic International Services Inc.
Beijing Representative Office
Room 708
Canway Building
66 Nan Li Shi Lu
Xicheng District
Beijing 100045, China
Tel: 86.10.6804.2534 to 38
Fax: 86.10.6804.2521

France
Rungis Cedex
Azzurri Technology France
22 Rue Saarinen
Sillic 274
94578 Rungis Cedex
Tel: 33.1.41806310
Fax: 33.1.41730340

Germany
Haar
EBV Elektronik
Hans-Pinsel Str. 4
D-85540 Haar
Tel: 49.89.4600980
Fax: 49.89.46009840

Munich
Avnet Emg GmbH
Stahlgruberring 12
81829 Munich
Tel: 49.89.45110102
Fax: 49.89.42.27.75

Wuennenberg-Haaren
Peacock AG
Graf-Zepplin-Str 14
D-33181 Wuennenberg-Haaren
Tel: 49.2957.79.1692
Fax: 49.2957.79.9341

Hong Kong
Hong Kong
AVT Industrial Ltd
Unit 608 Tower 1
Cheung Sha Wan Plaza
833 Cheung Sha Wan Road
Kowloon, Hong Kong
Tel: 852.2428.0008
Fax: 852.2401.2105

Serial System (HK) Ltd
2301 Nanyang Plaza
57 Hung To Road, Kwun Tong
Kowloon, Hong Kong
Tel: 852.2995.7538
Fax: 852.2950.0386

India
Bangalore
Spike Technologies India Private Ltd
951, Vijayalakshmi Complex,
2nd Floor, 24th Main,
J P Nagar II Phase,
Bangalore, India 560078
♦ Tel: 91.80.664.5530
Fax: 91.80.664.9748

Israel
Tel Aviv
Eastronics Ltd
11 Rozanis Street
P.O. Box 39300
Tel Aviv 61392
Tel: 972.3.6458777
Fax: 972.3.6458666

Japan
Tokyo
Daito Electron
Sogo Kojimachi No.3 Bldg
1-6 Kojimachi
Chiyoda-ku, Tokyo 102-8730
Tel: 81.3.3264.0326
Fax: 81.3.3261.3984

Global Electronics Corporation
Nichibei Time24 Bldg. 35 Tansu-cho
Shinjuku-ku, Tokyo 162-0833
Tel: 81.3.3260.1411
Fax: 81.3.3260.7100
Technical Center
Tel: 81.471.43.8200

Marubeni Solutions
1-26-20 Higashi
Shibuya-ku, Tokyo 150-0001
Tel: 81.3.5778.8662
Fax: 81.3.5778.8669

Shinki Electronics
Myuru Daikanyama 3F
3-7-3 Ebisu Minami
Shibuya-ku, Tokyo 150-0022
Tel: 81.3.3760.3110
Fax: 81.3.3760.3101

Yokohama-City
Innotech
2-15-10 Shin Yokohama
Kohoku-ku
Yokohama-City, 222-8580
Tel: 81.45.474.9037
Fax: 81.45.474.9065

Macnica Corporation
Hakusan High-Tech Park
1-22-2 Hadusan, Midori-Ku,
Yokohama-City, 226-8505
Tel: 81.45.939.6140
Fax: 81.45.939.6141

The Netherlands
Eindhoven
Acal Nederland b.v.
Beatrix de Rijkweg 8
5657 EG Eindhoven
Tel: 31.40.2.502602
Fax: 31.40.2.510255

Switzerland
Brugg
LSI Logic Sulzer AG
Mattenstrasse 6a
CH 2555 Brugg
Tel: 41.32.3743232
Fax: 41.32.3743233

Taiwan
Taipei
Avnet-Mercuries Corporation, Ltd
14F, No. 145,
Sec. 2, Chien Kuo N. Road
Taipei, Taiwan, R.O.C.
Tel: 886.2.2516.7303
Fax: 886.2.2505.7391

Lumax International Corporation, Ltd
7th Fl., 52, Sec. 3
Nan-Kang Road
Taipei, Taiwan, R.O.C.
Tel: 886.2.2788.3656
Fax: 886.2.2788.3568

Prospect Technology Corporation, Ltd
4Fl., No. 34, Chu Luen Street
Taipei, Taiwan, R.O.C.
Tel: 886.2.2721.9533
Fax: 886.2.2773.3756

Wintech Microeletronics Co., Ltd
7F., No. 34, Sec. 3, Pateh Road
Taipei, Taiwan, R.O.C.
Tel: 886.2.2579.5858
Fax: 886.2.2570.3123

United Kingdom
Maidenhead
Azzurri Technology Ltd
16 Grove Park Business Estate
Waltham Road
White Waltham
Maidenhead, Berkshire SL6 3LW
Tel: 44.1628.826826
Fax: 44.1628.829730

Milton Keynes
Ingram Micro (UK) Ltd
Garamonde Drive
Wymbush
Milton Keynes
Buckinghamshire MK8 8DF
Tel: 44.1908.260422

Swindon
EBV Elektronik
12 Interface Business Park
Bincknoll Lane
Wootton Bassett,
Swindon, Wiltshire SN4 8SY
Tel: 44.1793.849933
Fax: 44.1793.859555

♦ Sales Offices with Design Resource Centers