Symbios® SYM22902
PCI to Ultra2 SCSI Dual Channel Low Profile PCI Host Adapter

User's Guide

March 2000

Version 1.0

LSI LOGIC®

S14039

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 Symbios® SYM22902 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 DB15-000137-00, First Edition (March 2000). This document describes Version 1.0 of LSI Logic Corporation's Symbios® SYM22902 PCI to Ultra2 SCSI Dual Channel 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.

Preface

This book is the primary reference and user's guide for the LSI Logic Symbios® SYM22902 PCI to Ultra2 SCSI Dual Channel Low Profile PCI Host Adapter. It contains a complete functional description for the SYM22902 and includes complete physical and electrical specifications for the SYM22902.

Audience

This document assumes that you have some familiarity with SCSI protocol and related support devices and will benefit persons installing and using the SYM22902 Host Adapter Board.

Organization

This document has the following chapters and appendixes:

- Chapter 1, **Using the SYM22902 Low Profile PCI Host Adapter**, defines the interfaces and characteristics of the SYM22902 PCI to Ultra2 SCSI Dual Channel Low Profile PCI Host Adapter Board.
- Chapter 2, **Installing the SYM22902 Host Adapter**, provides both quick and detailed installation instructions.
- Chapter 3, **Configuring the SYM22902 Host Adapter**, describes the SCSI BIOS Configuration Utility to configure adapter and device settings.
- Appendix A, **Technical Specifications**, describes the physical and operational environments of the SYM22902 Host Adapter Board.
- Appendix B, **Glossary of Terms and Abbreviations**, provides definitions of various terminology that is referenced throughout this user's guide.

Related Publications

Symbios® PCI Storage Device Management System SDMS™ 4.0 User's Guide, Version 10, LSI Logic Corporation, Order Number S14007.A

Symbios® SYM53C896 PCI to Dual Channel Ultra2 SCSI Multifunction Controller Technical Manual, Version 3.0, LSI Logic Corporation, Order Number S14015.A

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Chapter 1
Using the SYM22902 Low Profile PCI Host Adapter

This chapter describes the SYM22902 Low Profile PCI Host Adapter interface to PCI computer systems and includes these topics:

1.1 General Description

The LSI Logic Symbios® SYM22902 PCI to Ultra2 SCSI Dual Channel Low Profile PCI Host Adapter provides two SCSI-3, Ultra2 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 SYM22902 host adapter provides two independent Ultra2 SCSI channels. The external channel on the SYM22902 board supports Low Voltage Differential (LVD) and Single-Ended (SE) SCSI, while the internal channel supports LVD SCSI only. The SYM22902 is a SCSI solution for an 1U and 2U size server. This board can support legacy fast SCSI devices, Ultra SCSI devices, and the newest Ultra2 SCSI devices on the appropriate connections.

The Symbios 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 128K Flash device.

This guide and the LSI Logic *Symbios PCI Storage Device Management System SDMS 4.0 User’s Guide* contain product information and

installation instructions to help you gain the full benefits of your SYM22902 PCI to Ultra2 SCSI Dual Channel Low Profile PCI Host Adapter.

1.2 Features

This section provides an overview of the PCI Interface, the SCSI Interface, and Board Characteristics for the SYM22902 host adapter board.

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. The PCI portion of the SYM53C896 Dual Channel Ultra2 controller is powered from the host system PCI + 3.3 V power rail. The implementation is PCI 2.2 compliant.

The PCI interface includes these features:

- Supports 64-bit or 32-bit (33 MHz) DMA bus master
- Bursts 2 to 128 Dwords across PCI bus
- Prefetches up to 8 Dwords of SCRIPTS™ instructions
- Supports PCI Write and Invalidate, Read Line, and Read Multiple commands
- Provides zero wait-state bus master data bursts
- Includes PCI Universal 3.3 V/5 V bus support

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 with/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 Ultra2 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, and Ultra2 data transfer capability: Ultra2 SCSI LVD synchronous transfers are as fast as 80 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 SYM22902 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 SYM22902 is J3 for both channels. See Table A.5 for the signal name and pin numbers for this LED interface.

1.2.5 Wide Ultra2 SCSI

The SYM22902 fully supports Wide Ultra2 SCSI. This interface is an extension of the SCSI-3 family of standards that expands the bandwidth of the SCSI bus to allow faster synchronous data transfers, up to 80 Mbytes/s. Wide Ultra2 SCSI provides a doubling of the data rate over the Ultra2 SCSI interface, while it increases cable lengths and allows a larger number of devices on the cable than Ultra2 SCSI interfaces.

Special SCSI cables are specified for operation with Wide Ultra and Ultra2 SCSI devices. You must consider the total number of devices and the length of your SCSI bus when setting up your system. See Chapter 2, “Installing the SYM22902 Host Adapter” for a more detailed explanation of SCSI bus connections.

The cable included in the SYM22902 host adapter kit is matched for fast/Ultra/Ultra2 SE or LVD operation. This cable also has built-in LVD termination since most Ultra2 hard disk drives are not made with on-board LVD termination. Table 1.1 provides an overview of standard SCSI cable specifications.

Table 1.1 Standard Cables

STA Term	Maximum Bus Length, Meters[1]		Maximum Devices
	SE	LVD	
Wide Ultra SCSI	1.5	Note[2]	8
Wide Ultra SCSI	3	Note[2]	4
Wide Ultra2 SCSI	Note[3]	12	16

1. This parameter may be exceeded in point-to-point and engineered applications.
2. LVD was not defined in the original SCSI standards for this speed. If all devices on the bus support LVD, then 12-meter operation is possible at this speed. However, if any device on the bus is SE only, then the entire bus switches to SE mode, and the distances in the SE column apply.
3. SE and high power differential are not defined at Ultra2 speeds.

1.3 Benefits of LVD Link™

The SYM53C896 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. Ultra2 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.

For backward compatibility to existing SE devices, the SYM53C896 features universal LVD Link transceivers that can support LVD SCSI, SE, and HVD modes. The LVD Link technology also supports HVD signaling in legacy systems, when external transceivers are connected to the SYM53C896. This allows the SYM53C896 to be used in both legacy and Ultra2 SCSI applications.

1.4 TolerANT® Technology

The SYM53C896 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 LSI Logic *Symbios SYM53C896 PCI to Dual Channel Ultra2 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 the SYM53C896 and all LSI Logic fast SCSI, Ultra SCSI, and Ultra2 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 SYM22902 Host Adapter

This chapter provides instructions on how to install the SYM22902 host adapter board 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 SYM22902 host adapter, 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 SYM22902 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 A.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 SYM22902 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 LSI Logic *Symbios 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 SYM22902 host adapter board, 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 Chapter 3, "Configuring the SYM22902 Host Adapter").
  - 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 this host adapter board.

Step 2. Remove the SYM22902 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 A.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 SYM22902 requires a PCI slot that allows bus master operation. Figure 2.2 is a representative drawing of a computer motherboard.

2.2.3 Inserting the Host Adapter

Perform the following steps to install the SYM22902 in your PC motherboard.

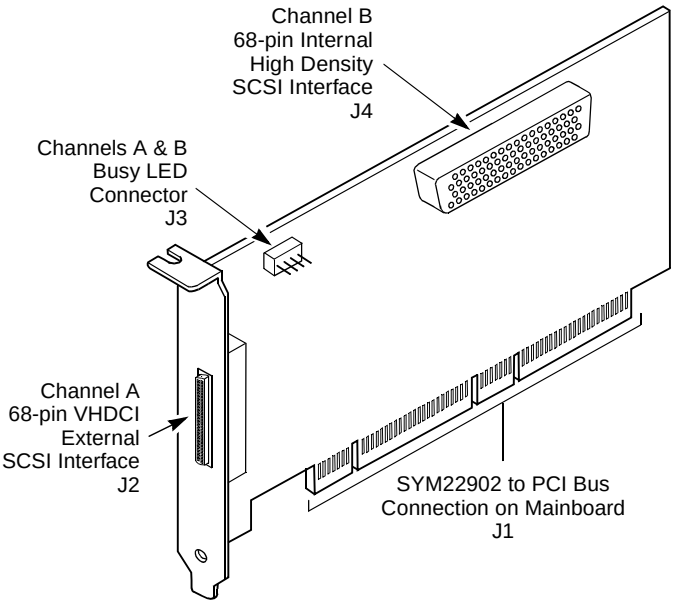
Step 1. Remove the blank bracket panel on the back of the computer aligned with the PCI slot you intend to use.

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.

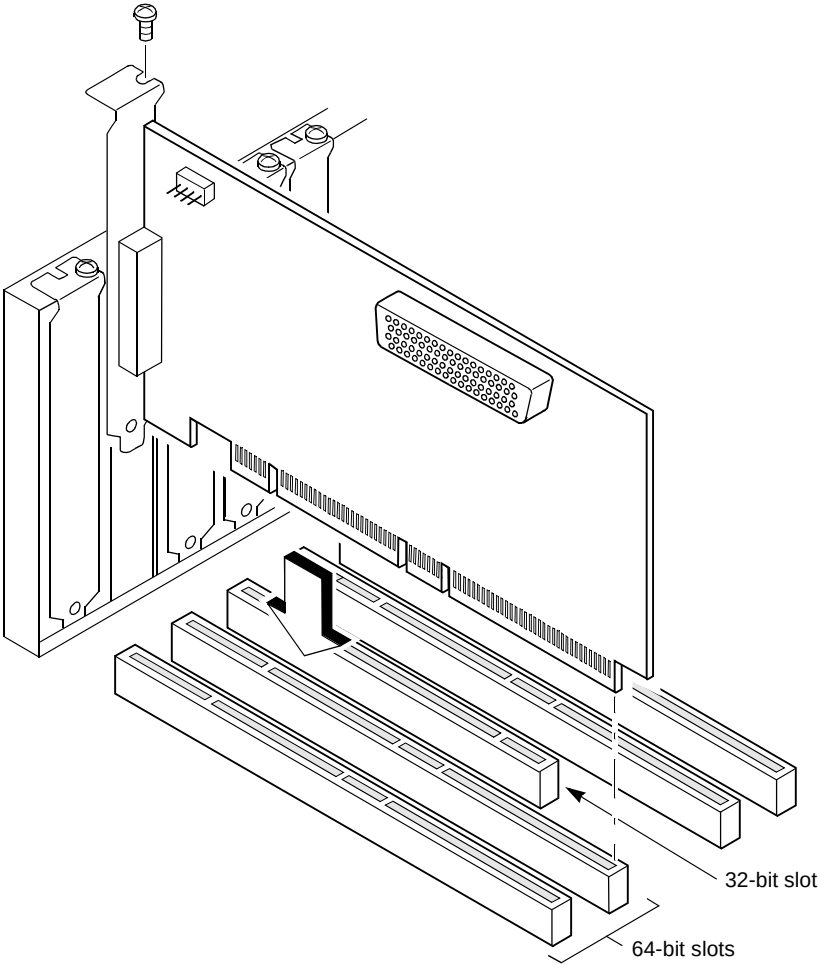
Figure 2.1 Hardware Connections for the SYM22902 Host Adapter



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

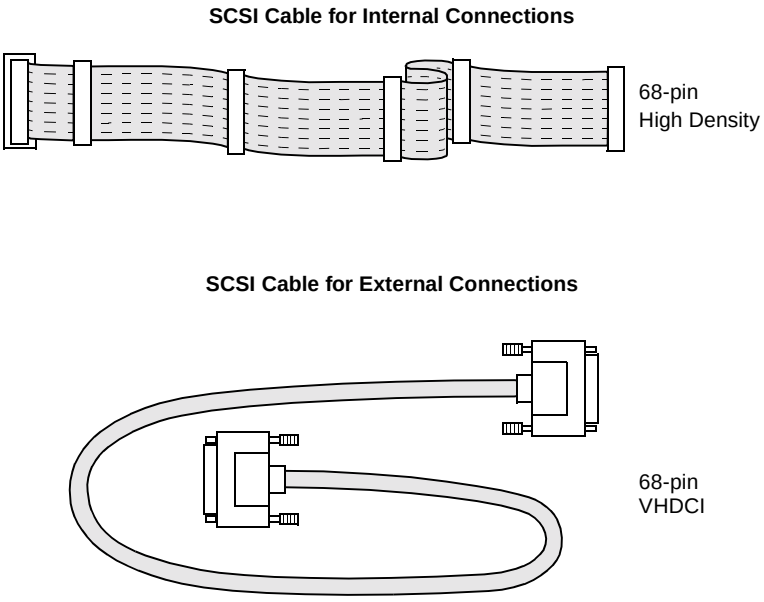


2.2.4 Connecting SCSI Peripherals

All internal SCSI bus connections to the SYM22902 host adapter 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. Use Ultra/Ultra2 rated cables for these bus speeds. (See Table 1.1.)

All external SCSI bus connections to the SYM22902 host adapter 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 a LVD/SE emulator on one end. This end should be furthest from the host adapter.

Figure 2.3 SCSI Cables

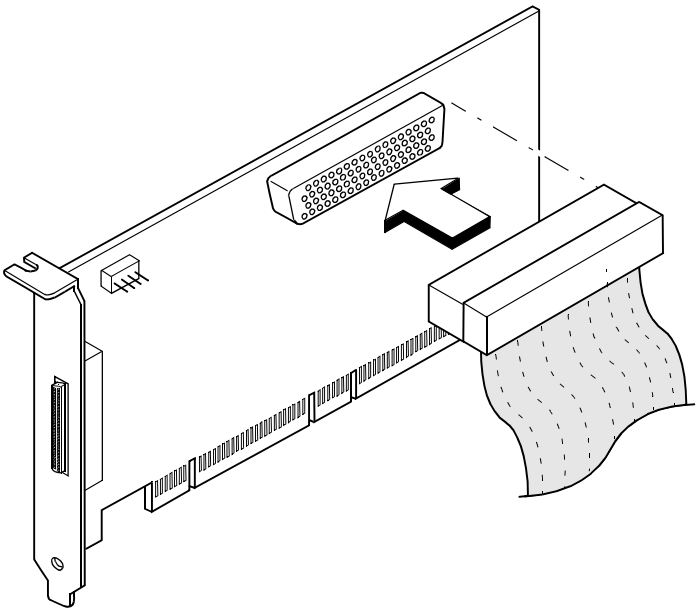


2.2.4.1 Making Internal SCSI Bus Connections

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.

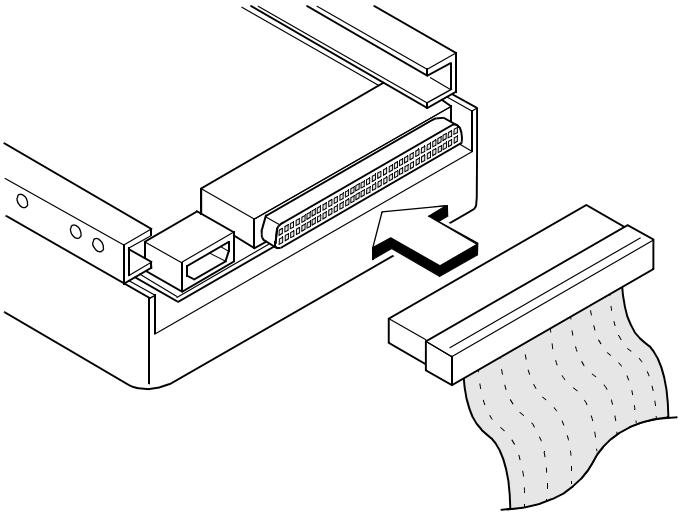
Figure 2.4 Internal SCSI Ribbon Cable to Host Adapter



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

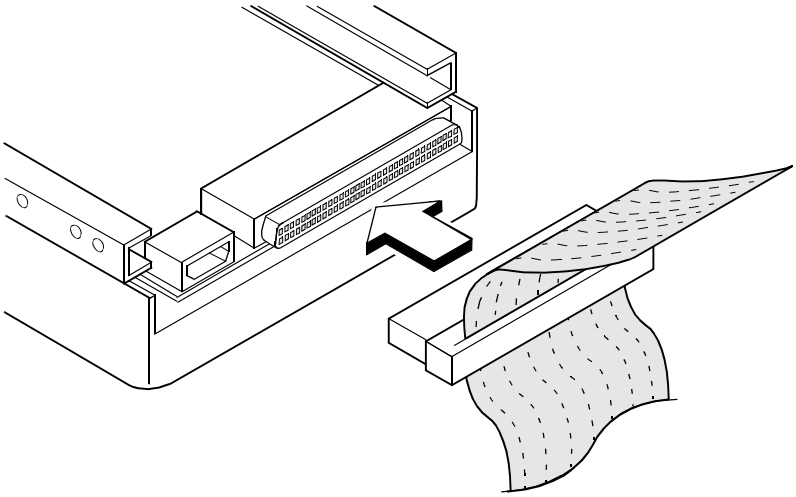
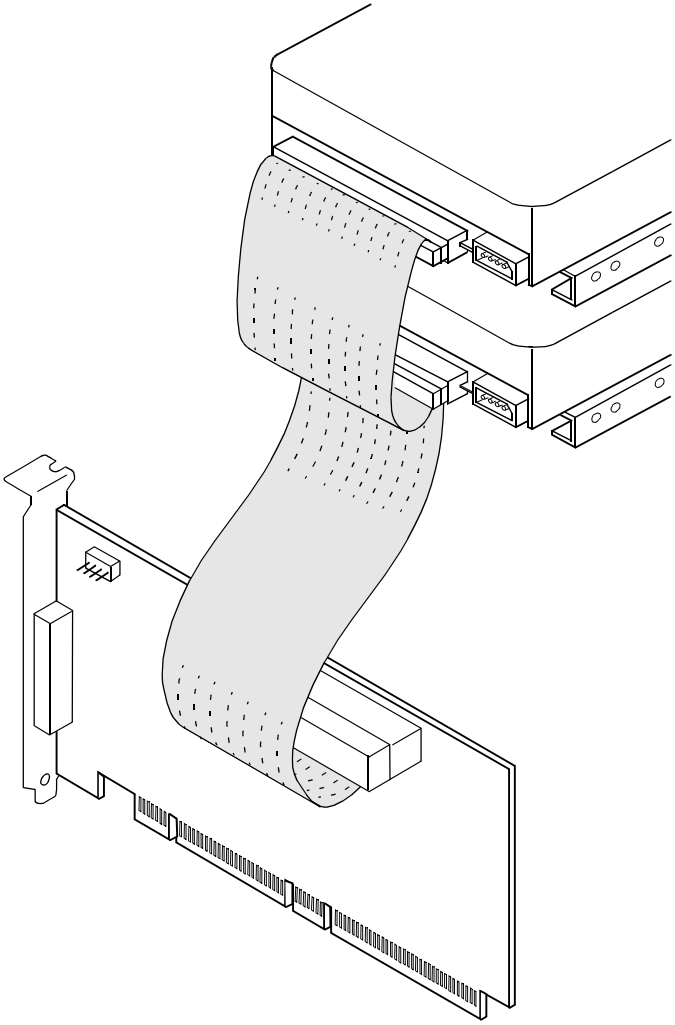


Figure 2.7 Multiple Internal SCSI Devices Chained Together



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.

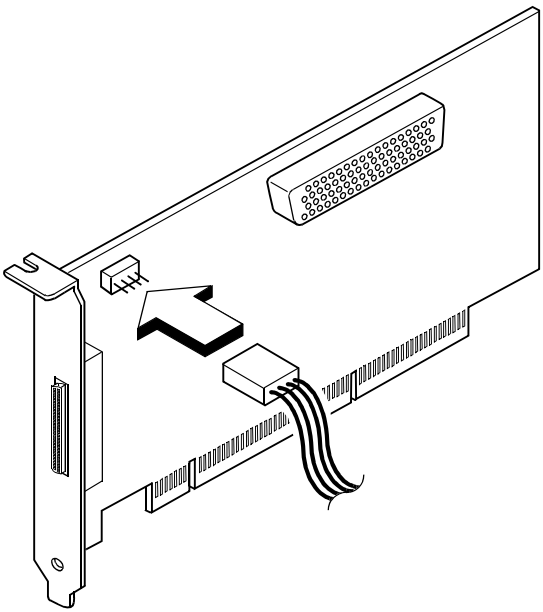
Step 4. Connect the LED cable to J3 on your SCSI host adapter, as shown in Figure 2.8.

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 SYM22902 host adapter board that indicates activity on the SCSI bus.

See Table A.5 for connector pin out information.

Figure 2.8 SCSI LED Connector



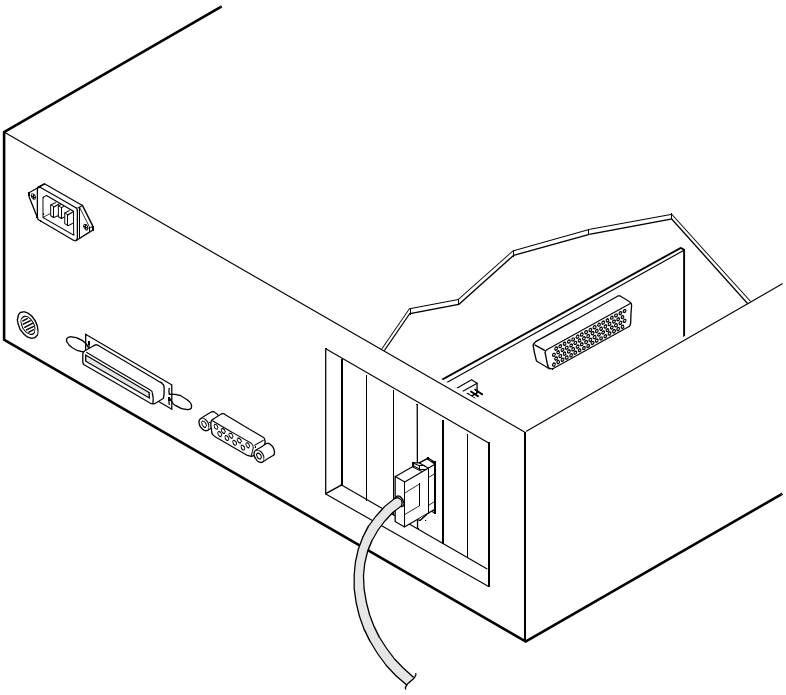
2.2.4.2 Making External SCSI Bus Connections

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.

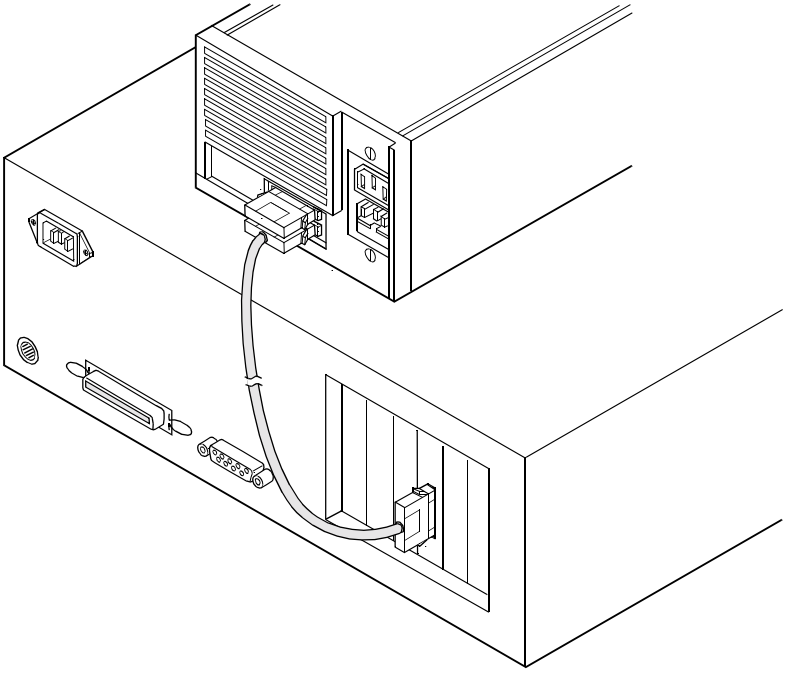
Figure 2.9 External Cable to Host Adapter



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.

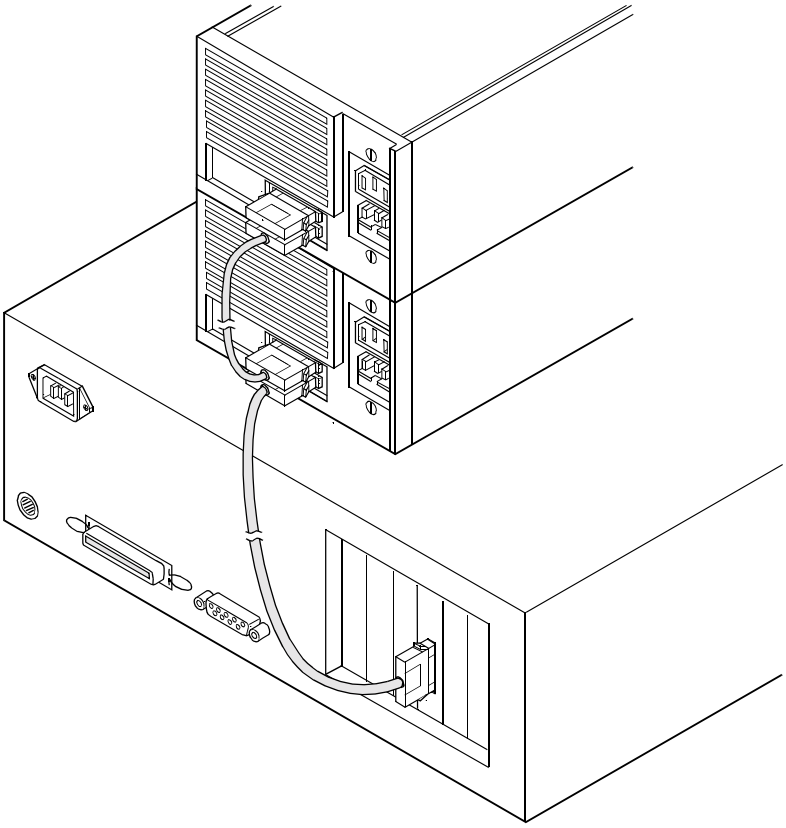
Figure 2.10 External Cable to External SCSI Device



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 to allow three modes of termination. 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 SYM22902 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:

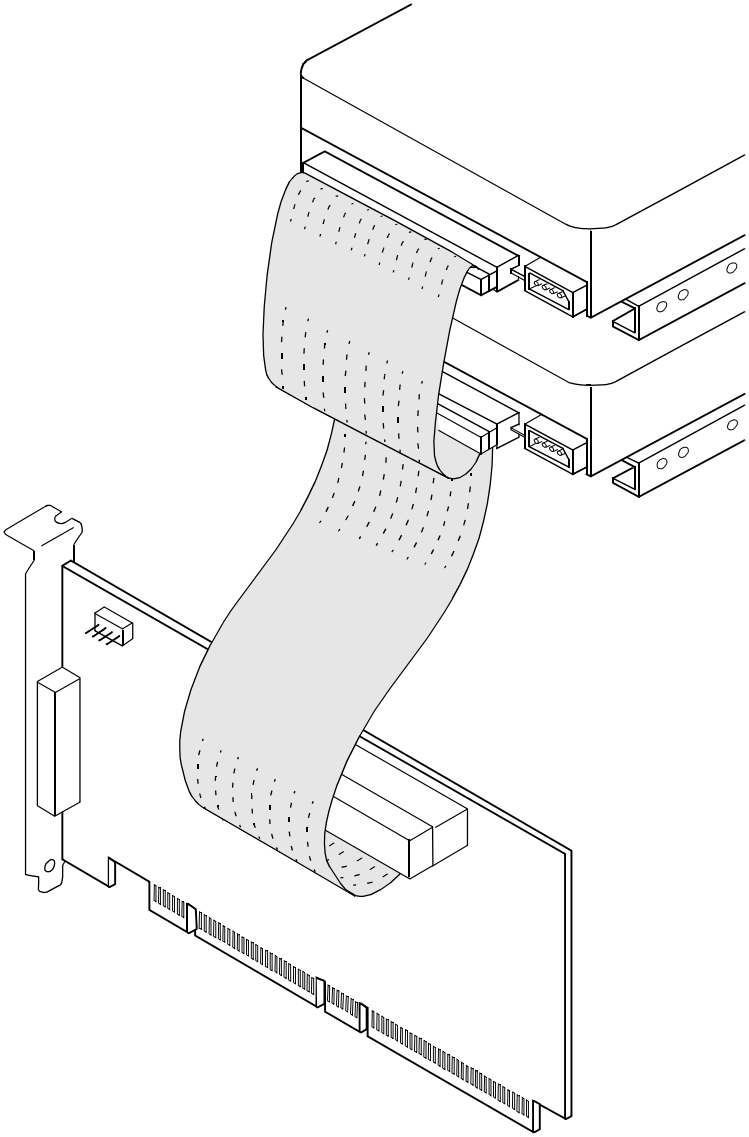
- Use BIOS software control, where the BIOS termination option is changed from Auto to Off.
- Manually place Channel A shunt DIS_A and Channel B shunt DIS_B on both posts of their respective jumpers.

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



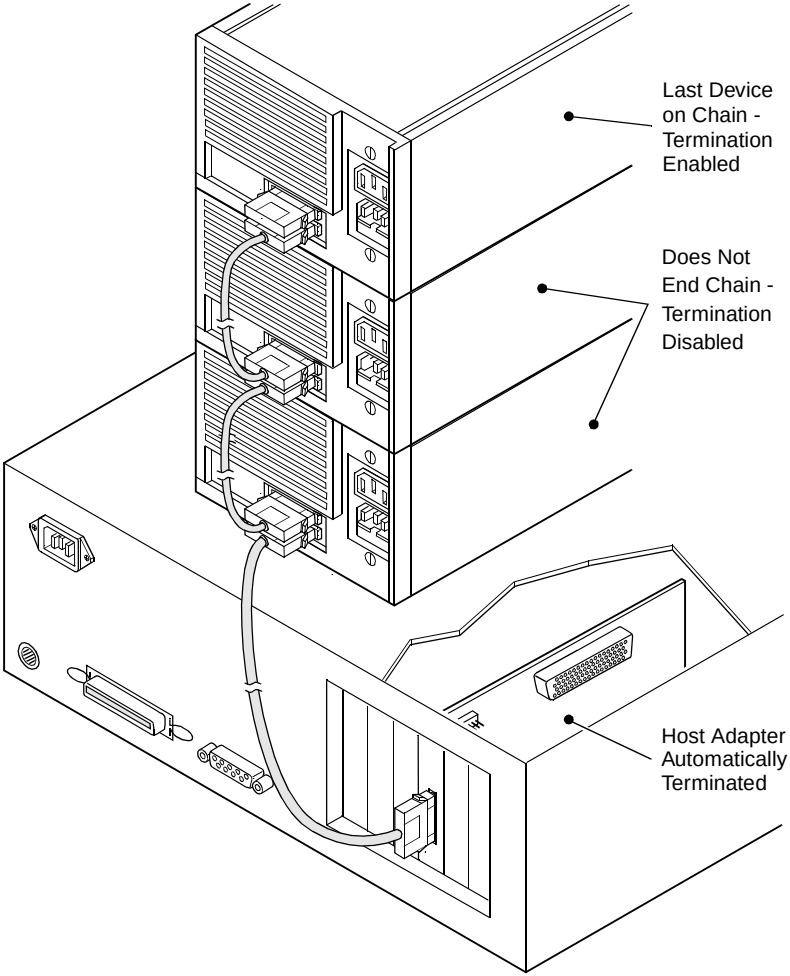
2.2.5.2 External SCSI Terminations

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. Chapter 3, "Configuring the SYM22902 Host Adapter" explains how to set your host adapter ID using the Symbios 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.

Note: As SCAM (SCSI Configured AutoMatically) support is off by default for the SYM53C896 Version 4.11.00 and above, you may choose to turn this on to assist in assigning SCSI IDs.

Step 1. Determine the SCSI ID of each device on the SCSI bus. Note any duplications.

Step 2. Make any necessary changes to the SCSI IDs and record the IDs for future reference. Correct any duplications at this time. Table 2.1 on page 2-21 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	SYM22902 (default)	SYM22902 (default)
6		
5		
4		
3		
2		
1		
0		

2.2.7 Setting Interrupts

Normally, you do not change the default interrupt routing for the SYM22902, 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 A.1) 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 Chapter 3, “Configuring the SYM22902 Host Adapter”.

Step 5. Refer to the LSI Logic *Symbios 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
Configuring the SYM22902 Host Adapter

This chapter describes configuring the SYM22902 host adapter and includes these topics:

3.1 Overview of the SCSI BIOS Configuration Utility

The SYM22902 host adapter is loaded with Symbios SCSI BIOS and Configuration Utility Version 4.16. This chapter describes the process you need to follow to change the configuration settings on your board.

The SDMS SCSI BIOS provides support for the BIOS Boot Specification (BBS), which allows you to choose which device to boot from by selecting the priority.

To use this feature, the system BIOS must also be compatible with the BBS. If your system supports the BBS, then you will use the system BIOS Setup Menu to select the boot and drive order. In the system BIOS setup, the Boot Connection Devices Menu appears with a list of available boot options. Use that menu to select the device and rearrange the order. Then exit to continue the boot process.

In most cases, you should not need to change the default configuration of the host adapter. You may decide to alter these default values if there is a conflict between device settings or if you need to optimize system performance.

There are four sets of configurations you can change. You make changes on subordinate menus called from the Main Menu, which is opened when you start the SCSI BIOS Configuration Utility. The subordinate menus are listed below.

- Adapter Properties
- Device Properties
- Boot Adapter List
- Global Properties

All these properties are controlled by menus you access through the configuration utility through the Main Menu. The Main Menu also gives an overview of some properties of installed Symbios host adapter boards.

3.2 Starting the Configuration Utility

You can see the version number of your Symbios SCSI BIOS in a banner displayed on your computer monitor during boot. If the utility is available, the following message also appears on your monitor:

```
Press Ctrl-C to start Symbios Configuration Utility...
```

This message remains on your screen for about five seconds, giving you time to start the utility. If you decide to press “Ctrl-C,” the message changes to:

```
Please wait, invoking Symbios Configuration Utility...
```

After a brief pause, your computer monitor displays the Main Menu of the Symbios SCSI BIOS Configuration Utility.

These messages may appear during the boot process:

- “`Adapter removed from boot order, parameters will be updated accordingly`” appears when an adapter is removed from the system or relocated behind a PCI bridge.
- “`Configuration data invalid, saving default configuration!`” appears if none of the information in the NVRAM is valid.

- "`Found SCSI Controller not in following Boot Order List, to Add: Press Ctrl-C to start Symbios Configuration Utility...`" appears when less than four adapters are in the boot order and more adapters exist than are shown.

NonVolatile Random Access Memory (NVRAM) is available on the SYM22902 host adapter. Changes can be made and stored using this menu driven utility.

Important: This utility is a powerful tool. If, while using it, you somehow disable all of your controllers you can recover. Pressing Ctrl-E after memory initialization during a reboot allows you to re-enable and reconfigure.

Note: Not all devices detected by the SCSI BIOS Configuration Utility can be controlled by the BIOS. Devices such as tape drives and scanners require that a device driver specific to that peripheral be loaded. This device driver is provided by the device manufacturer.

3.3 The Symbios SCSI BIOS Configuration Utility Menus

This section describes the menu system of the Symbios SCSI BIOS Configuration Menu System.

3.3.1 Using the Menus

You make your configuration changes in the main area (central portion) of the menu. As in the example menus shown in the figures, it is lighter in color than the header or footer areas on the top and bottom of the menu. The commands you use to make changes are shown in the footer area and described in Table 3.1. Settings with black text can be changed, while settings with white text cannot. This is true regardless of whether the Color or Mono setting is chosen in the Global Properties Menu (Figure 3.6), which is described in Section 3.3.6, "Global Properties Menu".

Table 3.1 Configuration Commands

Command	Description
F1 = Help	Provides context sensitive help for the cursor resident field.
Arrow Keys = Select Item	Move the cursor up, down, left, or right.
+/– = Change [Item]	Changes items with values in [ ] brackets. Only the numeric keypad '+' and '–' are enabled. When pressed, they toggle modifiable field to its next relative value. '+' toggles the value up and '–' toggles the value down.
Esc = Abort/Exit	Aborts the current context operation and/or exits the current screen. This option calls an Exit Menu, described further in Section 3.4.
Home/End = Select Item	Moves the cursor to the start/end of a scrollable field.
Enter = Execute <Item>	Executes options with values in < > brackets. Press Enter to execute the field's associated function.
F2 = Menu	Sets cursor context to the Optional Menu area. Select a menu item and press **Enter.** This option is only available from the Main Menu.

3.3.2 Main Menu

When you start the Symbios SCSI BIOS Configuration Utility, the Main Menu appears. Figure 3.1 provides an example of this menu, which displays a list of installed Symbios PCI to SCSI host adapters. This list displays up to four boards with information about each one and a series of other menu options.

At the opening menu, the cursor is on one of the listed adapters. If you need to change the configuration of an adapter, move to the board you want to change with the arrow keys and press Enter. This calls the Adapter Properties Menu described in detail on page 3-7. From this menu you can view and/or change the current settings for that adapter and the SCSI devices attached to it. You can select an adapter only if Current Status is "On." Changes are possible since NVRAM is present on this host adapter.

Figure 3.1 Main Menu

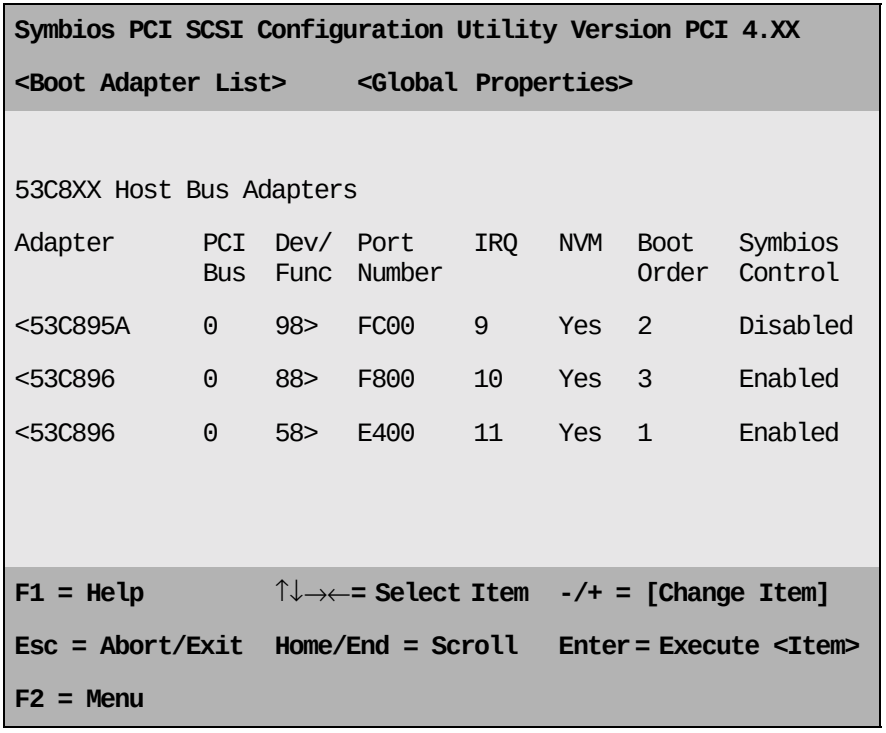


Table 3.2 lists the Main Menu fields and their descriptions.

Table 3.2 Main Menu Fields and Descriptions

Fields	Descriptions
Adapter	Indicates the specific SYM53C8XX Host Adapter.
PCI Bus	Indicates the PCI Bus number (range 0x00–0xFF, 0–255 decimal) assigned by the system BIOS to an adapter.
Dev/Func	Indicates the PCI Device/Function assigned by the system BIOS to an adapter. The 8-bit value is mapped as follows: Bit # 7 6 5 4 3 2 1 0 Bits [7:3]: Device (range 0x00–0x1F, 0–31 decimal) Bits [2:0]: Function (range 0–7)

Table 3.2 Main Menu Fields and Descriptions (Cont.)

Fields	Descriptions
Port Number	Indicates which I/O port communicates with an adapter, as assigned by the system BIOS.
IRQ	Indicates the Interrupt Request Line used by an adapter, as assigned by the system BIOS.
NVM	Indicates whether an adapter has NVM (NonVolatile Memory) associated with it. An adapter's configuration is stored in its associated NVM. NVM can refer to NVRAM that is resident on a host adapter or to system NonVolatile Storage (NVS).
Boot Order	Indicates the relative boot order (0 to 3) of an adapter. The Symbios SCSI BIOS traverses up to four adapters in the specified order in search of bootable media. To modify this field, access the Boot Adapter List Menu.
Symbios	Indicates whether an adapter is eligible for LSI Logic Symbios software control or is reserved for control by non-Symbios software.

3.3.3 Adapter Properties Menu

The Adapter Properties Menu allows you to view and modify adapter settings and as well as the SCSI devices connected to it. It also provides access to an adapter's device settings. To display this menu, select a device in the Adapter field on the Main Menu and press Enter. After pressing Enter, the following message flashes before the menu appears: "`Initializing the adapters, reading for non-volatile settings, and scanning for devices.....`". After a few seconds, the Adapter Properties Menu appears. Figure 3.2 provides an example of this menu.

Figure 3.2 Adapter Properties Menu

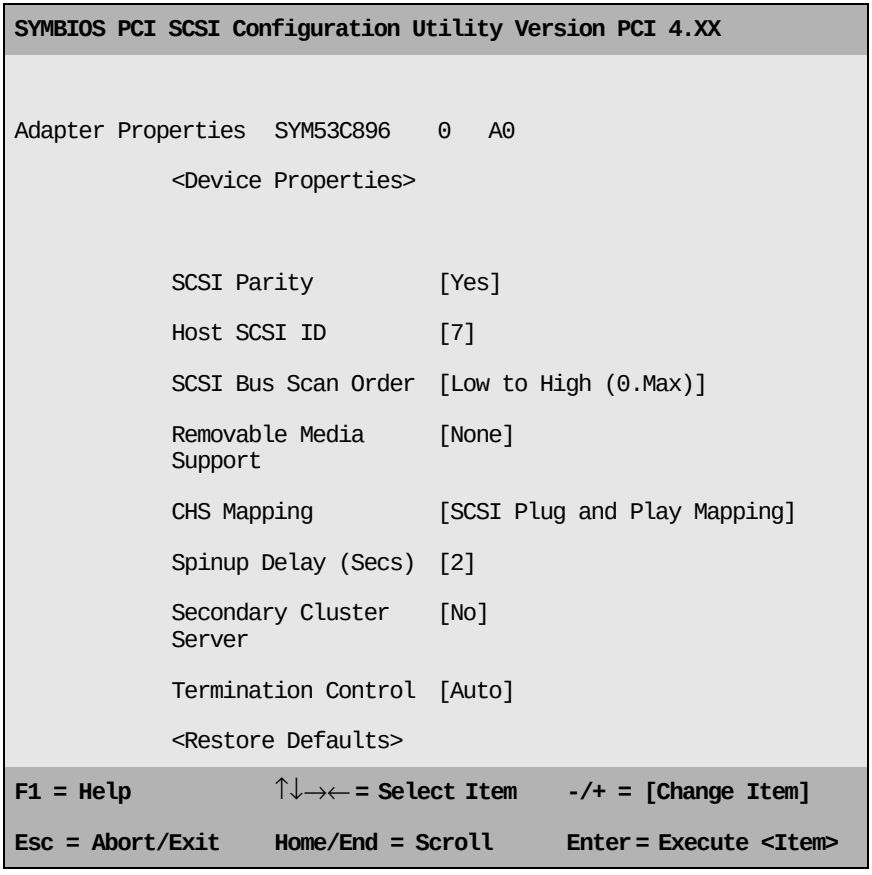


Table 3.3 lists the fields you can access and their descriptions.

Note: If the field displays in black text, it is available for changes. If it displays in white text, it is not available.

Table 3.3 Adapter Properties Fields and Descriptions

Field	Field Type [Value]	Descriptions
Device Properties	Executable	Select this option and press Enter to view and modify device properties.
SCSI Parity	Configuration [Yes/No]	Indicates whether SCSI parity is enabled for an adapter. When disabled, it is also necessary to disable disconnects for all devices, as parity checking for the reselection phase is not disabled. If a non-parity generating device disconnects, its operation will never complete because the reselection fails due to parity error.
Host SCSI ID	Configuration [0 to 7 / 0 to 15]	Indicates the SCSI identifier of an adapter. It is recommended that this field be set to the highest priority SCSI identifier, which is 7.
SCSI Bus Scan Order	Configuration [Low to High (0 to Max) / High to Low (Max to 0)]	Indicates the order in which to scan SCSI identifiers on an adapter. Changing this item affects drive letter assignment(s) if more than one device is attached to an adapter.
Removable Media Support	Configuration [None / Boot Drive Only / With Media Installed]	Specifies the removable media support option for an adapter. Removable media support only applies to devices that report themselves as a hard drive. It does not apply to CD-ROM devices or Magnetic Optical devices. **None** indicates no removable media support. **Boot Drive Only** provides removable media support for a removable hard drive if it is first in the scan order. **With Media Installed** provides removable media support regardless of the drive letter assignment.

Table 3.3 Adapter Properties Fields and Descriptions (Cont.)

Field	Field Type [Value]	Descriptions
CHS mapping	Configuration [SCSI Plug and Play Mapping / Alternate CHS Mapping]	Defines how the Cylinder Head Sector (CHS) values are mapped onto a disk without pre-existing partition information. SCSI Plug and Play Mapping automatically determines the most efficient and compatible mapping. Alternate CHS Mapping utilizes an alternate, possibly less efficient mapping that may be required if a device is moved between adapters from different vendors. **Note:** Neither of these options has any effect after a disk has been partitioned using the FDISK command. To change the CHS Mapping on a partitioned disk, use FDISK to delete all partitions. Then reboot the system to clear memory or the old partitioning data will be reused, thus nullifying the previous operation. **Caution:** Use care to ensure that the correct disk is the target of an FDISK command.
Spinup Delay (Seconds)	Configuration [1 to 15]	Indicates the delay in seconds between spinups of devices attached to an adapter. Staggered spinups balance the total electrical current load on the system during boot. The default value is 2 seconds.
Secondary Cluster Server	Configuration [Yes / No]	Indicates whether an adapter has one or more devices attached that are shared with one or more other adapters and therefore, the Symbios SCSI BIOS should avoid SCSI bus resets as much as possible. This option allows the user to enable an adapter to join a cluster of adapters without doing any SCSI bus resets. This is a requirement for Microsoft Cluster Server. The default value is No with an alternate option of Yes.
Termination Control	Configuration [Auto / Off]	If available, the field indicates whether an adapter has automatic termination control. Auto means that the adapter termination is on. Auto is the default state unless termination is done manually, in which case, the configuration is Off. Off means that termination for that channel is off.
<Restore Defaults>	Executable	Press Enter to obtain default settings.

3.3.4 Device Properties Menu

The Device Properties Menu allows you to view and update individual device settings for an adapter. Changing a setting for the host device (for example, SCSI ID 7) changes the setting for all devices. The number of fields displayed requires the menu to scroll left/right in order to display the information. When accessing this menu online, use the Home/End keys to scroll to columns currently not displayed. The scroll indicator on the bottom of the menu shows where the cursor is relative to the first and last columns. The example for the Device Properties Menu is presented in two figures, Figure 3.3 and Figure 3.4, due to the width of its multiple fields/columns.

Figure 3.3 Device Properties Menu (Left Half)

Symbios PCI SCSI Configuration Utility Version PCI 4.XX

Device Properties 53C896 0 A0

SCSI ID	Device Identifier	MB/sec	MT/sec	Data Width	Scan ID	Scan LUNs>0	Disconnect
0	Quantum Viking 4.5	[80]	[40]	[16]	[Yes]	[Yes]	[On]
1	Quantum Viking 4.5	[80]	[40]	[16]	[Yes]	[Yes]	[On]
2	Quantum Viking 4.5	[80]	[40]	[16]	[Yes]	[Yes]	[On]
3	Quantum Viking 4.5	[80]	[40]	[16]	[Yes]	[Yes]	[On]
4	Quantum Viking 4.5	[80]	[40]	[16]	[Yes]	[Yes]	[On]
5	Quantum Viking 4.5	[80]	[40]	[16]	[Yes]	[Yes]	[On]
6	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
7	53C896	[80]	[40]	[16]	[Yes]	[Yes]	[On]
8	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
9	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
10	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
11	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
12	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
13	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
14	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]
15	-	[80]	[40]	[16]	[Yes]	[Yes]	[On]

<<

F1 = Help **↑↓→←= Select Item** **-/+ = [Change Item]**

Esc = Abort/Exit **Home/End = Scroll** **Enter= Execute <Item>**

Figure 3.4 Device Properties Menu (Right Half)

Symbios PCI SCSI Configuration Utility Version PCI 4.XX

Device Properties SYM53C896 0 A0

SCSI ID	Device Identifier	SCSI Timeout	Queue Tags	Boot Choice	Format	Verify	Restore Defaults
0	Quantum Viking 4.5	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
1	Quantum Viking 4.5	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
2	Quantum Viking 4.5	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
3	Quantum Viking 4.5	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
4	Quantum Viking 4.5	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
5	Quantum Viking 4.5	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
6	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
7	53C896	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
8	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
9	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
10	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
11	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
12	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
13	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
14	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>
15	-	< 10>	[On]	[No]	[Format]	[Verify]	<Defaults>

>>

F1 = Help **↑↓→← = Select Item** **-/+ = [Change Item]**

Esc = Abort/Exit **Home/End = Scroll** **Enter = Execute <Item>**

Table 3.4 lists the fields on this menu and their descriptions.

Table 3.4 Device Properties Fields and Descriptions

Field	Field Type [Value]	Description
SCSI ID	Information	Indicates the device's SCSI Identifier.
Device Identifier	Information	Indicates the ASCII device identifier string, as extracted from the device's inquiry data.
MB/sec	Configuration	Indicates the maximum synchronous data transfer rate in megabytes per second.
MT/sec	Configuration 0 / 5 / 10 / 20 / 40	Indicates the maximum synchronous data transfer rate in megatransfers per second. Mega Xfers per second: 0 = Asynch; 5; 10; 20; 40 Data Width = 8 bits: 0 = Asynch; 5; 10; 20; 40 Data Width = 16 bits: 0 = Asynch; 10; 20; 40; 80 Synch Period (ns): 0 = Asynch; 200; 100; 50; 25
Data Width	Configuration [8 / 16]	Maximum data width in bits.
Scan ID	Configuration [Yes / No]	Indicates whether to scan for this SCSI identifier at boot time. Utilizing this setting allows you to ignore a device. This decreases boot time by disabling inquiry of unused SCSI identifiers. Set this option to **No** if there is a device that you do not want to be available to the system. Also, on a bus with only a few devices attached, the user can speed up boot time by changing this setting to **No** for all unused SCSI IDs.

Table 3.4 Device Properties Fields and Descriptions (Cont.)

Field	Field Type [Value]	Description
Scan LUNs > 0	Configuration [Yes / No]	Indicates whether to scan for LUNs greater than zero for a device. LUN 0 is always queried. This option should be used if a multi-LUN device responds to unoccupied LUNs or if it is desired to reduce the visibility of a multi-LUN device to LUN 0 only. Set this option to **No** if you have problems with a device that responds to all LUNs whether they are occupied or not. Also, if a SCSI device with multiple LUNs exists on your system but you do not want all of those LUNs to be available to the system, then set this option to **No**. By doing so, you will limit the scan to LUN 0.
Disconnect	Configuration [On / Off]	Indicates whether to allow a device to disconnect during SCSI operations. Some (usually newer) devices run faster with disconnect enabled, while some (usually older) devices run faster with disconnect disabled.
SCSI Timeout	Executable [0–9999]	Indicates the maximum allowable time for completion of a SCSI operation in seconds. Since time-outs provide a safeguard that allow the system to recover should an operation fail, it is recommended that a value greater than zero be used. A value of zero allows unlimited time for an operation to complete and could result in the system hanging (waiting forever) should an operation fail. **Note**: This field is executable and must be selected by pressing **Enter**. You also input the new value with the number keys from the keyboard, not the number pad.
Queue Tags	Configuration [On / Off]	Indicates whether to allow a device to use queue tags. Currently the BIOS does not use queue tags. This item specifies queue tag control to higher level device drivers.
Boot Choice	Configuration [Yes / No]	Indicates whether this device can be selected as the boot device. This option is only applicable to devices attached to adapter number zero in the boot list on non-BBS systems. It provides primitive BBS flexibility to non-BBS systems.

Table 3.4 Device Properties Fields and Descriptions (Cont.)

Field	Field Type [Value]	Description
Format	Executable	Allows low-level formatting on a disk drive, if enabled. Low-level formatting completely and irreversibly erases all data on the drive. To low level format a device, select the device from the menu and use the arrow keys to move the cursor to the Format column. Press **Enter**. **Note:** Formatting will default the drive to a 512-byte sector size even if the drive had previously been formatted to another sector size.
Verify	Executable	Allows verification of all sectors on a device and reassigns defective Logical Block Addresses, if enabled. To verify all sectors, select the device from the menu and use the arrow keys to move the cursor to the Verify column. Press **Enter**.
<Restore Defaults>	Executable	Press **Enter** to obtain default settings.

3.3.5 Boot Adapter List Menu

The Boot Adapter List Menu specifies the order in which adapters boot when there are multiple Symbios adapters in a system. Up to four of the adapters in a system can be selected as bootable. This menu may also list additional adapters in your system that are not bootable. As many as 256 adapters can be listed. To control a Boot Volume, only one of the four “active” controllers can be used.

To select this menu:

1. Press F2 while on the Main Menu to move the cursor to the Optional Menu area.
2. Move the cursor to Boot Adapter List with the arrow keys.
3. Press Enter.

Adapters can be added or deleted using this menu. Use the arrow keys to move the cursor to the lower list, the adapter select list, to add or remove an adapter. To add an adapter to the boot list, press the Insert key while on the Boot Adapter List. Use the arrow keys to select the desired adapter and press Enter to add it to the end of the Boot Adapter List. To change the configuration of the adapter, use the arrow keys to move to the configuration you want to alter.

To remove an adapter from the boot list, press the Delete key while on the desired adapter in the Boot Adapter List.

Note: If a new device is added after this utility loads, it can only be seen in the adapter configuration section of this utility after a reboot. You must exit the utility and restart it for the new device to be seen by the SCSI BIOS Configuration Utility.

Figure 3.5 provides an example of the Boot Adapter List Menu.

Figure 3.5 Boot Adapter List Menu

```
Symbios PCI SCSI Configuration Utility Version PCI 4.XX


Boot Adapter List
Insert = Add an adapter          Delete = Remove an adapter
Adapter          PCI    Dev/    Boot    Current   Next
                 Bus    Func    Order   Status    Boot
<53C895A         0      98>     [2]     Off       [On]
<53C896          0      88>     [1]     On        [Off]
<53C896          0      58>     [0]     On        [On

Hit Insert to select an adapter from this list.
<53C895A         0      98>
<53C896          0      88>
<53C896          0      58>

F1 = Help        ↑↓→← = Select Item      -/+ =[Change Item]
Esc = Abort/Exit Home/End = Scroll       Enter=Execute <Item>
```

Table 3.5 lists the fields on this menu and their descriptions.

Table 3.5 Boot Adapter List Fields and Descriptions

Field	Field Type [Value]	Description
Adapter	Information	Indicates the specific SYM53C8XX Host Adapter.
PCI Bus	Information	Indicates the PCI Bus number (range 0x00–0xFF, 0–255 decimal) assigned by the system BIOS to an adapter.
Dev/Func	Information	Indicates the PCI Device/Function assigned by the system BIOS to an adapter. An 8-bit value is mapped as follows: Bit # 7 6 5 4 3 2 1 0 Bits [7:3]: Device (range 0x00–0x1F, 0–31 decimal) Bits [2:0]: Function (range 0–7)
Boot Order	Configuration [0 to 3]	Indicates the relative boot order of the listed adapter. The Symbios SCSI BIOS traverses up to four adapters, in the specified order, searching for bootable media.
Current Status	Information	Indicates whether an adapter in the boot list was enabled during the most recent boot. Disabled adapters and their attached devices are ignored by the Symbios SCSI BIOS, although they are still visible to the configuration utility.
Next Boot	Configuration [On / Off]	Indicates whether to enable an adapter upon the next boot. The Symbios SCSI BIOS ignores disabled adapters and their attached devices although they are still visible to the configuration utility.

3.3.6 Global Properties Menu

The Global Properties Menu allows you to view display boot information and to set display and video modes. Figure 3.6 provides an example of the Global Properties Menu.

Figure 3.6 Global Properties Menu

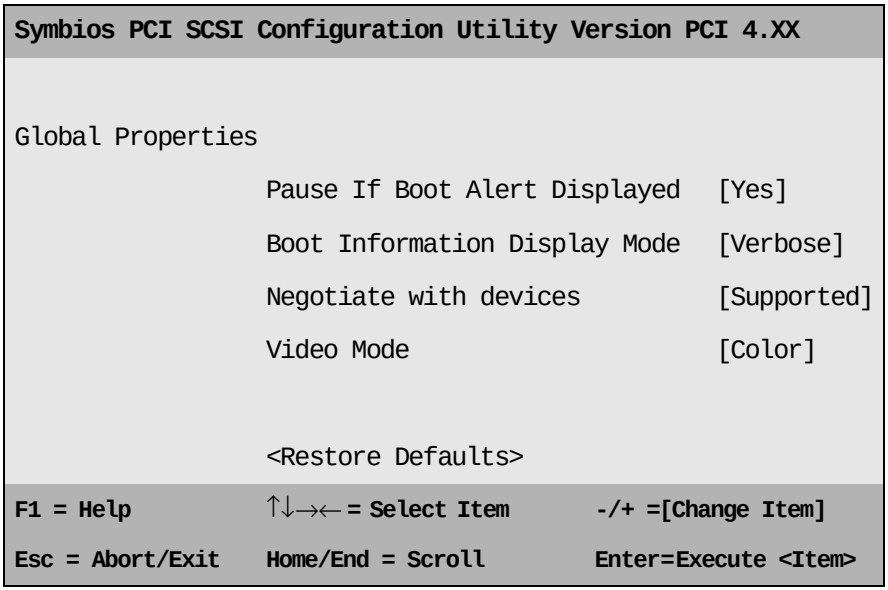


Table 3.6 lists the fields on this menu and their descriptions.

Table 3.6 Global Properties Fields and Descriptions

Field	Field Type [Value]	Description
Pause When Boot Alert Displayed	Configuration [Yes / No]	Specifies a pause during the boot for user acknowledgement. The pause occurs after displaying an alert message. To continue after displaying a message, specify **No**. To wait for any key after displaying a message, specify **Yes**.
Boot Information Display Mode	Configuration [Terse / Verbose]	Specifies how much BIOS information displays during boot. To display minimum information, specify **Terse** mode. To display detailed information, specify **Verbose** mode.
Negotiate with Devices	Configuration [All, None, Supported]	Sets the default value for synchronous and wide negotiations with specified devices.
Video Mode	Configuration [Color / Monochrome]	Specifies the default video mode for the SCSI BIOS Configuration Utility. The monochrome setting enhances readability on a monochrome monitor.
<Restore Defaults>	Executable	Press **Enter** to obtain default settings.

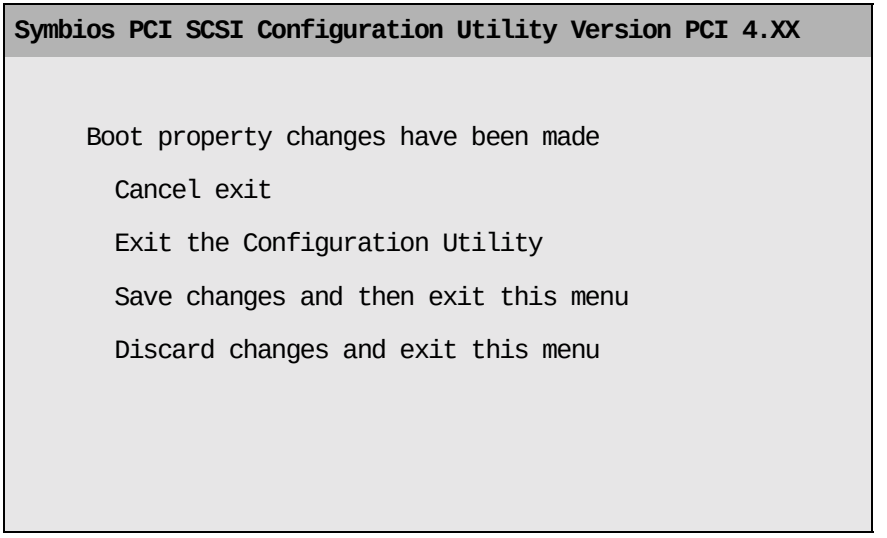
3.4 Exiting the SCSI BIOS Configuration Utility

Since most changes only take effect after the system reboots, you must properly exit the SCSI BIOS Configuration Utility. The proper exit technique is described below. It also describes exiting the subordinate menus.

3.4.1 Exit Menu

The Exit Menu for the SCSI BIOS Configuration Utility is used for all five of the menus listed above. However, the available functionality is different for the Main Menu and the four subordinate menus. Figure 3.7 provides an example of the Exit Menu.

Figure 3.7 Exit Menu



If you are exiting Adapter Properties, Device Properties, Boot Adapter List, or Global Properties, the Exit Menu gives you the following options:

Cancel exit	This option returns you to the previous menu.
Save changes and exit this menu	This option implements any changes you made on the previous menu and returns you to the main menu.
Discard changes and exit this menu	This option restores the default settings and returns you to the Main Menu.

If you are exiting the Main Menu, the Exit Menu gives you the following options:

Cancel exit	This option returns you to the Main Menu.
Exit the Configuration Utility	This option closes the configuration utility and returns you to the DOS prompt.

Important: You must reboot in order for the changes you have made to take effect.

Appendix A
Technical Specifications

This appendix discusses the physical environment associated with the SYM22902 host adapter. It includes a mechanical drawing of this board, which is shown in Figure A.1. It also includes these topics:

A.1 Physical Environment

This section discusses the physical, electrical, thermal, and safety characteristics of the SYM22902 host adapter board. Additionally, this board is compliant with electromagnetic standards set by the FCC.

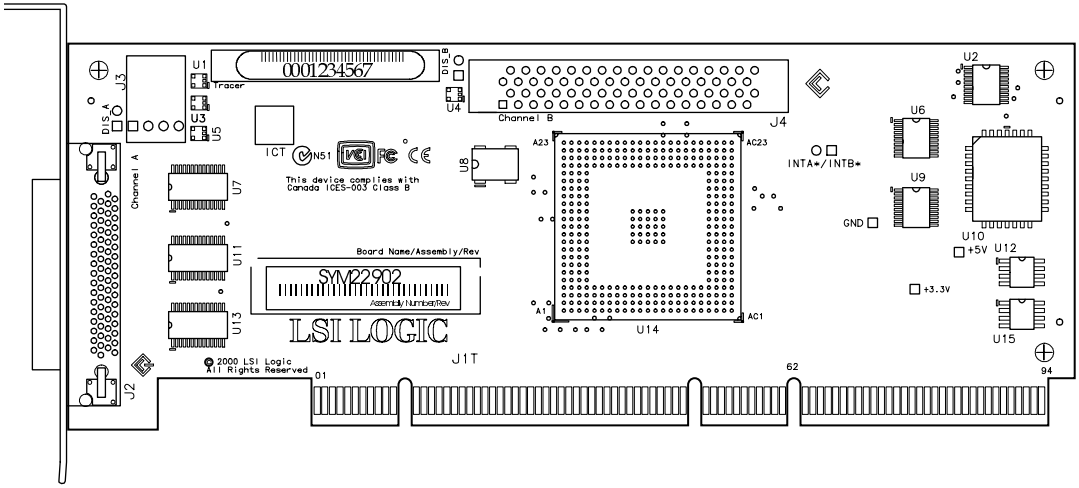
A.1.1 Physical Characteristics

The dimensions of the SYM22902 host adapter board 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 SYM22902 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 Low Profile PCI (LPPCI) or ISA/EISA bracket, which is attached to the face of the connector outside of the cabinet where the SYM22902 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 A.1 SYM22902 Mechanical Drawing



A.1.2 Electrical Characteristics

The SYM22902 maximum power requirements that include SCSI TERMPWR (termination power) under normal operation are:

Table A.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.

A.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

A.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.

A.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.

A.2 Operational Environment

The SYM22902 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.

A.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 A.2, Table A.3, and Table A.4.

Note: The SYM22902 board uses 3.3 V pins to run the SYM53C896 chip and some other parts. The 3.3 V is required for the board to work through the host system.

Table A.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 A.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.

A.2.2 The SCSI Interface

The SCSI interface operates as two 16-bit, synchronous or asynchronous buses, and supports Ultra2 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 termination power is also supplied by the board. Table A.4 shows the signal assignments for J2 and J4.

Table A.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
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		

A.2.3 The LED Interface

The SYM22902 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 SYM22902 is J3 for both channels. Table A.5 lists the signal and pin numbers for the LED interface.

Table A.5 LED Connector J3 Pin Out

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

A.3 Subsystem ID and Subsystem Vendor ID

The Subsystem ID and System Vendor ID for the SYM22902 are provided in Table A.6. The ID numbers are contained in the SYM22902 EEPROM. During system initialization, the IDs are loaded into the Subsystem Vendor ID and Subsystem ID registers in the on-board controller chip, the SYM53C896. For more information on the operation of these registers, refer to the LSI Logic *Symbios SYM53C896 PCI to Dual Channel Ultra2 SCSI Multifunction Controller Technical Manual*.

Table A.6 Subsystem ID and Subsystem Vendor ID

Subsystem	ID
Subsystem Vendor ID	1000
Subsystem ID	1030

Appendix B
Glossary of Terms and Abbreviations

Active Termination	The electrical connection required at each end of the SCSI bus, which is composed of active voltage regulation and a set of termination resistors. Ultra and Ultra2 SCSI require active termination.
Address	A specific location memory, designated either numerically or by a symbolic name.
Asynchronous Data Transfer	A method of transmission which does not require a common clock, but separates fields of data by stop and start bits. It is slower than synchronous data transfer.
BIOS	Basic Input/Output System. Software that provides basic read/write capability. Usually kept as firmware (ROM based). The system BIOS on the mainboard of a computer is used to boot and control the system. The SCSI BIOS on your host adapter acts as an extension of the system BIOS.
Bit	A binary digit. The smallest unit of information a computer uses. The value of a bit (0 or 1) represents a two-way choice, such as on or off, true or false, and so on.
Bus	A collection of unbroken signal lines across which information is transmitted from one part of a computer system to another. Connections to the bus are made using taps on the lines.
Bus Mastering	A high-performance way to transfer data. The host adapter controls the transfer of data directly to and from system memory without bothering 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.
Chain	A topology in which every processor is connected to two others, except for two end processors that are connected to only one other.

CISPR	An 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.
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. A method of moving data from a storage device directly to RAM, without using the CPU’s resources.
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	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).
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 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.
LPPCI	Low Profile Peripheral Component Interconnect. A 1U and 2U mechanical implementation of the PCI 2.2 specification covered in the Low Profile PCI mechanical addendum. The electrical specifications remain the same as the PCI 2.2 requirements.
LUN	Logical Unit Number. An identifier, zero to seven, for a logical unit.

LVD	Low Voltage Differential. LVD is a robust design methodology that improves power consumption, data integrity, cable lengths and support for multiple devices, while providing a migration path for increased I/O performance.
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.
Mbyte	Megabyte. A measure of computer storage equal to 1024 kilobytes.
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).
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 Programmable 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. One 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, an error message appears.
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 ensure proper alignment, but internal SCSI ribbon cables are sometimes 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 allows 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 microcode scripts.
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 current SCSI specification which adds features to the original SCSI-1 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 ID 7 giving it priority to control the bus.
SDMS	Storage Device Management System. A LSI Logic software product that manages SCSI system I/O.
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.
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).
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.
Termination	The electrical connection required at each end of the SCSI bus, composed of a set of resistors and active devices. It improves the integrity of bus signals.
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. STA (SCSI Trade Association) supports using the term “Ultra SCSI” over the 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. STA (SCSI Trade Association) supports using the term “Ultra2 SCSI” over the older term “Fast-40”.
VCCI	Voluntary Control Council for Interference.
VHDCI	Very High Density Cable Interconnect. A trapezoidal shielded connector that has a 0.8 mm pitch.
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 STA (SCSI Trade Association) term for SCSI bus width 16-bits, SCSI bus speed maximum data rate 40 Mbytes/s.
Wide Ultra2 SCSI	The STA (SCSI Trade Association) term for SCSI bus width 16-bits, SCSI bus speed maximum data rate 80 Mbytes/s.
Word	A two byte (or 16-bit) unit of information.

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W. E. Tel: 800.568.9953
Miami
B. M. Tel: 305.477.6406
Orlando
A. E. Tel: 407.657.3300
W. E. Tel: 407.740.7450
Tampa
W. E. Tel: 800.395.9953
St. Petersburg
A. E. Tel: 727.507.5000

Georgia
Atlanta
A. E. Tel: 770.623.4400
B. M. Tel: 770.980.4922
W. E. Tel: 800.876.9953
Duluth
I. E. Tel: 678.584.0812

Hawaii
A. E. Tel: 800.851.2282

Idaho
A. E. Tel: 801.365.3800
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 (Component and HAB)

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

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18301 Von Karman Ave
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Irvine, CA 92612
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Pleasanton Design Center
5050 Hopyard Road, 3rd Floor
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Pleasanton, CA 94588
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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
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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
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4940 Pearl East Circle
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4420 Arrowswest Drive
Colorado Springs, CO 80907
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Oakbrook Terrace, IL 60181
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1262 Chestnut Street
Bowling Green, KY 42101
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6903 Rockledge Drive
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Waltham, MA 02451
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Fax: 781.890.6158

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77 South Bedford Street
Burlington, MA 01803
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Fax: 781.685.3801

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

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

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215 Longstone Drive
Cherry Hill, NJ 08003
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Fax: 856.489.5531

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550 Willowbrook Office Park
Fairport, NY 14450
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Fax: 716.218.9010

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Suite 235
Beaverton, OR 97006
Tel: 503.645.0589
Fax: 503.645.6612

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

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

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Suite 450
Houston, TX 77070
Tel: 281.379.7800
Fax: 281.379.7818

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Ottawa
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Suite 400
Kanata, ON K2L 3H1
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Fax: 33.1.34.63.13.19

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

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

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20041 Agrate Brianza, Milano
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Fax: 39.039.6057867

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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

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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

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

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

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Stockholm
LSI Logic AB
Finlandsgatan 14
164 74 Kista
♦ Tel: 46.8.444.15.00
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LSI Logic Asia, Inc.
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Fax: 886.2.2718.8869

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

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