AHA-2740 Series

EISA-to-Fast SCSI Host Adapter

Technical Reference Manual

adaptec

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Adaptec reserves the right to make changes in the product design without reservation and without notification to its users.

Literature

Additional information may be obtained from:

Adaptec, Inc.
Literature Department - MS/40
691 South Milpitas Blvd.
Milpitas, CA 95035

800-934-2766

FCC Compliance Statement

NOTE: 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 residential installations. 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 interference to radio or television equipment 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
- Move the equipment away from the receiver
- Plug the equipment into an outlet on a circuit different from that to which the receiver is powered
- If necessary, the user should consult the dealer or an experienced radio/television technician for additional suggestions

CAUTION: Only equipment certified to comply with Class B (computer input/output devices, terminals, printers, etc.) should be attached to this equipment, and must have shielded interface cables.

Finally, any change or modifications to the equipment by the user not expressly approved by the grantee or manufacturer could void the user's authority to operate such equipment.

Each AHA-2740/2742/2740T/2742T is equipped with an FCC compliance label which shows only the FCC Identification number. The full text of the associated label follows:

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.

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Preface

This Technical Reference Manual contains technical information for Adaptec's AHA™-2740 Series EISA-to-Fast SCSI host adapters. The intended audience for this manual is Adaptec customers who need detailed information on the operation of the board at a command protocol level. Documentation of board schematics, integrated circuits, microcode and BIOS routines is not provided.

If you are writing device drivers for specific peripherals, we strongly advise you to use the Advanced SCSI Programming Interface (ASPI) specification appropriate to the operating system you have chosen. This will give you flexibility across all boards complying with ASPI Manager modules and will prevent software obsolescence. Please contact Adaptec Corporate Communications for copies of ASPI specifications. Software managers are documented and sold separately.

Typographic Conventions

The following typographic conventions are used throughout this manual:

bold
Used for keystrokes (... press the **Enter** key ...) and screen selection fields (... select **Enable Parity Checking** ...).

Helvetica
Used for operator entry that must be typed exactly as shown (... device=c:\cdrom\cdrom.tsd ...) and for screen messages (... Enter Password ...).

Helvetica Italics
Used as a place holder for text you must determine and type in (... enter *nn* for number ...). Also used for program and file names in body text (... the *autoexec.bat* file ...).

Italics
Used for emphasis (... is *only* supported ...) and document reference (... refer to Chapter Three, *Installation* ...).

ALL CAPITALS
Used for acronyms, such as SCSI and CD-ROM.

Hexadecimal Numbers
Are followed by an 'h', e.g., 330h.

Numbered Step Marker
The ➤ symbol marks the first in a series of numbered steps.

End Mark
The ❒ symbol marks the end of the text for each chapter.

Advisories

Advisories are brief notes that emphasize an important point or warn of a potential hazard to the system, the data, and/or the user. This manual uses two kinds of advisories, which are as follows:

> Note
> Text set off in this way presents reminders, tips, or suggestions which may simplify the installation and use of the host adapter.

> **Caution**
> Failure to observe this kind of advisory could result in damage to your system, devices, and/or data.

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1

Introduction

Document Scope

This manual contains information about the features, architecture, and functionality of the Adaptec AHA-2740, AHA-2742, AHA-2740T, and AHA-2742T host adapters. It also contains information on configuring and troubleshooting the boards. For convenience, we will refer to these four host adapters collectively as the AHA-2740 Series. The two single-channel host adapter models, the AHA-2740 and AHA-2742, will be referred to as the AHA-2740/2742; the TwinChannel™ host adapter models, the AHA-2740T and AHA-2742T, will be referred to as the AHA-2740T/2742T.

We recommend that you do not program peripheral drivers directly to the hardware interface of the AHA-2740 Series host adapters. Instead, use the ASPI (Advanced SCSI Programming Interface) specifications, which provide a simpler and more flexible interface that is protected against changes, upgrades and obsolescence of the boards.

General Description

The AHA-2740 Series is a new high-performance family of intelligent host adapter boards based on the AIC-7770 chip architecture. This highly integrated chip incorporates a dedicated RISC sequencer, the SCSI PhaseEngine™, that automates SCSI command processing and significantly reduces interrupts and command overhead. AHA-2740 Series host adapters provide a powerful multi-tasking interface between the EISA (Extended Industry Standard Architecture) bus and the SCSI (Small Computer System Interface) bus.

AHA-2740 Series host adapters support a maximum asynchronous SCSI rate of 3 MBytes/second and a synchronous transfer rate of 10 MBytes/second. These host adapters support multi-threaded I/O operations, allowing simultaneous operations on multiple targets/LUNs. Disconnect/Reconnect support maximizes bus utilization for multiple target systems. Scatter/Gather allows high performance even in systems with fragmented memory buffers.

The AHA-2740 Series provides a solution for system applications that require very high performance, configuration flexibility, multi-threaded I/O capability, and system redundancy. The on-board BIOS also allows AHA-2740 Series boards to be used in place of a standard hard disk controller.

AHA-2740T/2742T host adapters support two SCSI channels, allowing you to connect up to 14 SCSI devices to a single host adapter.

Product Features

Fast Data Transfer Rates

- Up to 33 MBytes/sec on the EISA bus
- Up to 3.0 MBytes/sec asynchronous SCSI data rate
- Up to 5.0 MBytes/sec synchronous SCSI data rate
- Up to 10.0 MBytes/sec synchronous Fast SCSI data rate

Maximum Off-loading the Host CPU

- On-board RISC sequencer (SCSI PhaseEngine™) automates all SCSI protocol
- Low SCSI processing overhead
- Bus Master DMA implementation
- Task scheduling and message-based communication
- Programmable interrupts
- 32-, 16-, and 8-bit host bus data transfer

Fully Disk Array Capable

- Able to boot from any drive on the SCSI bus
- Background processing permits smooth error recovery
- Extensive support from leading disk array vendors

Advanced Fast SCSI-2 Implementation

- Concurrent support of Fast SCSI, synchronous and asynchronous devices
- Concurrent support of both standard and Fast SCSI devices
- Scatter/Gather operation
- Disconnect/Reconnect
- Simultaneous Target/Initiator
- Fully multi-tasking/multi-threading

- Uses the superior SCSI-2 (Alternative 1) external connector and standard internal ribbon connector
- Tagged Queuing support
- Programmable active SCSI termination
- Multiple LUN support
- Parity handling in Data, Message and Command phases

Small Form Factor

- Board is only 7" wide by 5" high

Multiple Device and Applications Support

- AHA-2740/AHA-2742 can be used to install up to seven SCSI devices
- AHA-2740T/AHA-2742T can be used to install up to 14 SCSI devices
- AHA-2742/AHA-2742T can be used to install up to two floppy diskette drives
- On-board BIOS fully supports extended partitioning capabilities of DOS 3.3 for up to two drives and DOS 5.0 and above for up to seven drives per SCSI channel, eight total
- Managers and device module software available for all major operating systems
- Support for disk drives >1 GByte

Configuration Diskette (ASW-C274)

Like other EISA boards, AHA-2740 Series host adapters are configured by the EISA Configuration Utility (ECU) that came with your EISA computer. The ASW-C274 diskette contains the configuration and overlay files needed by the ECU to configure the board. This diskette also includes utilities for running diagnostics and for low-level formatting of hard disks. The configuration process and the utilities are described in Chapter Three, *Installation and Configuration.*

Product Specifications

Physical Dimensions

Length:	7.0 inches
Width:	0.625 inches
Height:	5.0 inches

Standard EISA-compatible form factor.

Power Requirements

5.0 +/- 0.25 Volts at 2.0 Amps maximum.

Environmental Requirements

Temperature 0-55° C (operating or storage)

Reliability Information

Mean Time Between Failures:

(calculated per Bellcore TR-NWT-000332, Issue 3)

AHA-2740:	*data not available*
AHA-2742:	507,511 hours
AHA-2740T:	*data not available*
AHA-2742T:	*data not available*

(calculated per Mil Handbook 217E, ground benign, 40° C)

AHA-2740:	135,166 hours
AHA-2742:	128,932 hours
AHA-2740T:	*data not available*
AHA-2742T:	*data not available*

Mean Time to Repair:

30 minutes

EISA Interface

Table 1-1. Standard EISA Bus Electrical and Physical Interface

Driver Output Signals		
V_{OL}	0 volts minimum	0.4 volts maximum
I_{OL}	24 mA	
V_{OH}	2.4 volts minimum	5.25 volts maximum
I_{OH}	8 mA	
Receiver Input Signals		
V_{IL}	0.8 volts maximum	
V_{IH}	2.0 volts minimum	

Connector configuration as specified by manual of EISA host computer.

SCSI Interface

Electrical Interface

These are the specifications listed in ANSI X3.131-1986 for single-ended operation.

Output Signals

All signals use open collector or three-state drivers. Each signal driven by a SCSI device has the following output characteristics when measured at the SCSI device's connector:

Table 1-2. Output Signals

Signal	Definition	Characteristics
V_{OL}	Low-level output voltage	0.0 to 0.5 volts DC at 48 mA sinking (signal assertion)
V_{OH}	High-level output voltage	2.5 to 5.25 volts DC (signal negation)

Input Signals

SCSI inputs meet the following electrical characteristics on each signal, including both receivers and passive drivers:

Table 1-3. Input Signals

Signal	Definition	Characteristics
V_{IL}	Low-level input voltage	0.0 to 0.8 volts DC (signal true)
V_{IH}	High-level input voltage	2.0 to 5.25 volts DC (signal false)
I_{IL}	Low-level input current	-0.4 to 0.0 mA at V_1 = 0.5 volts DC
I_{IH}	High-level input current	0.0 to 0.1 mA at V_1 = 2.7 volts DC
Minimum input hysteresis = 0.2 volts DC. Maximum input capacitance = 25 pF (measured at the device connector closest to the stub, if any, within the device).		

Internal SCSI Connector

The internal SCSI connector must be an unshrouded 50-pin header, compatible with an unshielded alternative 1 connector, as specified in ANSI X3.131-1986.

Appendix B, *Connector Pinout*, lists connector pin assignments.

Here is a partial list of compatible connector plugs (for reference only):

Table 1-4. Selected Internal Connector Manufacturers

Manufacturer	Model	Part Number
3M	N.A.	3425-6000
T&B Ansley	N.A.	609-5000M

The cable for the internal SCSI connector should be good quality 50-conductor flat cable with 26- or 28-gauge conductors and a characteristic impedance (Z_0) of 100 ±10 ohms. Cable shielding is necessary if extremely noisy circuitry or extremely noise-sensitive circuitry is present inside the host computer frame.

External SCSI Connector

The external SCSI connector must be a shielded 50-pin high density (Alternative 1) connector, as specified in proposed ANSI standard X3T9.2/86-109 Revision 10h, Section 4, Figure 5.

Appendix B, *Connector Pinout*, lists connector pin assignments.

Here is a partial list of compatible connector plugs or cable assemblies (for reference only):

Table 1-5. Selected External Connector Manufacturers

Manufacturer	Model	Part Number
AMP	Connector	749111-4
	Back Shell	749193-1
Fujitsu	Connector	FCN-237R050-G/F
	Back Shell	FCN-230C050-D/E or -C/E
Honda	Connector	PCS-XE50MA
	Back Shell	PCS-E50LA

Cable for the external SCSI connector should be good quality 100% shielded round cable with 25 twisted pairs. Each pair should have a characteristic impedance (Z_0) between 90 ohms and 135 ohms. Wire gauge may be 26 or 28 AWG. All pairs should have the same impedance and the same delay per length of cable. Cables meeting these requirements will normally operate correctly in any SCSI configuration and should normally meet all FCC requirements.

For best results, the SCSI committee recommends that SCSI connectors should not be placed less than one foot apart on internal (ribbon) cable or on external cable when using Fast SCSI 10 MBytes/second data transfers.

Cable material that meets this specification is available from a number of vendors, including:

Table 1-6. Selected Cable Material Manufacturers

Manufacturer	Part Number	Phone Number
C&T	16035	
Madison	4099	(508) 752-7320

Complete cable assemblies are available from a number of manufacturers, including:

Table 1-7. Selected Cable Assembly Manufacturers

Manufacturer	Phone Number
Amphenol Interconnect Products	(607) 786-4370
Quitec Interconnect Systems	(408) 272-8000
Icontec	(408) 945-7766
Enhance Cable Technology	(408) 293-2425

Floppy Disk Interface

Standard Electrical and Physical Interface

Table 1-8. Output and Input Signals

Driver Output Signals		
V_{OL}	0 volts minimum	0.5 volts maximum
V_{OH}	Open collector	5.25 volts maximum
I_{OL}	60 mA	
I_{OH}	0.1 mA	
Receiver Input Signals		
V_{T-}	1.0 volts maximum	
VT+	1.4 volts minimum	
Tied to +5 volt supply through 150 ohm resistors. Schmidt Trigger with 0.8-volt hysteresis		

Connector

The floppy disk interface connector should be an unshrouded 34-pin header. Here is a partial list of compatible connector plugs (for reference only):

Table 1-9. Selected Floppy Disk Cable Manufacturers

Manufacturer	Model	Part Number
3M	N.A.	3414-6000
T&B Ansley	N.A.	609-3400M

The cable for the floppy connector should be good quality 34-conductor flat cable with 28-gauge conductors. Addressing of the second drive may be generated by twisting connector signals 10 through 16 or by changing jumpers in the floppy disk drives.

Radiation Immunity

The AHA-2740 Series host adapters meet radiation limits specified for a Class B computing device in accordance with the specifications in Subpart J of Part 15 of FCC Rules. See the FCC compliance notes and recommendations in the front matter of this manual.

Reference Documents

- *EISA Specification*, v3.11 from BCPR Services
- *Adaptec AIC-7770 Data Book*
- *Adaptec AIC-7770 Design-In Handbook*
- *Small Computer System Interface, ANSI X3T9.2/86-109 Revision 10h*, American National Standards Institute
- *Adaptec AHA-2740 Series Installation Guide*, and the ASW-C274 diskette
- *AHA-2740/2742/2740T/2742T User's Manual*
- *Intel 82077SL Floppy Disk Controller Data Sheet*

2

Internal Architecture

Hardware

AHA-2740 Series host adapters use the latest VLSI technology to provide maximum performance in a minimum of board space. These boards use commercially available components in combination with Adaptec's custom-designed host adapter chip, the AIC-7770. The components are assembled on a multi-layer printed circuit board in Adaptec's own volume manufacturing plant and undergo extensive functional, mechanical and compatibility inspections and tests.

Figure 2-1 shows the general architecture of the AHA-2740 Series.

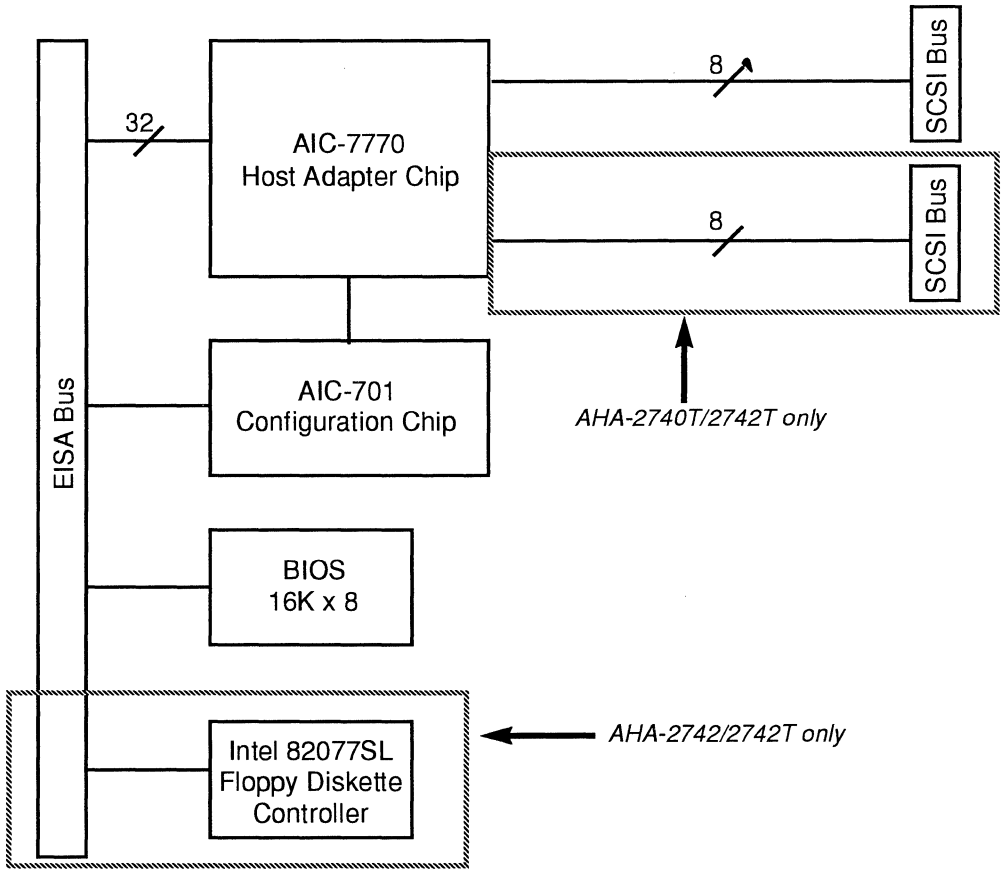

Figure 2-1. AHA-2740 Series Block Diagram

AHA-2740 Series host adapters support all SCSI functions supported by Adaptec's other EISA host adapters (the industry standard AHA-1740 Series). These include new SCSI-2 features such as tagged queuing and 10 MBytes/second data transfers (Fast SCSI). Specifically, AHA-2740 Series host adapters support synchronous negotiation to 10 MBytes, up to an offset of 15 bytes, and they support the Modify Data Pointers extended message, Tagged Queuing and Contingent Allegiance. Fast, synchronous and asynchronous peripherals can be freely combined on the SCSI bus.

AHA-2740 Series host adapters can select specific targets during configuration to initiate synchronous negotiation. They can also enable parity checking globally for all devices, power-up devices in sequence with the Send Start Unit command, and allow disconnection. These host adapters have a thermistor, instead of a fuse, to allow non-destructive current limiting of terminator power supplied to the SCSI cable.

EISA-to-Fast SCSI Host Adapter Chip (AIC-7770)

The Adaptec AIC-7770 host adapter chip provides most of the power and functionality of the AHA-2740 Series host adapters. The major components of the AIC-7770 chip, as shown in Figure 2-2, are the SCSI PhaseEngine™, EISA host interface, data FIFO and TwinChannel™ SCSI controllers.

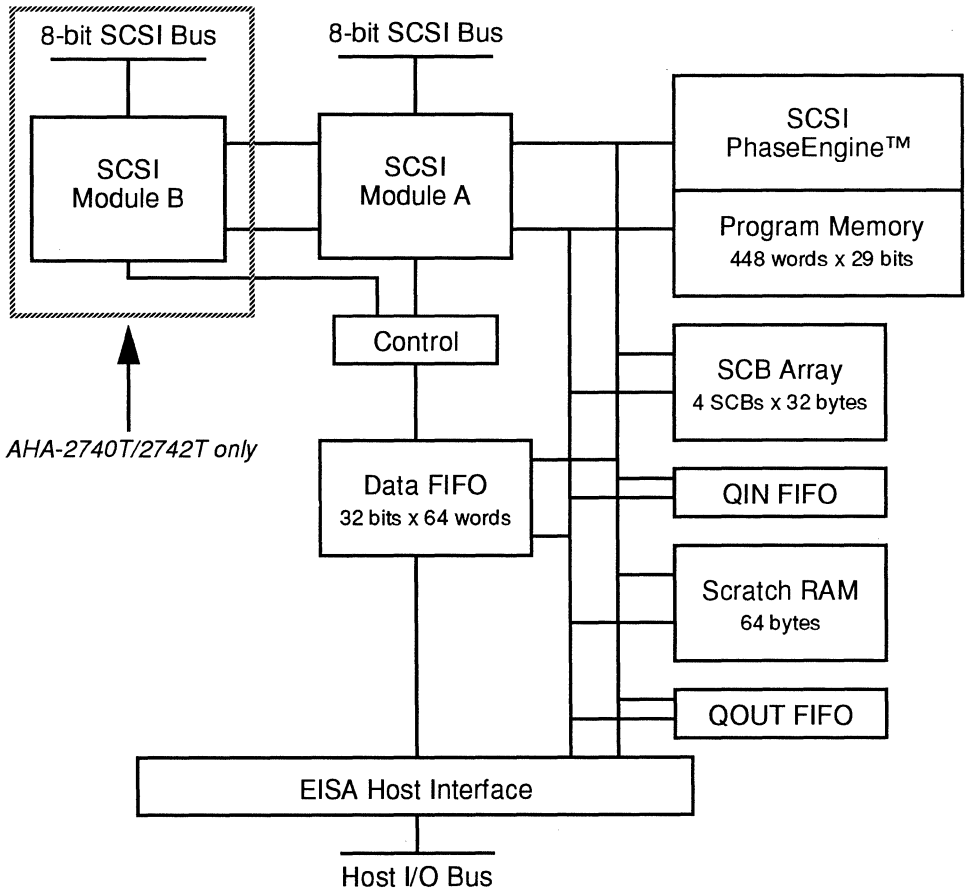

Figure 2-2. AIC-7770 Block Diagram

TwinChannel SCSI (AHA-2740T and AHA-2742T Only)

The AIC-7770 features two independent 8-bit Fast SCSI channels: A and B. Each channel has its own set of control and data lines and has on-board 48mA drivers for direct connection to single-ended Fast SCSI channels.

The TwinChannel capability is designed into all AIC-7770 chips but is implemented only on the AHA-2740T and AHA-2742T host adapter boards.

Sequencer/PhaseEngine

The SCSI PhaseEngine is a dedicated sequencer that provides the AIC-7770's on-board intelligence. The PhaseEngine is an Adaptec custom-designed 29-bit RISC processor optimized to control multi-tasking, multi-threaded SCSI phase operations.

The SCSI PhaseEngine provides on-board processing intelligence for the AIC-7770, allowing it to off-load I/O transactions from the host CPU and to independently handle entire SCSI transfer operations. The SCSI PhaseEngine is programmable and uses its own self-contained microcode program, which is downloaded by the host at system initialization.

The host processor initiates a SCSI I/O operation by downloading a SCSI Command Block (SCB) to the AIC-7770. This SCB contains all the information needed by the chip to independently execute the entire SCSI operation. Up to four SCBs may be active in the AIC-7770 at one time, with the PhaseEngine multi-tasking between them.

The PhaseEngine includes a 64-byte scratch RAM, where configuration information such as synchronous transfer rate values is stored.

Bus Master DMA

The AIC-7770 controls the host EISA bus as a master and transfers data directly to and from main system memory. This implementation, called Bus Master DMA, greatly reduces the host software overhead because the host CPU does not have to maintain the DMA channel's address pointers and word counts. Bus Master DMA also reduces the number of interrupts generated per I/O command.

AIC-7770 Bus Master DMA can achieve a 33 MByte/second burst data rate. This speed is especially valuable in multi-tasking systems where tasks execute on a time shared basis. Appendix A, *Memory Cycle Timing Diagrams*, includes diagrams of the timing required to achieve the DMA rates supported by the AHA-2740 Series host adapters.

The AIC-7770 uses burst cycles on the EISA bus if the memory supports the transfer by asserting SLBURST. If not, the host adapter will use 32-bit wide data transfers with the normal two-cycle timing. The chip relies on system translation logic when reading from or writing to 16-bit expansion board memory in non-burst mode.

The host adapter will act as an 8-bit I/O slave with registers for use during setup and operation. Several configuration registers are implemented in EISA I/O space to allow autoconfiguration.

AHA-2740 Series host adapters can be programmed to use interrupts 9, 10, 11, 12, 14, and 15. The interrupt may be shared by multiple AHA-2740 Series boards, since it is implemented on the host adapter, and EISA drivers may be written to use multiple AHA-2740 Series boards on the same interrupt.

16-Bit Memory and Odd Byte Data Transfers

The AIC-7770 handles both odd-byte and odd-memory address data transfers with no performance degradation. The adapter can align bytes when the starting address is not a multiple of four or the byte count is an odd value. It will transfer 1, 2, or 3 bytes at the beginning or end of the transfer so that 32-bit burst cycles may be used.

During normal Bus Master DMA operations, nearly all transfers to and from memory are 32-bit transfers. An 8-, 16-, or 24-bit transfer may occur at the very end, or the very beginning, of an odd address boundary.

AHA-2740 Series host adapters will automatically shift to 16-bit data transfers as indicated by the control lines on the EISA bus. Bus master data transfers into 16-bit wide memory are fully supported, as are full 32-bit wide data transfers.

Host Data FIFO

The AIC-7770 chip has a 256-byte data FIFO, with four status indicators for the following conditions:

- Nearly empty (within 16 bytes)
- 50 percent full
- 75 percent full
- Nearly full (within 16 bytes)

These status indicators are combined with programmable threshold control logic in the host interface to allow the host data FIFO to intelligently analyze the speed differential between SCSI and host data transfer rates. This, in turn, enables optimal utilization of the SCSI bus and the host bus.

The host data FIFO also has manual and automatic flush capability.

See Chapter Four, *Hardware Configuration*, for more information about the AIC-7770 chip. Also see the *AIC-7770 Data Book*.

EISA Configuration Chip (AIC-701)

The AIC-701 EISA configuration chip, which is located next to the AIC-7770, provides additional functionality and allows you to configure the host adapter with software instead of with jumpers. The configuration chip provides these features:

- Select and define interrupts
- Enable or disable SCSI bus termination
- Select BIOS enable, location, and options
- Generate chip selects to local BIOS ROM, shadow RAM and floppy controllers
- Allow shadow RAM to reside in same address space as local BIOS ROM, and enable it to be Read/Write or Read only
- Allow local BIOS ROM to be addressed either as 16 KByte ROM or 32 KByte ROM

The AHA-2740 Series I/O operating environment software, which you may need to install to use removable media drives, CD-ROM drives, and other SCSI devices, fully support these features.

See Chapter Four, *Hardware Configuration*, for more information about the AIC-701 EISA configuration chip.

Floppy Disk Controller Chip (82077SL)

The 82077SL single-chip floppy disk drive controller is used on the AHA-2742/2742T host adapter boards. The controller is enabled by default on these boards and can be disabled by removing the jumper shunt on jumper J4. To use the on-board floppy controller, leave the jumper shunt installed and disable your existing floppy controller.

See Chapter Four, *Hardware Configuration*, for more information about the floppy disk controller chip.

Firmware

The software manager for AHA-2740 Series host adapter boards is subdivided into two modules:

- An O/S Specific Module (OSM)
- A Hardware Interface Module (HIM)

These modules, together with the device drivers and the ASPI layer, comprise a complete AHA-2740 Series hardware driver for a specific operating system. By replacing the O/S specific part of the software manager, drivers for other operating systems may easily be created.

The microcode program used by the programmable PhaseEngine (sequencer) onboard the AIC-7770 chip is downloaded from the HIM when the system is initialized, as shown in Figure 2.3.

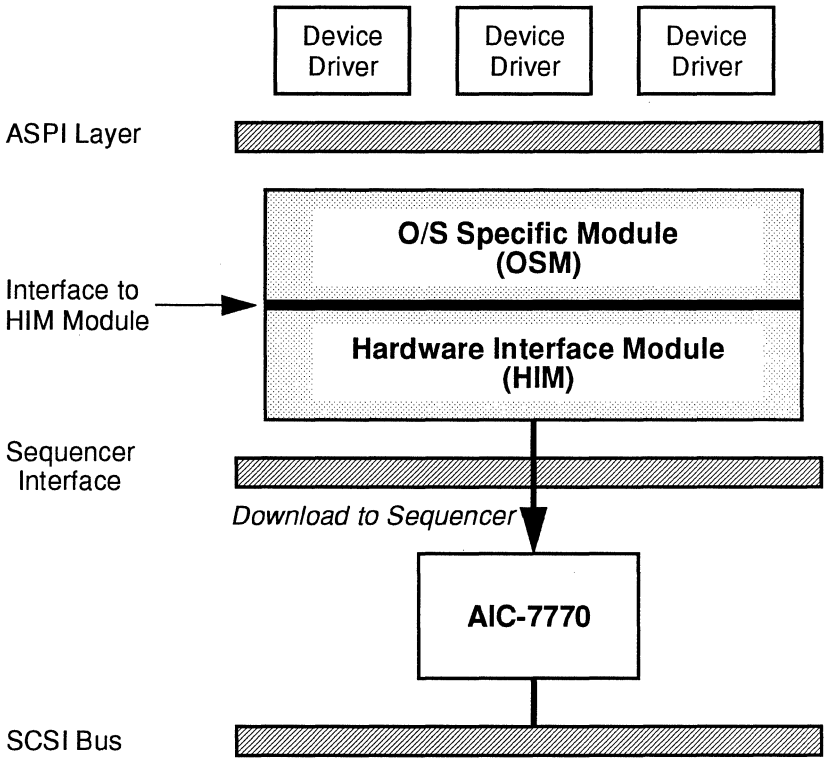

Figure 2-2. Hardware Interface Module

The HIM has access to all registers on the AIC-7770 chip, and it manages SCBs, interrupts and exceptional SCSI conditions. The HIM can manage multiple AHA-2740 Series host adapters.

For more information about HIM functions, see the *AIC-7770 Design-In Handbook.*

Onboard BIOS Operation

The AHA-2740 Series host adapter BIOS emulates the standard hard disk BIOS and boot functions. This BIOS enables the host adapter to be used in place of a standard hard disk controller on any EISA-compatible system.

The AHA-2740 Series BIOS is compatible with the standard hard disk BIOS. This allows DOS to access up to seven hard disk devices on a SCSI bus (eight total) without a driver for DOS 5.0 and above and up to two devices for earlier versions of DOS. The BIOS supports all normal I/O functions, including system booting.

During system boot the BIOS scans for configuration information in the freeform data area of system RAM. If it finds the correct data format, it uses this data to configure both the board parameters and the parameters associated with the peripherals on the SCSI bus. If it cannot find the data or cannot recognize it, the BIOS will configure the board to a default set of parameters. Refer to Chapter Three, *Installation and Configuration*, for details.

Power-up Diagnostics

When the system is powered-up, the BIOS is initialized and several onboard diagnostics are performed:

- RAM is verified
- Write/Read registers are checked for proper operation
- The data path is checked for correct internal operation

If the host adapter is not functional, the BIOS will fail to detect it and will display an on-screen message stating that the adapter was not initialized. If you do not see this error message, you will know that the diagnostics ran successfully and the host adapter is initialized.

You can run the on-board diagnostics at any time by using the configuration utility, as described in Chapter Three, *Installation and Configuration.*

ASW-C274 Configuration Diskette

AHA-2740 Series host adapters are normally shipped with configuration software, product number ASW-C274. This package includes 5.25-inch and 3.5-inch high-density diskettes and an Installation Guide. (The two diskettes contain identical information). The functions of the files on the diskette may be supplied as part of the system utilities for the EISA host system in which the host adapter is installed.

The configuration diskette contains the following two files:

- *!adp7771.cfg* - Configuration file for AHA-2740 Series host adapters
- *adp7770.ovl* - Configuration overlay file for SCSI bus parameters

The *adp7770.ovl* file includes the low-level format and diagnostic utilities. To learn how these utilities work, see Chapter Three, *Installation and Configuration*, and Chapter Eight, *Problem Determination*. If the host adapter has no ASW-C274 package, or if the utility is incomplete and the system utilities do not include the function needed, either ask the board vendor for a copy or contact the Adaptec bulletin board to download the files.

The Adaptec bulletin board number is 408-945-7727. Use 8 data bits, 1 stop bit, no parity; 1200, 2400 or 9600 baud.

Free-form Data Structure

The configuration overlay file uses a free-form data area to configure the SCSI bus and the specific structure within the free-form data area. This data area is not specified by the EISA specification. Adaptec uses a two-byte data structure for each device (SCSI ID #*n*).

Appendix D has a table showing the length and structure of the free-form data and an explanation of each free-form data value.

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Installation and Configuration

Adaptec AHA-2740 Series EISA-to-Fast SCSI host adapters are designed to operate as shipped in standard EISA class computers. Most of the time you will not need to change the factory default settings when you install one of these host adapters. If you do need to change settings, almost all AHA-2740 Series configuration is done with software, not with hardware jumpers.

Here, briefly, are the steps required to install an Adaptec AHA-2740 Series host adapter.

- Unpack and inspect the board
- Prepare the SCSI devices
- Power-off the system
- Insert the board into an EISA-compatible connector
- Attach SCSI cables from the on-board connector to SCSI target devices
- Power-up the system
- Configure the board for operation

This chapter contains general information on the installation and configuration process. The *AHA-2740/2742/2740T/2742T Installation Guide* and the *AHA-2740/2742/2740T/2742T User's Manual* have detailed instructions for physically installing the host adapter board.

Unpacking and Inspection

When you receive your AHA-2740 Series host adapter open the shipping container and inspect the equipment. The carrier is responsible for damage incurred during shipment. In case of damage, have the carrier note the damage on both the delivery receipt and the freight bill, then notify your freight company representative so that the necessary insurance claims can be initiated.

After opening the shipping container, use the packing slip to verify receipt of the individual items listed on the slip. Keep the shipping container and packing material in case you need to return the equipment to the manufacturer.

Preparing for Installation

Disk Drive Configuration

DOS version 5.0 and above and the standard BIOS support up to eight hard disk drives (beginning with drive letter *C*). Earlier versions of DOS support up to two hard disk drives.

If one standard hard disk drive is installed, the AHA-2740 Series BIOS allows DOS to access the SCSI drive with the Target:LUN address of 0:0 as the second supported drive (drive *D*). If no standard hard disk drives are installed, the AHA-2740 Series BIOS allows DOS to access the SCSI drive with the address of 0:0 as the first supported drive (drive *C*) and the SCSI drive with the address of 1:0 as the second drive (drive *D*).

> Note
>
> The term *standard hard disk* refers to the disk drive(s) attached to the system by a standard ISA/EISA non-SCSI disk controller–for example, IDE drives. Standard hard disks can be set to the *installed* or *not installed* state by the setup program supplied with the host computer. The setup program allows you to select the number of standard hard disks that are recognized by the system, regardless of whether they are physically installed. SCSI drives are not controlled through the setup program.

The system will boot from the floppy drive if a floppy diskette is in the drive. If no floppy is present, the system attempts to boot from the drive chosen as drive *C* through the above process, regardless of whether the drive is a standard hard disk or a SCSI hard disk.

The AHA-2740 Series BIOS fully supports the extended partitioning capabilities of DOS. Adaptec supplies a range of products based on the ASPI (Advanced SCSI Programming Interface) architecture that allow the support of multiple physical or logical devices under DOS. Many other operating systems, including SCO® Xenix® and UNIX®, also have this feature and will allow access to any number of attached SCSI devices. Refer to Chapter Six, *Device Drivers*, for more details. Peripheral devices such as SCSI tape, DAT, CD-ROM and others require installation of device driver software.

Default Settings

Your host adapter is already configured for the majority of EISA class computers. Table 3-1 lists the host adapter default settings. The *System Configuration* section later in this chapter explains how to change these settings.

Table 3-1. Host Adapter Default Settings

Description	Default Setting
Interrupt Level	IRQ11
Bus Release Time	60 BCLKS
Data FIFO Threshold	100%
Host Adapter BIOS Address	D8000h
Host Adapter SCSI ID	Device ID7
SCSI Bus Parity Check	Enabled
SCSI Selection Timeout	256 milliseconds
SCSI Bus Reset at Power-on	Enabled
SCSI Bus Termination	Enabled
Extended Translation for Drives >1 GigaByte	Enabled
Support More than Two Drives	Disabled
Support Removable Disks as Hard Disks	Boot Device Only

On-board Floppy Controller (AHA-2742/2742T Only)

The on-board floppy controller on the AHA-2742/2742T host adapters is enabled by default and is controlled by jumper J4. (This is the only jumper on the board; all other configuration is done through software, as described in the *System Configuration* section of this chapter.)

- If your floppy diskette drives are already running under another controller, disable the on-board floppy controller by removing the jumper shunt on jumper J4.
- To use the on-board floppy controller, leave the jumper shunt installed on jumper J4 and then disable your existing floppy controller. Refer to your computer or floppy controller user documentation.

Termination

The SCSI bus must be terminated correctly in order for the host adapter board and SCSI devices to work correctly. The first and last physical SCSI devices on the SCSI bus must have terminators installed/enabled. All other SCSI devices must have terminators removed/disabled. You can implement SCSI termination either by physically installing/removing terminators on a SCSI device or by enabling/disabling it with a software program. You enable or disable SCSI termination on AHA-2740 Series adapters by running the EISA Configuration Utility (ECU).

The internal and external connectors of the AHA-2740 Series adapters connect to the same SCSI bus, so you must consider both internal and external cabling in determining whether termination is enabled or disabled.

If only one cable (either internal or external) is connected to the host adapter, termination must remain enabled in the host adapter. Termination must be enabled on the device at the farthest end of the cable from the host adapter and must be disabled on all other attached SCSI devices.

If both an internal and external cable are connected to the host adapter, disable termination on the host adapter and enable termination on the devices at the farthest end of each cable. Disable termination on all devices except the device at the end of each cable. The instruction manuals for each SCSI device will indicate how the terminators can be removed or replaced.

SCSI channel B on the AHA-2740T/2742T host adapters has only an internal SCSI connector. Therefore, termination for channel B should always be enabled.

Refer to the *AHA-2740/2742/2740T/2742T User's Manual* for detailed information on setting SCSI termination.

SCSI Addressing (ID)

The SCSI target address for each SCSI device to be attached must be selected by setting the proper jumpers or switches on the device. AHA-2740 Series host adapters can boot from a disk device at any SCSI ID.

Each installed peripheral must have a different SCSI address. The host adapter's default SCSI ID is 7. Duplicate SCSI addresses will cause errors that are extremely difficult to identify.

Any jumpers that control operating modes must also be properly set. If a SCSI device has a jumper that enables synchronous transfer and/or synchronous negotiation, the jumper should be set to enable synchronous operation.

SCSI Parity

Check all SCSI devices to ensure that they generate parity. If *any* SCSI device on the SCSI bus does not generate parity, then parity checking should be disabled for *all* SCSI devices on the bus. If all SCSI devices on the bus generate parity, you should enable parity checking for all devices on the bus. (Note that *generating* parity and *checking* parity are different functions.) The AHA-2740 Series configuration overlay can be used to enable or disable parity checking.

System Configuration

All EISA computers are shipped with an ECU program used to configure the computer's motherboard and option boards. After you physically install your AHA-2740 Series board, you can run the utility program if you need to change any default host adapter parameters.

The ASW-C274 disk that came with your host adapter contains a configuration file and an overlay file that the ECU uses when you run it. The *AHA-2740/2742/2740T/2742T User's Manual* has detailed configuration instructions that apply to EISA utilities in general. The following section tells you how to use two popular EISA configuration programs: MCS and Phoenix.

To start the ECU:

➤ 1 Place the bootable EISA configuration diskette in a floppy disk drive, close the drive door and reset the system so it boots from this drive. If the ECU is installed on your hard disk drive, reboot the system and run the utility from your hard disk.

Ignore any error which indicates that an unknown board has been detected in the system.

2 Look at the information on the screen and determine which kind of ECU you have.

Board configuration selections will vary for different configuration utilities. There are two main types, supplied by MCS and Phoenix. The name of the utility may be obscured by the screen banner used by the system vendor.

3 Type cf and press **Enter** to start the MCS utility. For the Phoenix utility, type ptlecu and press **Enter**.

4 Select **Board Configuration** and press **Enter**.

5 The ECU usually allows you to select from a number of options, including copying new configuration files. Select this last option to install the two files *!adp7771.cfg* and *adp7770.ovl* from the ASW-C274 floppy disk.

If the ECU does not provide this option, then you must copy the two files from the ASW-C274 diskette to either the bootable EISA Configuration diskette or to

the directory on the hard disk where the EISA utility is located. Then run the ECU again.

The utility program will autoconfigure the system and display a diagram of the motherboard showing which boards have been configured into which slots. Continue with the next section.

MCS Configuration

To use the MCS configuration utility, begin by selecting the slot in which the host adapter is installed and pressing **Enter**. If necessary, scroll down until you find a screen that lists the host adapter and its parameters and that looks similar to the typical set of host adapter parameters shown in Figure 3-1.

```
Slot 1 - Adaptec AHA-2470/AHA-2740T SCSI Host Adapter

  Host Adapter Interface Definitions
    Interrupt Level ..... IRQ 11
    Bus Release Time ..... 60 BCLKS
    Data FIFO Threshold ..... 100%
  BIOS Definitions
    Host Adapter BIOS Base Address ..... D8000H

  SCSI Channel A Configuration
    Host Adapter SCSI ID .....7
    SCSI Bus Parity Check .....Enabled
    SCSI Selection Timeout .....256 milliseconds
    SCSI Bus Reset at Power-on .....Enabled
    SCSI Bus Termination ..... Enabled
  BIOS and Device configuration .....Press <Enter> to configure
  Utilities ..... Press <Enter> to access
                                                    More: PgUp/PgDn
Edit=Enter   <Edit Resources=F6>   <Advanced=F7>   <Done=F10>
```

Figure 3-1. Host Adapter Parameters

Configuring Host Adapter Parameters

On this screen and the other configuration screens, use the arrow keys to move the selection highlight and the **Enter** key to make selections. You can also use a mouse, if one is installed on your system. Here is a description of each host adapter parameter.

Interrupt Level (IRQ)

The default setting for Interrupt Level is IRQ 11. If you have installed multiple AHA-2740 Series host adapters in your system, all will initially share the same IRQ line.

To select a different IRQ level, highlight **Interrupt Level** and press **Enter**. The menu shown in Figure 3-2 will appear.

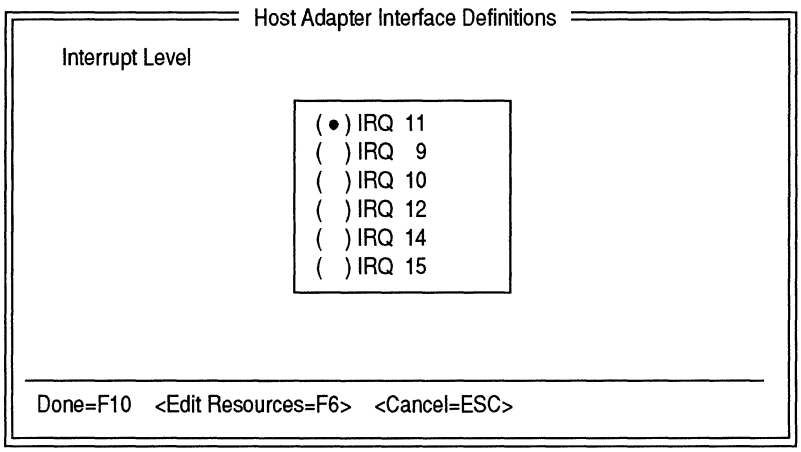


Figure 3-2. Selecting Interrupt Level

Multiple AHA-2740 Series host adapters installed in your system can share the same IRQ. However, system performance will probably improve if you select a different IRQ for each host adapter.

> Note
> An AHA-2740 Series adapter cannot share an IRQ with an ISA mode adapter such as an AHA-1540 or AHA-1520. If any of these host adapters are installed in your system, you must assign unique IRQs to the AHA-2740 Series adapter(s).

Bus Release Time

The Bus Release Time is the amount of time, in BCLKS (Bus Clocks), for which the host adapter will continue to transfer data *after* being pre-empted in Bus Master mode.

The default Bus Release Time of 60 BCLKS is usually optimal. If multiple Bus Master host adapters are installed in your system, you may want to lower this value to free the bus sooner. To change the setting, highlight **Bus Release Time** and press **Enter**. When the screen shown in Figure 3-3 appears, choose the setting you want.

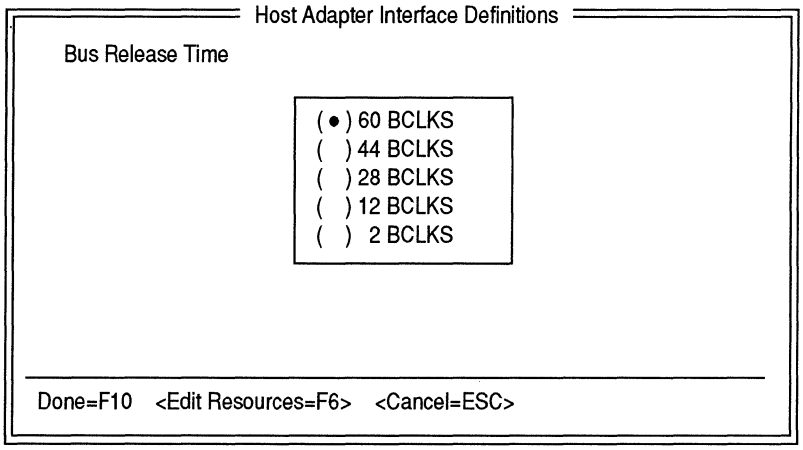


Figure 3-3. Selecting Bus Release Time

Data FIFO Threshold

The Data FIFO Threshold specifies the percentage of the FIFO that is used by the host adapter. The default setting of 100% is usually optimal. (For more information about this option, see *Data FIFO Threshold Control* on page 4-7.)

To change the setting, highlight **Data FIFO Threshold** and press **Enter**. When the screen shown in Figure 3-4 appears, choose the setting you want.

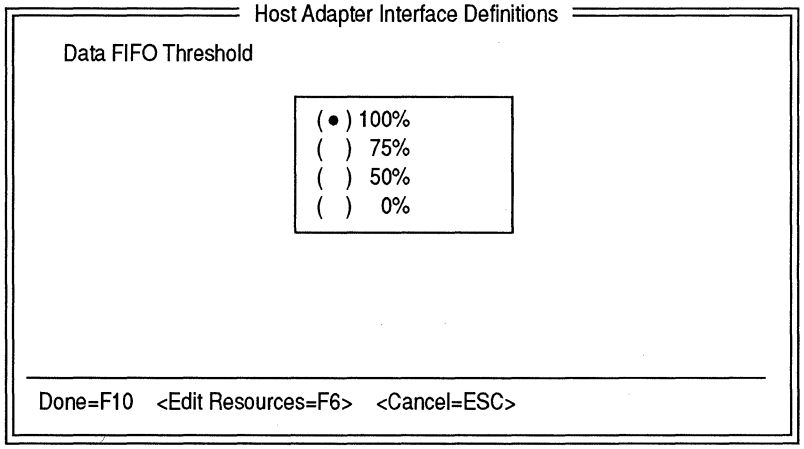


Figure 3-4. Selecting Data FIFO Threshold

Host Adapter BIOS Base Address

The default base address for the host adapter BIOS is D8000h. Use this option if you want to select a different pre-defined base address or if you want to disable the host adapter BIOS. To change the setting, highlight **Host Adapter BIOS Base Address** and press **Enter**. When the screen shown in Figure 3-5 appears, choose the setting you want.

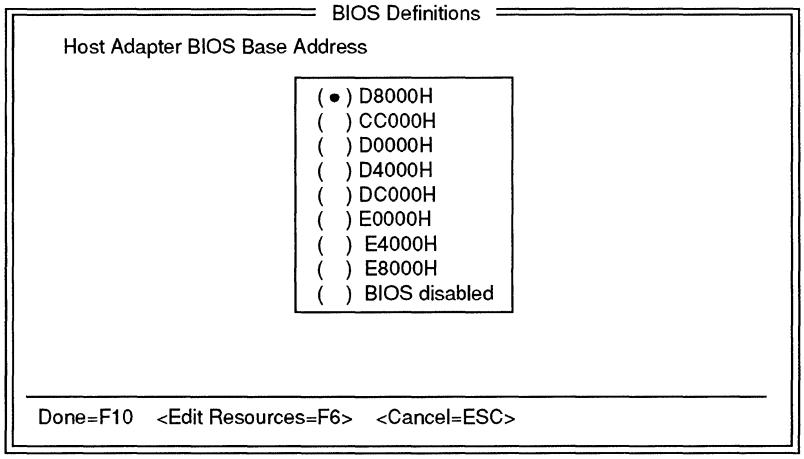


Figure 3-5. Selecting Host Adapter BIOS Base Address

When choosing the base address, be sure there is no conflict with another device using the same address. Often the Configuration utility will notify you if there is a conflict.

Host Adapter SCSI ID

Each installed SCSI device must have a unique SCSI ID. SCSI ID 7 is normally assigned to the host adapter; SCSI IDs 0 and 1 should be reserved for SCSI hard disk drives. If two host adapters are installed, each has its own separate SCSI bus; therefore both host adapters can be assigned SCSI ID 7.

To change the SCSI ID setting, highlight **Host Adapter SCSI ID** and press **Enter**. When the screen shown in Figure 3-6 appears, choose the setting you want.

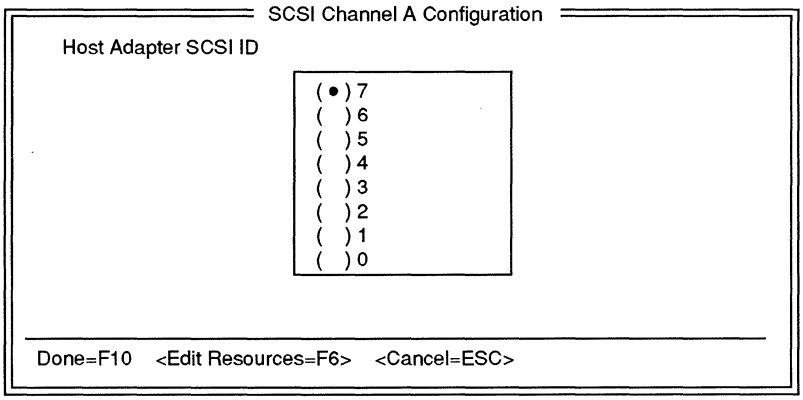


Figure 3-6. Selecting Host Adapter SCSI ID

SCSI Bus Parity Check

SCSI bus parity checking is enabled by default when you install your AHA-2740 Series host adapter. The host adapter always generates parity when writing to the SCSI bus. If any attached SCSI devices do not support SCSI parity checking, you should disable SCSI Bus Parity Check. Most currently available SCSI devices, however, do support parity checking.

To change the parity checking setting, highlight **SCSI Bus Parity Check** and press **Enter**. When the screen shown in Figure 3-7 appears, choose the setting you want.

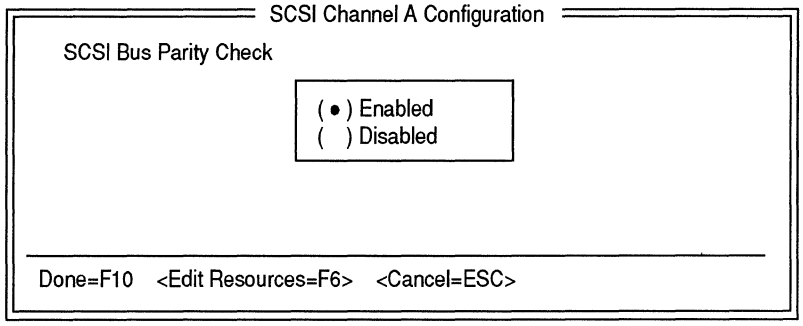


Figure 3-7. Selecting SCSI Bus Parity

SCSI Selection Timeout

The SCSI Selection Timeout is the time, in milliseconds, used by the host adapter during the SCSI selection phase. The default setting is 256 milliseconds. Changing this setting to a lower number will allow for faster SCSI bus scans. Before you change it, however, you must make sure that all devices on the SCSI bus can handle the shorter selection phase time for each SCSI device.

To change the timeout setting, highlight **SCSI Selection Timeout** and press **Enter**. When the screen shown in Figure 3-8 appears, choose the setting you want.

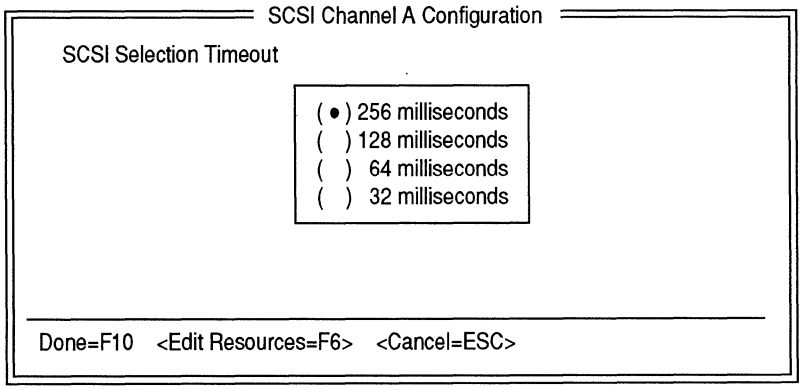


Figure 3-8. Selecting SCSI Selection Timeout

SCSI Bus Reset at Power-on

SCSI Bus Reset at Power-on enables or disables a SCSI bus reset generated by the host adapter during its power-on initialization and after a hard reset. This setting is enabled by default. Normally, you should leave it enabled.

To change SCSI Bus Reset at Power-on, highlight **SCSI Bus Reset at Power-on** and press **Enter**. When the screen shown in Figure 3-9 appears, choose the setting you want.

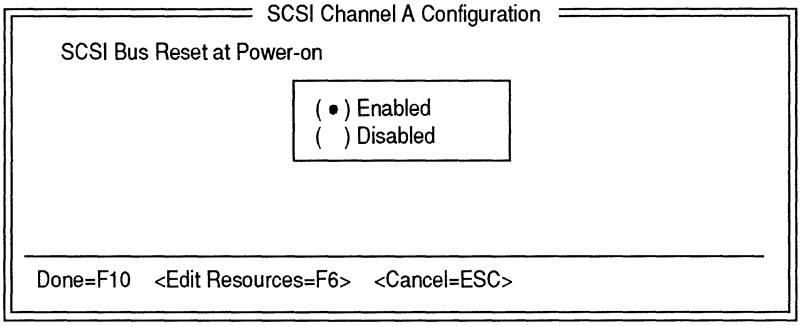


Figure 3-9. Selecting SCSI Bus Reset at Power-on

SCSI Bus Termination

SCSI Bus Termination enables or disables SCSI termination on the host adapter. This setting is enabled by default.

You should disable host adapter termination only if you attach SCSI devices to both internal and external connectors, since the host adapter would then be in the middle of the SCSI bus. Refer to Chapter Two of the *AHA-2740/2742/2740T/2742T User's Manual* for more information about SCSI termination.

> Note
>
> SCSI channel B on the AHA-2740T/2742T host adapters has only an internal SCSI connector. Therefore, termination for channel B should always be enabled.

To change this setting, highlight **SCSI Bus Termination** and press **Enter**. When the screen shown in Figure 3-10 appears, choose the setting you want.

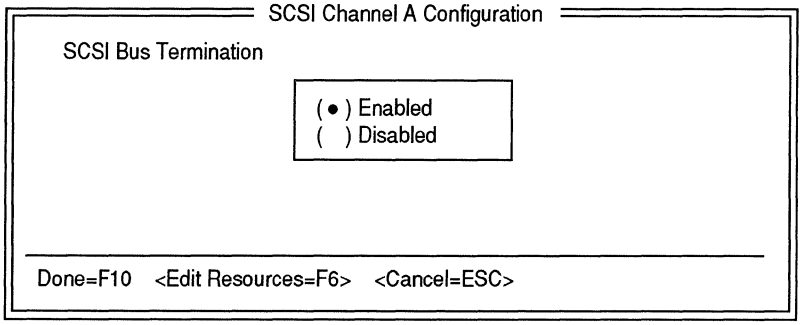


Figure 3-10. Selecting SCSI Bus Termination

Configuring BIOS and SCSI Device

If you select **BIOS and Device Configuration** from the screen shown in Figure 3-1, the sub-menu shown in Figure 3-11 appears.

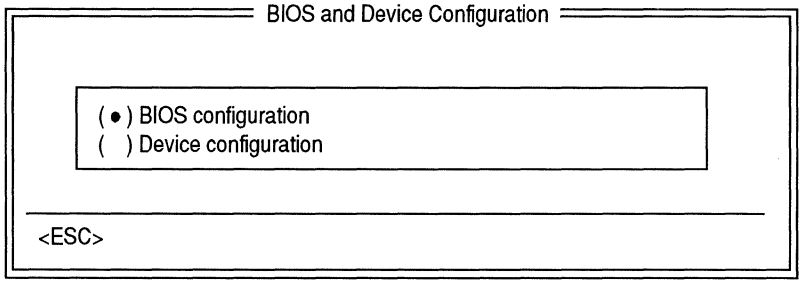


Figure 3-11. BIOS and Device Configuration

If you select **BIOS Configuration** from this sub-menu, the screen shown in Figure 3-12 appears.

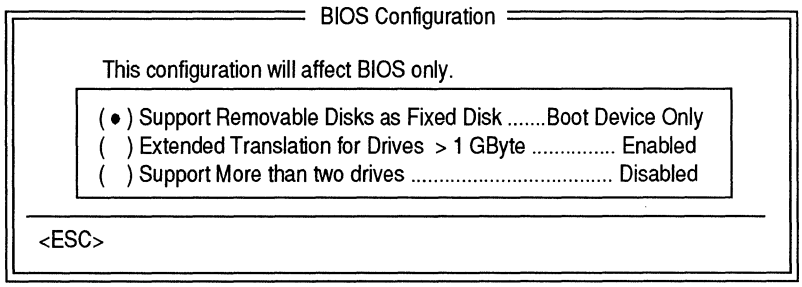


Figure 3-12. BIOS Configuration Options

The meaning of the three options on this screen is as follows:

Support Removable Disks as Fixed Disk

This option allows you to configure removable media drives supported by the BIOS. Your choices are:

- **Boot Device Only** - Only the removable media drive designated as the boot device will be treated as a hard disk drive. (This is the default.)
- **All Devices** - All removable media drives supported by the BIOS will be treated as hard disk drives.
- **Disabled** - No removable drives will be treated as hard disks.

Extended Translation for Drives > 1 GByte

This option allows you to enable or disable extended translation for hard disks with a capacity greater than 1 GByte. The default setting is Enabled.

If this option is enabled, the following translation schemes are used:

- Hard disks ≤ 1 GByte use a translation scheme of 64 heads, 32 sectors per track.
- Hard disks > 1 GByte, up to 7.85 GBytes, use a translation scheme of 255 heads, 63 sectors per track.

Some operating systems such as USL UNIX® do not currently support extended translation.

Support More Than Two Drives

This option allows you to enable or disable BIOS support for more than two SCSI hard disks (supported by DOS 5.0 and above). If this option is enabled, up to eight hard disks can be attached to Int 13h. The default setting is Disabled.

If you select **Device Configuration** from the **BIOS and Device Configuration** sub-menu, the screen shown in Figure 3-13 appears.

Configuration Setting for SCSI Devices (1x8)

Channel A Device ID	#0	#1	#2	#3	#4	#5	#6	#7
Enable Disconnection	yes	yes	yes	yes	yes	yes	yes	yes
Initiate Sync Negotiation	yes	yes	yes	yes	yes	yes	yes	yes
Maximum Sync Xfer Rate	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Include in BIOS Scan	yes	yes	yes	yes	yes	yes	yes	yes
Error if Device Not Found	no	no	no	no	no	no	no	no
Send Start Unit Command	no	no	no	no	no	no	no	no

OK <ESC> <DEFAULT>

Figure 3-13. Configuration Setting for SCSI Devices

You can use this screen to customize the configuration of each SCSI device connected on the SCSI bus. All SCSI IDs are displayed on the screen even if no SCSI device is attached; however, to configure a specific SCSI device, you will need to know which SCSI ID corresponds to that device.

Use the arrow keys to move between options. To toggle values for each option, press the **Enter** key. The meaning of each option is as follows:

Enable Disconnection

This option (sometimes called Disconnect/Reconnect) is used to determine whether the host adapter will allow a SCSI device to disconnect from the SCSI bus while the device completes a lengthy operation such as a SCSI seek command. If disconnection is enabled the host adapter can perform other operations on the SCSI bus while the device is temporarily disconnected.

When set to **yes**, the SCSI device may disconnect from the SCSI bus. The device, however, may choose not to disconnect, even if the host adapter allows it to do so (this is usually configurable on the SCSI device). When set to **no**, the SCSI device will not be allowed to disconnect from the SCSI bus. The default setting is **yes**.

In general, disconnect should be enabled to allow the most efficient SCSI bus utilization and the highest overall system performance. If only one SCSI device is attached to the SCSI host adapter, disconnects are not required for efficient SCSI bus utilization since only one SCSI device is using the SCSI bus. Performance may improve slightly if disconnect is disabled in this case, due to the decreased SCSI overhead. If your system has multiple SCSI devices, you should normally enable disconnect.

If a particular SCSI device does not support Disconnect/Reconnect, then Enable Disconnection should be disabled (set to **no**). If a particular SCSI device does support Disconnect/Reconnect, then Enable Disconnection should be enabled (set to **yes**). Most SCSI devices today support Disconnect/Reconnect. If a disk device on your system supports tagged queuing, Disconnect/Reconnect *must* be enabled.

Initiate Sync Negotiation

This option determines whether the host adapter will initiate synchronous negotiation with the SCSI device.

When set to **yes**, the host adapter will try to use the faster synchronous protocol for data transfers on the SCSI bus. The host adapter will negotiate for a data transfer rate of up to 10 MBytes/second and an offset of 15. When set to **no**, the host adapter will not initiate synchronous negotiation with the SCSI device.

The host adapter, however, will always respond to synchronous negotiation initiated from the SCSI device. If the SCSI drive negotiates for synchronous transfers, the host adapter will respond with a data transfer rate of up to 10 MBytes/second and an offset of 15, or the data transfer rate and offset suggested by the peripheral device, whichever is lower. The default setting is **yes**.

If neither the host adapter nor the SCSI peripheral negotiate for synchronous data transfers, all data transfers will be done asynchronously. Some older SCSI devices may not respond properly to synchronous negotiation, and this may cause erratic

behavior or a hang condition for these devices. Be sure to change this setting to **no** if your system has a SCSI device that does not support synchronous data transfer.

Maximum Synch Xfer Rate

This option determines the maximum synchronous transfer rate (MBytes/second) for which the host adapter will negotiate. AHA-2740 Series host adapters support rates up to the Fast SCSI maximum of 10 MBytes/second. The maximum offset negotiated for is always 15 bytes. The default value is 10 MBytes/sec. Valid values are: 10.0, 8.0, 6.67, 5.7, 5.0, 4.4, 4.0, and 3.6 MBytes/sec.

If the host adapter is set not to negotiate for synchronous data transfer (e.g. Initiate Sync Negotiation is set to **no**), then the value selected here will be the maximum rate at which the host adapter will respond.

The Fast SCSI synchronous data transfer rates are 10.0, 8.6, 6.67 and 5.7 MBytes/sec. In most cases, you can use the maximum value of 10.0 MBytes/sec. If the drive does not support the Fast SCSI data transfer rate, it can negotiate for a slower rate (this is standard SCSI protocol). However, if a drive cannot accept values greater than 5.0 MBytes/sec (the highest standard synchronous transfer rate), then Fast synchronous data rates should not be used for the device. Older SCSI-1 devices may not accept values between 10.0 and 5.7 MBytes/sec., which may result in erratic behavior or a hang condition.

Include in BIOS Scan

This option determines whether the host adapter BIOS supports devices such as hard disk drives, removable media drives and magneto-optical drives on the SCSI bus without the need for device driver software.

When set to **yes**, the host adapter BIOS controls the SCSI device(s). When set to **no**, the host adapter BIOS will not search the SCSI ID for devices to control, and you will need device driver software to control the SCSI device(s). The default setting is **yes**.

> **Caution**
>
> If a removable media SCSI device is controlled by the host adapter BIOS, do not remove the media while the system is powered-on or you could lose data! The host adapter BIOS does not support removability while the system is turned on. If you want to be able to remove media while the system is powered-on, you must install the removable media device with device drivers and not with the host adapter BIOS.

Error if Device Not Found

This option determines whether the host adapter BIOS generates an error message if it cannot find the device during boot-up.

When set to **yes**, the BIOS checks the SCSI ID for a SCSI device; if none is found, an error message is displayed during boot-up similar to the following:

```
Channel A, Target #1 – Device Not Found
```

When set to **no**, the BIOS will not display an error message for the particular SCSI device. The default setting is **no**.

Send Start Unit Command

This option, which is supported by some SCSI devices, determines whether the SCSI Start Unit command (SCSI command 1Bh) is sent to the SCSI device: Devices only require this command if they are jumpered to start via a SCSI Start Unit command. This command reduces the load on your computer's power supply by allowing the host adapter to power-up SCSI devices one-at-a-time when you boot your system. Otherwise, the devices will all power-up at the same time.

When set to **yes**, the command is sent to the SCSI device during boot-up. When set to **no**, the SCSI device must power-up in its normal fashion. The default setting is **no**.

If you select this option for more than one SCSI device, the command will be sent first to the SCSI device with the lowest SCSI ID. When the first device is ready and responds to the host adapter, the command is sent to the next highest SCSI ID with a setting of **yes**. This process continues until all supported devices respond to the host adapter.

Your system may take longer to boot-up if this option is enabled for many drives, depending on how long each drive takes to spin-up.

Exit SCSI Device Configuration

When you have finished configuring the SCSI devices, press **Esc** to exit the SCSI Device Configuration. You will be prompted to either Save or Abandon the device configurations, as shown in Figure 3-14.

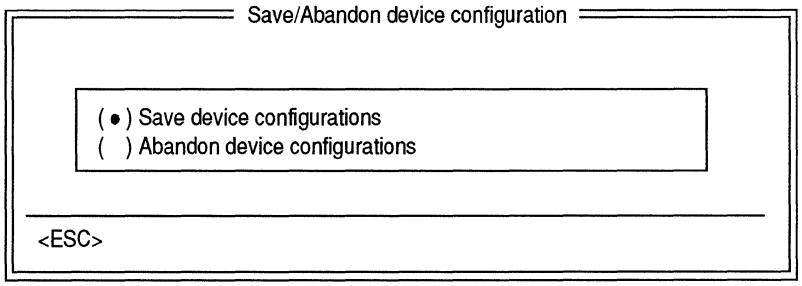


Figure 3-14. Exiting SCSI Device Configuration

Exit the EISA Configuration Utility

When the host adapter and SCSI devices are properly configured, save the settings and exit the ECU by following the directions on the screen. Use the arrow keys to select **Save Configuration and Exit,** then press **Enter**.

Phoenix Configuration

Configuration with the Phoenix utility is similar to configuration with the MCS utility. Use the arrow keys to select a board to configure after entering the Configuration menu. Press **Enter** when the slot for the appropriate board is highlighted.

Select among the available system options by using the up/down arrow keys. Press the **Spacebar** at the option to toggle among available options. There is no facility for selecting peripheral options under Phoenix. To exit, skip to the bottom of the page and press **Enter** when **OK** is highlighted.

Floppy Disk Configuration

AHA-2742/2742T host adapters are normally shipped with their floppy disk controller enabled. If you need to disable the floppy disk controller to prevent conflict with an existing floppy disk controller already in the system, simply remove the single jumper at location J4.

The floppy disk resides at I/O port (primary) address 3F0h-3F7h. AHA-2742/2742T host adapters do not support I/O port (secondary) address 370h-377h.

Utilities

You can access a Disk Format Utility and a Host Adapter Diagnostic Utility through the ECU. To do this, select **Utilities** from the menu shown earlier in Figure 3-1. A sub-menu appears, as shown in Figure 3-15.

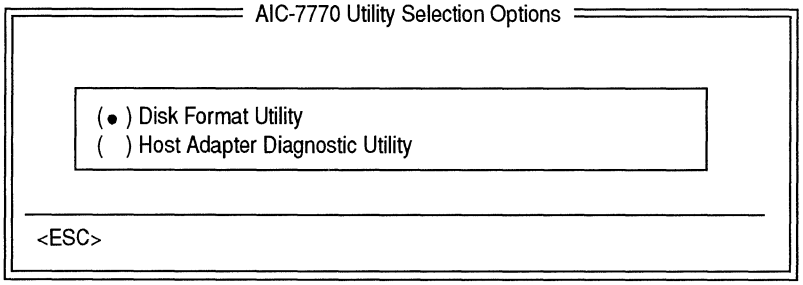


Figure 3-15. Utility Selection

Disk Format Utility

This utility lets you low-level format your SCSI disk and/or scan it for defects.

Disk Format

Your hard disk media must be low-level formatted before you can use your operating system's partitioning and file preparation utilities, such as the MS-DOS *fdisk* and *format*.

Most SCSI disk devices are pre-formatted by the manufacturer and do not need to be formatted again before you use them. The Adaptec low-level format utility is compatible with almost all currently-available models of SCSI disk drives.

> **Caution**
> All data on the drive will be lost when you perform a low-level format. Be sure to back up your data before performing this operation.

Disk Verify

Once your SCSI disk is low-level formatted, you can use Disk Verify to scan the disk media for defects. If it finds bad blocks, it prompts you to reassign them.

Host Adapter Diagnostic Utility

This utility runs a diagnostic on your host adapter by performing DMA transfers between the SCSI host adapter and system memory. This test will run indefinitely until you press **Esc**.

4

Hardware Configuration

Hardware Overview

This chapter describes the AHA-2740 Series host adapter hardware functional interface to the EISA host software.

The main hardware components of the AHA-2740 Series host adapters are:

- AIC-7770 EISA-to-Fast SCSI controller chip
- AIC-701 configuration chip
- 82077SL floppy controller chip (AHA-2742/2742T only)

The AIC-7770 chip is the central hardware element of the AHA-2740 Series host adapters. This chip has powerful built-in capabilities such as an on-board SCSI PhaseEngine (sequencer) capable of processing SCSI commands without host microprocessor intervention. The programmable PhaseEngine uses its own self-contained microcode that is downloaded by the host at initialization.

The AHA-2740T/2742T host adapters feature TwinChannel SCSI, which gives the user two independently configurable 8-bit SCSI channels. The DMA control logic in the AIC-7770 chip controls the bus arbitration and data transfer handshaking. During DMA data transfers, the AHA-2740 Series host adapter becomes a bus master.

The AIC-701 configuration chip stores configuration settings and enables you to configure the host adapter via a software program instead of by changing jumper settings on the board.

The 82077SL floppy controller chip enables the AHA-2742/2742T boards to control two floppy disk drives.

The remainder of this chapter describes in greater detail how each of these hardware components functions on the AHA-2740 Series host adapters.

AIC-7770 Controller Chip

Figure 4-1 shows the functional elements of the AIC-7770 controller chip that provides the key functionality of each AHA-2740 Series host adapter.

This diagram shows two Fast SCSI channels controlling two SCSI buses, which applies only to the AHA-2740T/2742T host adapters. The AHA-2740/2742 host adapters have only one SCSI channel.

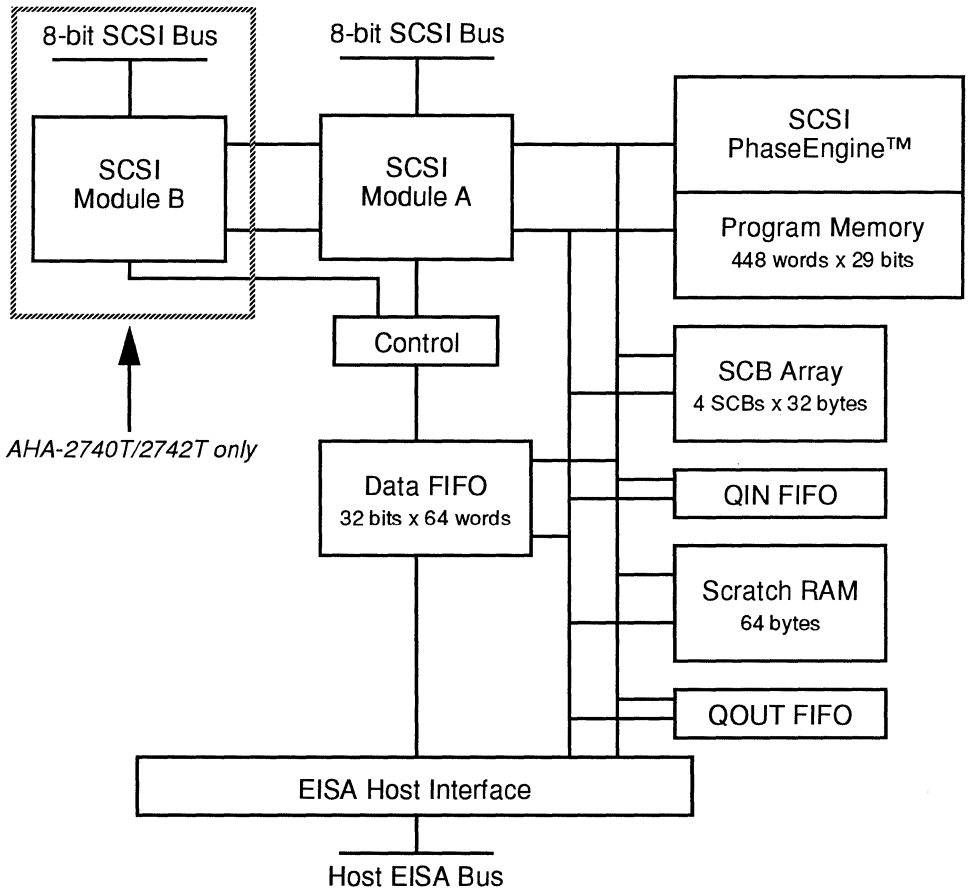


Figure 4-1. AIC-7770 Block Diagram

Now we will describe each functional part of the AIC-7770 beginning with the host interface. For more details about AIC-7770 registers and software operation, see the *AIC-7770 Data Book* and the *AIC-7770 Design-In Handbook*.

Host Bus Interface

The AIC-7770 host bus interface supports the EISA bus with full bus master transfer capability. The chip interfaces to the EISA bus by directly connecting to similarly named signals, with no additional logic required. It can transfer data at the full 33 MByte/second burst mode rate using a 32-bit data bus. EISA burst mode operation with only a 16-bit data bus is also available. Full 32-bit addressing is used during transfers. You can select the bus release time when a bus master transfer is preempted.

EISA Interface Pin Functions

The AIC-7770 is set up for direct connection to the EISA host bus. The set of host interface pins has the following functions, as shown in Figure 4-2.

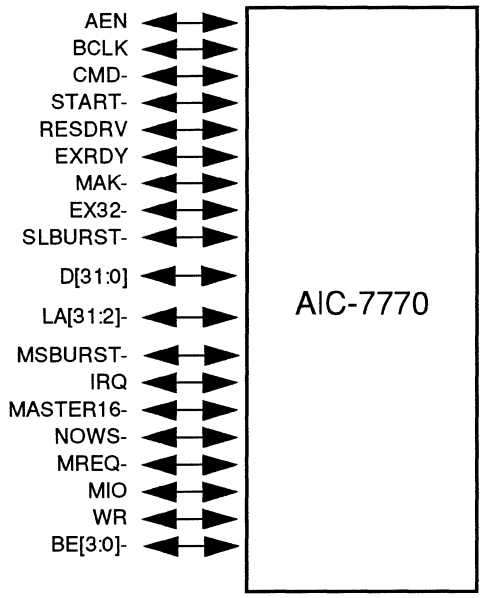


Figure 4-2. AIC-7770 Host Interface Pins

EISA Bus Address Mapping

When the AIC-7770 operates in Host mode its various internal areas are mapped linearly starting from C00h, as shown in Table 4-1:

Table 4-1. Internal Address Mapping

Area	I/O Address Range
SCSI Register Array	zC00h - zC1Fh
Scratch RAM	zC20h - zC5Fh
Sequencer Registers	zC60h - zC7Fh
Host Registers	zC80h - zC9Fh
SCB Array	zCA0h - zCBFh
z = EISA slot number	

EISA Product Identification Registers

As required by the EISA standard, the AIC-7770 chip has an identification string coded at EISA address locations zC80h-zC83h. The value returned for the AHA-2740 Series host adapters is ADP7771, which indicates the chip is being used on a host adapter board instead of as a stand-alone host adapter chip (ADP7770) on the motherboard. Table 4-2 lists the product identification registers and their hex values.

Table 4-2. Product Identification Registers

EISA Address	7770 Register Name	Register Contents
zC80h	BID0	04h
zC81h	BID1	90h
zC82h	BID2	77h
zC83h	BID3	71h

These registers will be described in more detail later in this chapter.

SCSI Interface

The design of the AIC-7770 SCSI interface is based on proven SCSI designs used in other Adaptec custom integrated circuits. The SCSI interface consists of one Fast SCSI controller in the AHA-2740/2742 host adapters and two identical Fast SCSI controllers, collectively called TwinChannel SCSI, in the AHA-2740T/2742T host adapters. Figure 4-3 shows the highlighted SCSI interface on the TwinChannel version of the host adapter.

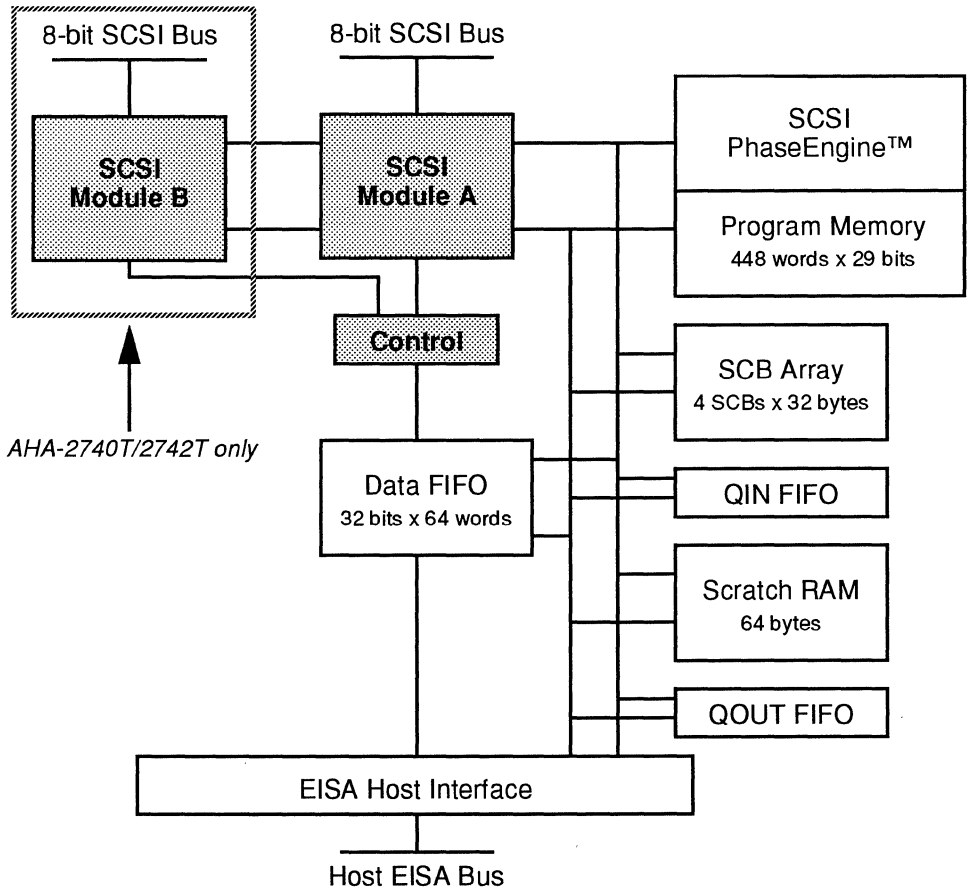


Figure 4-3. AIC-7770 SCSI Interface

Each channel connects directly to its own 8-bit SCSI bus. Single-ended SCSI drivers are built into the chip. Each channel contains a FIFO in the data path, allowing up to 15-byte synchronous offsets.

TwinChannel SCSI

The AHA-2740T/2742T host adapters feature two independent 8-bit Fast SCSI channels: A and B. Each channel has its own set of control and data lines and features onboard 48 mA drivers for direct connection to single-ended Fast SCSI buses. Figure 4-4 shows the TwinChannel configuration of the SCSI interface pins.

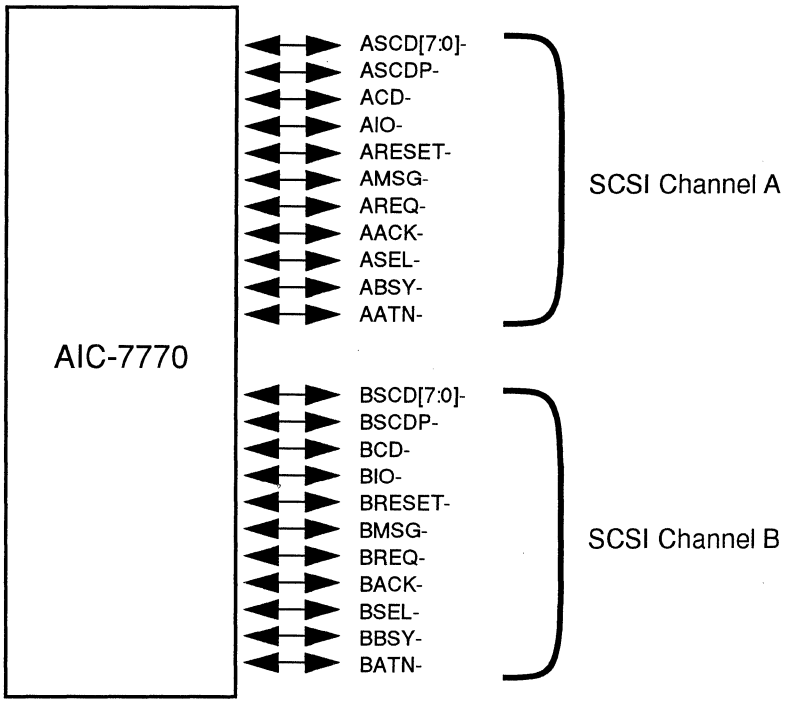


Figure 4-4. Dual 8-bit Fast SCSI Channels (AHA-2740T/2742T only)

Host Data FIFO

The host data FIFO in the AIC-7770 is structured as an array of 64, 32-bit double words for a total of 256 bytes. The FIFO features four status indicators reflecting nearly empty (within 16 bytes), 50 percent full, 75 percent full, and nearly full (within 16 bytes). These status indicators are combined with programmable threshold control logic in the host interface to allow the host data FIFO to intelligently match SCSI data transfer rates and host system data transfer rates for optimal speed. Manual and automatic flush capability is another feature of the host data FIFO.

Data FIFO Operations

Data from the SCSI channels is multiplexed into the data array to build the 32-bit double words. The host driver or AIC-7770 sequencer can also access the FIFO via Read/Write ports. Individual bytes in the FIFO array are selected by the lowest two bits of the host address register. Figure 4-5 illustrates the data FIFO operations.

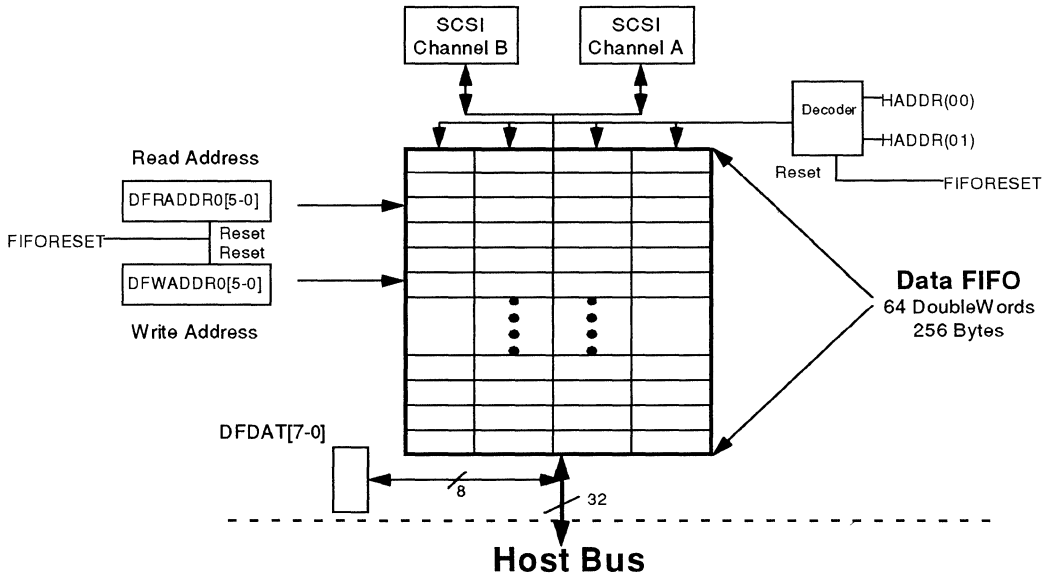


Figure 4-5. Data FIFO Operations

Data FIFO Threshold Control

To maximize host and SCSI bus usage, the AIC-7770 features data FIFO controls and status indicators. Integrated with the AIC-7770 Bus Master DMA and SCSI control circuits, they allow maximum utilization of the host and SCSI buses based on the speed differential between the host and SCSI devices. The AIC-7770 can manage four possible cases through the DFTHRSH1 and DFTHRSH0 control bits:

- SCSI much faster than host
- SCSI slightly faster than host
- Host slightly faster than SCSI
- Host much faster than SCSI

SCSI Much Faster than Host

If the SCSI device is much faster than the host, the SCSI device can take information faster than the host can supply it. On a Write operation, the AIC-7770 arbitrates for the host bus as soon as there are 16 bytes free in the DFIFO. This allows the AIC-7770 to remain on the SCSI bus for as long as possible before having to disconnect because the AIC-7770 FIFO ran out of data. On a Read operation, the AIC-7770 arbitrates for the host bus as soon as there are 16 bytes in the data FIFO. Once the transfer gets underway, the SCSI device supplies data much faster than the host can take it. This type of threshold control is shown in Figure 4-6.

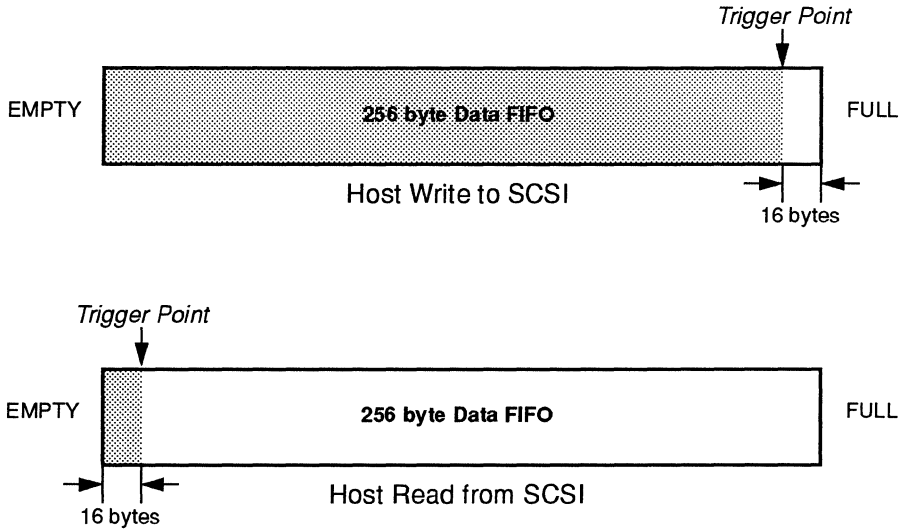


Figure 4-6. SCSI Much Faster than Host

SCSI Slightly Faster than Host

If the SCSI device is slightly faster than the host, a 50 percent trigger point is chosen to begin filling or emptying the data FIFO, as shown in Figure 4-7.

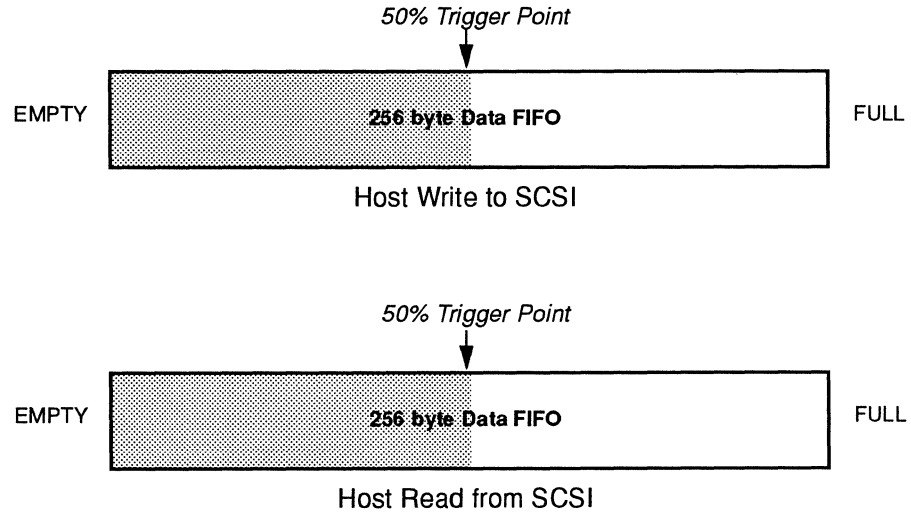


Figure 4-7. SCSI Slightly Faster than Host

Host Slightly Faster than SCSI

If the host is slightly faster than the SCSI device, a 75 percent trigger point is selected for both data reads and writes, as shown in Figure 4-8. A 75 percent trigger level is chosen for data writes because host bus usage is regularly interrupted by refresh operations that shift the transfer advantage over to the SCSI device.

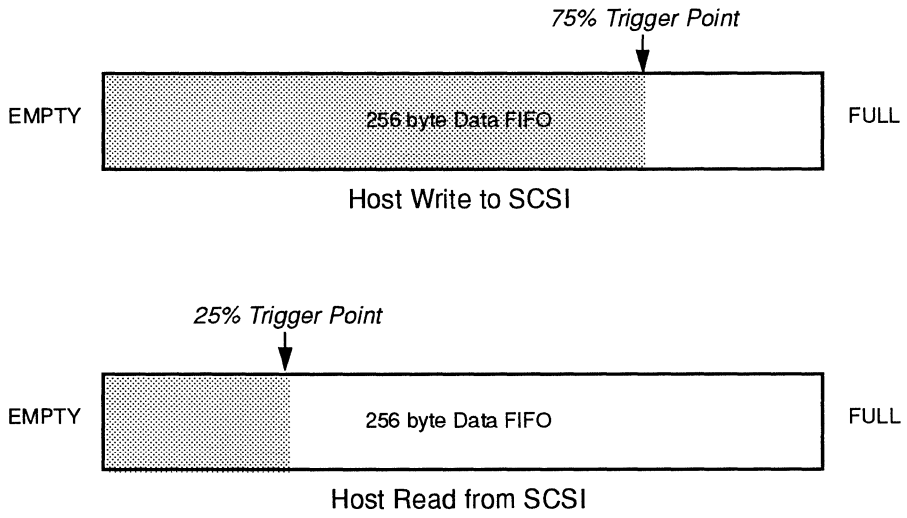


Figure 4-8. Host Slightly Faster than SCSI

Host Much Faster than SCSI

If the host is much faster than the SCSI device, the exact reverse of the first scenario occurs, as shown in Figure 4-9.

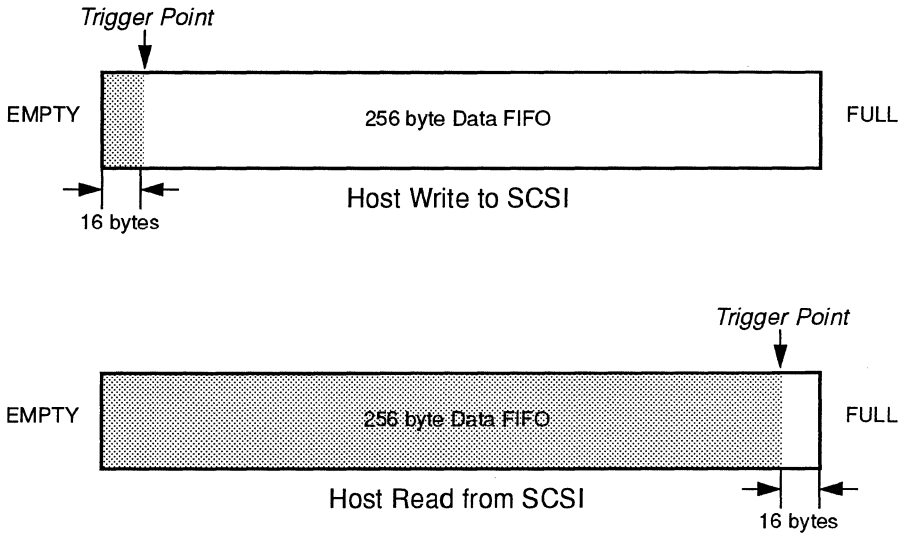


Figure 4-9. Host Much Faster than SCSI

The SCSI PhaseEngine

The SCSI PhaseEngine, also called the sequencer, provides the on-board intelligence in the AIC-7770. This part of the AIC-7770 architecture is highlighted in Figure 4-10.

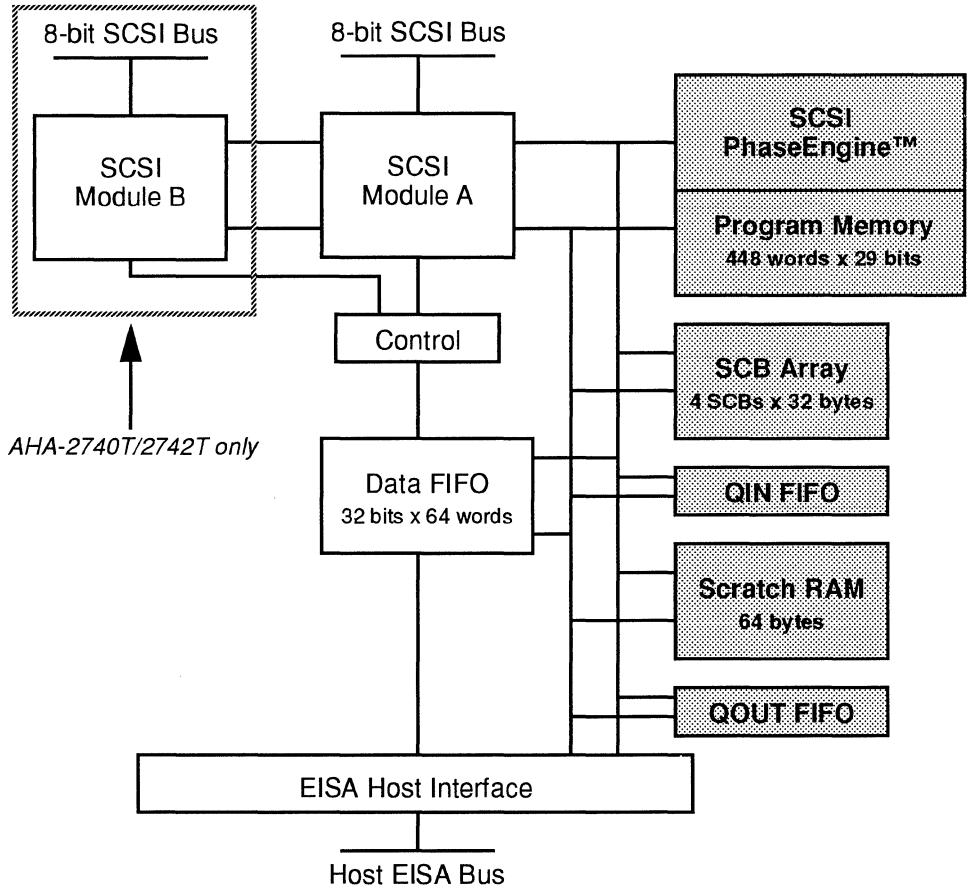


Figure 4-10. AIC-7770 PhaseEngine

The PhaseEngine is an Adaptec custom designed 29-bit RISC processor optimized to control multi-tasking, multi-threaded SCSI phase operations. The PhaseEngine executes microcode which is downloaded into its 1.8 KBytes of instruction RAM storage by the host software driver at system initialization. Because of its dedication as a SCSI phase processor, the AIC-7770 is able to reduce SCSI processing overhead 10x from the 500 µsecond/command found with state of the art SCSI host adapter boards to approximately 50 µsecond/command.

The sequencer can automatically execute an entire SCSI command to a target with no intervention by the host processor except at command complete. SCSI Command Blocks (SCBs) are downloaded to the sequencer by the host processor and are stored into a RAM area called the SCB Array. New or completed SCBs are posted into the QIN or QOUT FIFOs, respectively.

SCSI Command Block Array

A SCSI I/O operation begins by downloading 19 bytes of the 32-byte SCB to the AIC-7770. The SCB contains all of the information needed by the AIC-7770 to independently execute the requested I/O operation. The AIC-7770 can hold and simultaneously execute up to four SCBs. Each SCB is stored in a separate RAM area in the chip, as shown in Figure 4-11, and a particular SCB is accessed by setting the SCBPTR. Each SCB byte may be individually addressed or, for the convenience of downloading an entire SCB, the auto-incrementing pointer SCBCNT(4-0) may be used. When downloading an SCB, the host uses the REP OUT byte instruction to swiftly output the bytes.

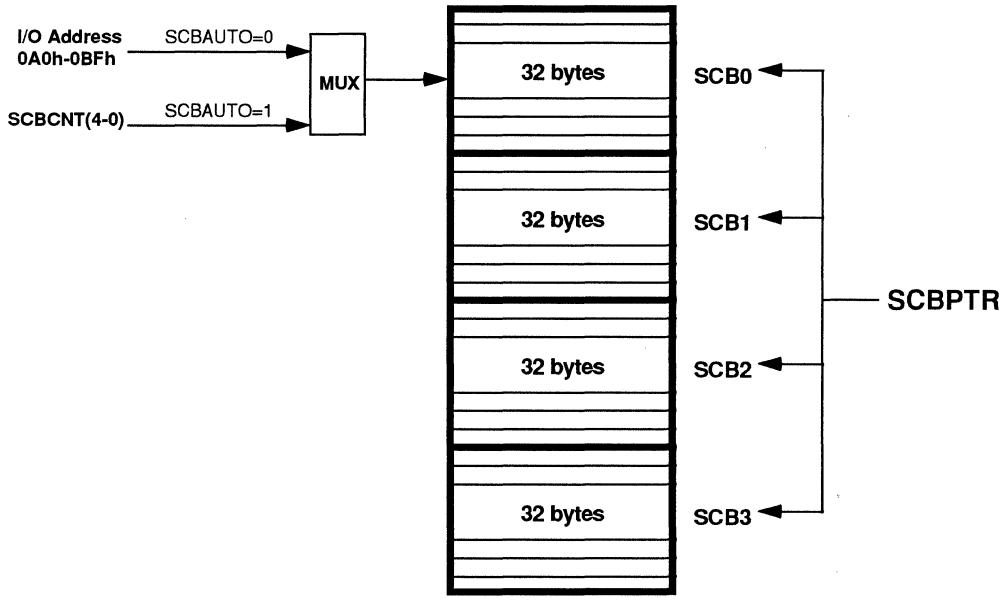


Figure 4-11. Storing and Accessing SCBs

Scratch RAM Configuration Registers

The scratch RAM area is addressed directly by the sequencer or host driver. Scratch RAM is used to store information about the SCSI bus setup, the current operation, and the system parameters. The scratch RAM is also used by the sequencer for temporary storage during operation. There are 64 scratch RAM locations, with addresses from zC20h to zC5Fh.

Here are brief description of the registers that must be initialized by the configuration utility during the boot process. The following conventions are used in this section:

- **set**: Means that the bit was loaded with a 1
- **cleared**: Means that the bit was loaded with a 0

> Note
> In the following register description tables, a blank space to the right of the bit number indicates either that the bit is Reserved or that the definition of that bit is not applicable to the hardware configuration information in this chapter. See the *AIC-7770 Data Book* for complete information on all registers and bit definitions.

Interrupt Definition Register

The configuration utility initializes all undefined fields in this register to zero. The AIC-701 chip also reads this value at boot-up and uses it to set the interrupt.

Register: zC5Ch	
7	
6	
5	
4	
3	IRQSEL3
2	IRQSEL2
1	IRQSEL1
0	IRQSEL0

3-0 IRQSEL[3:0] The value for these four bits indicates which IRQ line will be used to generate the interrupt to the EISA system. This value actually selects the IRQ line and is a user option when the ECU is run.

The bits are a binary value corresponding directly to the IRQ line. A value of 1011, for example, represents IRQ11. Any value from 0 to 15 can be written, though only the values 9, 10, 11, 12, 14 and 15 are supported. Other values will disable the IRQ lines in the host adapter.

The default IRQ value is 11.

Host Configuration Definition Register

The configuration utility initializes all undefined fields in this register to zero. This information is used only by the AIC-7770 chip.

Register: zC5Dh	
7	THRESHOLD1
6	THRESHOLD0
5	BUSRELEASE3
4	BUSRELEASE2
3	BUSRELEASE1
2	BUSRELEASE0
1	
0	

7-6 THRESHOLD[1:0] These two bits indicate the Data FIFO threshold level for which the AIC-7770 will be configured. The corresponding threshold level for each value is:

00 0% threshold
01 50% threshold
10 75% threshold
11 100% threshold

The default value is 11 (100% threshold)

5-2 BUS RELEASE[3:0] The value for these four bits indicates the number of BCLKS for which the AIC-7770 will continue transferring data after being preempted.

The bits are a binary value specifying the number of BCLKS divided by four. For example:

1111 (15 decimal) = 60 BCLKS
1011 (11 decimal) = 44 BCLKS
0001 (1 decimal) = 4 BCLKS
0000 (0 decimal) = 2 BCLKS

The default value is 1111 (60 BCLKS).

SCSI Configuration Register

This register holds configuration values for the host adapter SCSI channel(s). For the AHA-2740T/2742T TwinChannel adapters, values in register zC5Bh must be initialized the same as those in register zC5Ah. AHA-2740/2742 host adapters use only register zC5Ah. The host adapter BIOS ROM reads bit 7 of the configuration registers(s) at BIOS initialization to see if termination is enabled or disabled.

Register: zC5Ah		Register: zC5Bh	
7	TERM_ON_A	7	TERM_ON_B
6	RESET_SCSI_A	6	RESET_SCSI_B
5	PARITY_ENB_A	5	PARITY_ENB_B
4	SEL_TIM_A1	4	SEL_TIM_B1
3	SEL_TIM_A0	3	SEL_TIM_B0
2	SCSI_ID_A2	2	SCSI_ID_B2
1	SCSI_ID_A1	1	SCSI_ID_B1
0	SCSI_ID_A0	0	SCSI_ID_B0

7 **TERM_ON_A**
TERM_ON_B

If this bit is set the AIC-701 chip will enable termination for SCSI channels A or B. If this bit is cleared, termination is disabled.

The default value is 1 (termination enabled).

6 **RESET_SCSI_A**
RESET_SCSI_B

If this bit is set, the AIC-7770 chip will reset the SCSI bus A or B during initialization. If this bit is cleared, no SCSI bus reset will occur during initialization.

The default value is 1 (SCSI bus reset enabled).

5 **PARITY_ENB_A**
PARITY_ENB_B

If this bit is set, the software will configure the AIC-7770 to enable parity checking on SCSI channel A or B. If this bit is cleared, parity checking will be disabled.

The default value is 1 (parity checking enabled).

4-3 **SEL_TIM_A[1:0]**
SEL_TIM_B[1:0]

These two bits indicate the number of milliseconds the AIC-7770 chip will wait before determining that a selection timed out on SCSI channel A or B. The values for each possible setting are:

00 256 milliseconds
01 128 milliseconds
10 64 milliseconds
11 32 milliseconds

The default value is 00 (256 milliseconds).

2-0 **SCSI_ID_A[2:0]**
SCSI_ID_B[2:0]

These three bits hold the SCSI bus ID of SCSI channels A and B. This is a binary value from 000 to 111 (0 to 7 decimal).

The default value is 111 (ID 7).

Synchronous Negotiation Registers

The eight registers numbered zC20h to zC27h correspond to the SCSI IDs on channel A (zC20h for ID0, zC21h for ID1, etc.). For the AHA-2740T/2742T host adapters, the eight registers numbered zC28h to zC2Fh correspond to the SCSI IDs on channel B (zC28h for ID0, zC29h for ID1, etc.).

Registers: zC20h-zC2Fh	
7	
6	SYNC_RATE2
5	SYNC_RATE1
4	SYNC_RATE0
3	
2	
1	
0	SYNC_NEGO

6-4 SYNC_RATE[2:0] These three bits indicate the maximum synchronous transfer rate at which the AIC-7770 chip will negotiate during synchronous negotiation. The data transfer rates for each binary value are:

000	10.0 MBytes/second
001	8.0 MBytes/second
010	6.7 MBytes/second
011	5.7 MBytes/second
100	5.0 MBytes/second
101	4.4 MBytes/second
110	4.0 MBytes/second
111	3.6 MBytes/second

The default value is 000 (10.0 MBytes/second)

0 SYNC_NEGO If this bit is set, the software will configure the AIC-7770 chip to initiate synchronous negotiation to the corresponding device on SCSI channel A or B. If this bit is cleared, synchronous negotiation is disabled.

The default value is 1 (synchronous negotiation enabled).

Disconnection Register

For the TwinChannel AHA-2740T/2742T host adapters, register zC32h reflects disconnect settings for SCSI channel A and register zC33h reflects disconnect settings for SCSI channel B. For the single-channel AHA-2740/2742 host adapters, only register zC32h is needed for these settings.

Register: zC32h		Register: zC33h	
7	DISC_DSB_A7	7	DISC_DSB_B7
6	DISC_DSB_A6	6	DISC_DSB_B6
5	DISC_DSB_A5	5	DISC_DSB_B5
4	DISC_DSB_A4	4	DISC_DSB_B4
3	DISC_DSB_A3	3	DISC_DSB_B3
2	DISC_DSB_A2	2	DISC_DSB_B2
1	DISC_DSB_A1	1	DISC_DSB_B1
0	DISC_DSB_A0	0	DISC_DSB_B0

Register zC32h:

7-0 **DISC_DSB_A[7:0]** Each bit corresponds to a SCSI ID on channel A (bit 0 for ID0, bit 1 for ID1, etc.). If a bit is set, the software will configure the AIC-7770 to *not* allow disconnection during SCSI commands for the associated device ID. If a bit is cleared, disconnections are allowed for the associated device.

The default value is 0 for all bits (disconnection allowed for all devices on SCSI channel A).

Register zC33h:

7-0 **DISC_DSB_B[7:0]** Each bit corresponds to a SCSI ID on channel B (bit 0 for ID0, bit 1 for ID1, etc.). If a bit is set, the software will configure the AIC-7770 to *not* allow disconnection during SCSI commands for the associated device ID. If a bit is cleared, disconnections are allowed for the associated device.

The default value is 0 for all bits (disconnections allowed for all devices on SCSI channel B).

BIOS Control Register

The current version of the AHA-2740 Series BIOS occupies 16 KBytes. The 32 KByte BIOS option allows for future increases in the size of the BIOS code without changing the host adapter board hardware.

Register: zC5Fh	
7	WRTPRT
6	RAMEN
5	BIOSMODE1
4	BIOSMODE2
3	
2	BIOSSEL2
1	BIOSSEL1
0	BIOSSEL0

7 **WRTPRT** Ram Write Protect. When this bit is set the AIC-701 will not allow memory write access to the upper 128 bytes of shadow RAM space.

6 **RAMEN** RAM Enable. When this bit is set the AIC-701 chip will allow memory read access to the upper 128 bytes of shadow RAM space. Memory write access is valid only when RAMEN is set and WRTPRT is cleared.

5-4 **BIOSMODE[1:0]** These two bits define whether the 32 KByte BIOS ROM is enabled and how it is configured at boot time. The corresponding BIOS ROM configuration for each value is:

00 Lower 16 KBytes of BIOS ROM enabled
01 Upper 16 KBytes of BIOS ROM enabled
10 Contiguous 32 KBytes of BIOS ROM enabled
11 BIOS ROM disabled

The default value is 00 (BIOS enabled with lower 16 KBytes of the 32 KByte ROM selected).

2-0 **BIOSSEL[2:0]** These three bits select the starting address of where the BIOS ROM will be mapped. The corresponding address mappings for each binary value are:

	16 KByte BIOS	32 KByte BIOS
000	CC000h - CFFFFh	D0000h - D7FFFh
001	D0000h - D3FFFh	D0000h - D7FFFh
010	D4000h - D7FFFh	D8000h - DFFFFh
011	D8000h - DBFFFh	D8000h - DFFFFh
100	DC000h - DCFFFh	E0000h - E7FFFh
101	E0000h - E3FFFh	E0000h - E7FFFh
110	E4000h - E4FFFh	E8000h - EFFFFh
111	E8000h - EBFFFh	E8000h - EFFFFh

The default value is 011 (BIOS address D8000h).

The following registers also hold configuration information but are not located in scratch RAM. Only the bits pertaining to hardware configuration are described here. For a complete description of these registers, see the *AIC-7770 Data Book*.

Host Control Register

This register provides overall host control of the AHA-2740 Series host adapter board. It may be written at any time without consideration of the state of the PhaseEngine (sequencer).

> **Caution**
>
> The AIC-7770 must be paused by setting the PAUSE[ACK] bit before any data can be read from the scratch RAM. The chip is automatically paused by a system reset.

Register: zC87h	
7	
6	
5	
4	
3	
2	PAUSE[ACK]
1	
0	

2 **PAUSE[ACK]** Pause/Pause Acknowledge. When this bit is set the sequencer will be paused. This bit gives the PAUSEACK status when it is read; it should be polled to be sure that the sequencer is paused. Clearing this bit releases the sequencer, which will then continue at the current value of the program counter.

EISA Product Identification Registers

These four registers contain the EISA product identifier of the AIC-7770 chip, which is ADP7770. Register zC80h holds the most significant ID; register zC83h holds the least significant ID. These values are hard wired into the registers. At system bootup the AIC-701 chip reads and intercepts these register values and changes them to an ID of ADP7771, indicating that the chip is installed on a host adapter and is not installed directly on the motherboard.

Register: zC80h		Register: zC81h		Register: zC82h		Register: zC83h	
7	0	7	1	7	0	7	0
6	0	6	0	6	1	6	1
5	0	5	0	5	1	5	1
4	0	4	1	4	1	4	1
3	0	3	0	3	0	3	0
2	1	2	0	2	1	2	0
1	0	1	0	1	1	1	0
0	0	0	0	0	1	0	1

Host Control Register

The system BIOS enables the board by setting the ENABLE bit in this register at system bootup. Before this can happen the following conditions must be met.

- The BIOS location must be set to an address that does not conflict with other system resources. It may also be enabled or disabled for the particular board.
- The interrupt channel must be selected.
- The SCSI ID must be selected.
- The bus threshold and preemption must be selected. The host adapter board can stay on the bus for a programmable amount of time after preemption. The default value is 60 BCLKS.
- Termination, parity, selection timeout and reset must be configured.

After these registers are programmed, the ENABLE bit, as defined in the EISA specification, is set. This indicates to the adapter that the registers are valid.

Register: zC84h	
7	
6	
5	
4	
3	
2	
1	
0	ENABLE

0 **ENABLE** Enable Board. When this bit is set by the software the board is enabled for normal operation. When this bit is cleared the board is disabled and will not drive any bus signals as a master, but will respond as an I/O slave.

AIC-701 EISA Configuration Chip

The AIC-701 EISA configuration chip provides support for the floppy disk drive controller, the switchable upper/lower 16 KBytes or contiguous 32 KByte local BIOS ROM, 128 bytes of shadow RAM and other components of the AHA-2740 Series host adapters. This chip also makes it possible to configure the host adapter without having to set jumpers at all. The AIC-701 chip supports the following functions:

- Generates chip selects to local BIOS ROM and floppy controller.
- Allows the local BIOS ROM to be addressed either as 16 KByte ROM (switchable to upper/lower 16 KByte) or 32 KByte contiguous ROM.

  There are eight possible memory address locations where the local BIOS ROM can reside if the board is operating in 16 KByte mode. The addresses are recorded in the BIOS_CNTRL register (I/O addr = x5Fh) bits [2...0]. For 32 KByte mode there are only four possible starting memory locations.
- Generates the signal to enable the 8-bit transceiver/buffer from the local data bus to the EISA bus.

  The local BIOS ROM, shadow RAM, floppy controller and configuration chip all reside on the local data bus.
- Allows the shadow RAM to reside in the same address space as the local BIOS ROM.

  This overlays the upper 128 bytes of the local BIOS ROM space when the RAMEN bit is set.
- Allows the shadow RAM to be Read/Write or Read Only.
- Enables or disables the AHA-2740 Series host adapter from generating the selected IRQs.

  The local BIOS ROM will write to the AIC-7770 chip to enable or disable the AIC-7770 IRQ through I/O port zC87h (HCNTRL). The AIC-701 will copy this information to enable or disable the selected EISA IRQ lines. Only the AIC-7770 chip will respond during an I/O read to I/O port zC87h
- Allows the user to select IRQ levels through software (IRQSEL bits [3...0]).

  Although the IRQ levels are written to I/O address zC5Ch (AIC-7770 scratch RAM), the configuration chip also copies this information to its IRQSEL registers. Only the AIC-7770 chip will respond to I/O read zC5Ch.
- Traps the AIC-7770 chip from sending the last byte of the configuration ID 70h (I/O port zC83h) and instead outputs 71h to the EISA bus.
- Asserts NOWS during access to floppy drive controller, local BIOS or shadow RAM.

The AIC-7770 chip will assert its own NOWS when it is being accessed.

- Allows the user to enable or disable SCSI termination with software instead of with jumpers.

82077SL Floppy Drive Controller Chip (AHA-2742/2742T Only)

The 82077SL single-chip floppy disk drive controller is used on the AHA-2742/2742T host adapter boards. All drive control signals are fully decoded and have 40 mA drive buffers with selectable polarity. Signals returned from the drive are sent through an on-chip input buffer with hysteresis for noise immunity. The integrated analog data separator needs no external compensation yet allows for a wide motor speed variation with exceptionally low soft error rates.

The microprocessor interface has a 12 mA drive buffer on the data bus plus 100% hardware register compatibility for standard systems. The 16-byte FIFO with programmable thresholds is extremely useful in multi-master systems or in systems with a large amount of bus latency, typically found in performance EISA systems.

The 82077SL chip has no software configuration options for. It will respond only to primary I/O address 3F0h-3F7h.

❒

5

On-board BIOS Interface

Introduction

The AHA-2740 Series host adapter BIOS performs the following functions:

- Initializes AHA-2740 Series host adapter boards and attached SCSI devices, as needed, at system power-up.
- Supports the standard Int 13h interface for SCSI disk drives on the SCSI bus. This support enables use of drives attached to the adapter under real mode operating systems such as DOS without a device driver.

  The limit for Int 13h supported drives is eight (80h-87h). As far as the system drive count and drive tables are concerned, the limit is eight drives for DOS version 5.0 and above and two drives for earlier versions of DOS.
- Enables booting from a hard disk (or removable disk, if enabled) installed on the AHA-2740 Series host adapter.

BIOS Operation

The AHA-2740 Series BIOS resides on the host adapter board and supports up to seven SCSI Common Command Set (CCS) disk drives per SCSI channel under DOS 5.0 and above. (The host adapter itself is assigned one SCSI ID on each SCSI bus.) If your computer uses SCSI devices other than CCS disk drives, or if you need to support more than two disk drives under DOS version 4.x and earlier, you will need to use the Adaptec DOS driver. The AHA-2740 Series BIOS provides a very simple single-threaded capability that allows the host system to boot from a SCSI disk drive and to support standard DOS calls from any program.

The BIOS communicates with the host adapter through a special set of commands passed through the Hardware Interface Module software. These commands are not available to any programs except the Adaptec BIOS. The Adaptec BIOS provides a standard BIOS interface. The DOS interface to the standard BIOS is described in this section.

In many computers, the BIOS that resides on the motherboard supports up to two standard hard disk drives. Additional drives must be managed through an appropriate driver. The operation of the AHA-2740 Series BIOS on attached SCSI devices depends on the number of standard hard disks installed directly on the system.

> Note
> A *standard* hard disk means a disk that uses an ST-506/412 (MFM or RLL), IDE or ESDI interface.

Operation with No Standard Hard Disks Installed

If no standard hard disks are installed on the computer, the AHA-2740 Series BIOS can support up to seven SCSI drives. (Normally the host adapter itself uses SCSI ID 7.) The BIOS will scan targets 0 to 6, assuming that the host adapter SCSI ID is 7. The first drive it encounters that is attached to Int 13h will be the boot device. The BIOS will always use Logical Unit Number (LUN) 0.

Operation with One Standard Hard Disk Installed

If one standard hard disk is installed on the computer, the internally installed hard disk (that is, an IDE drive) is designated as drive 0 (drive *C*). The first SCSI disk device attached to the AHA-2740 Series BIOS and included in the BIOS scan will be designated as drive 1 (81h). The system boots from the internally installed standard hard disk. This configuration is called concurrent operation, meaning that the internally installed drive and one SCSI drive can operate together under the Adaptec BIOS.

Operation with Two Standard Internal Hard Disks Installed

If two standard internal system hard disks are installed on the computer, all the disks that can be supported by the BIOS are directly installed. In this situation the AHA-2740 Series BIOS will not support any SCSI drives under DOS 4.x and earlier, because of the two-drive DOS limitation. A device driver must be installed to access the SCSI drives. Under DOS 5.0 and later, however, the Adaptec BIOS can support up to six SCSI drives (eight drives total).

Hardware

The AHA-2740 Series host adapter BIOS occupies 16 KBytes of system ROM at one of a number of optional physical locations. These hex locations are CC000, D0000, D4000, D8000, DC000, E0000, E4000 and E8000. 128 bytes of this space is Read/Write shadow RAM, which enables the BIOS to store critical information without risking compatibility by using system data areas. The BIOS is coded using the 386 instruction set.

Initialization

The system BIOS recognizes the AHA-2740 Series BIOS by the board ID. When the system BIOS gains control, the following steps will be taken:

➤ 1 The BIOS will search the EISA slots for the adapter onto which it is installed. The correct adapter can be identified by matching the current code segment with the BIOS base address in the board's setup registers. If the board is not functioning properly, the BIOS will display the message:

Can't locate SCSI host adapter!

and the BIOS will fail initialization. The failure will be flagged to the system via the BP register so that the system BIOS can halt system initialization until the user strikes a key (**F1** on most systems).

2 The BIOS will normally initialize the host adapter, which may also result in a reset of the SCSI bus. The BIOS will wait two seconds before proceeding with initialization, since many SCSI devices are unable to communicate properly shortly after a SCSI reset.

3 Having found and initialized the host adapter, the BIOS will proceed to setup and test the on-board shadow RAM. If diagnostics on this RAM fail, the message:

Host adapter shadow RAM failure!

will be displayed, and initialization will fail.

4 The BIOS will pull adapter configuration information out of system CMOS RAM via Int 15h and will download this configuration information to the host adapter.

5 The BIOS will determine configuration information for installed SCSI devices from the CMOS RAM information.

If the Include in BIOS Scan option is set to **yes**, the BIOS will attempt to support the device under Int 13h. If the device is not installed or is not SCSI device type 0 (hard disk drive) or 7 (magneto-optical drive), as recorded in byte 0 of Inquiry info, the drive will not be supported under Int 13h.

If the Include in BIOS Scan option is set to **no** the BIOS will not support the device under Int 13h. The default setting is **yes** for all devices. The net effect of the defaults is to cause the BIOS to scan the entire SCSI bus looking for hard drives to support via Int 13h.

Other Changes

The BIOS is interrupt driven and fully supports Int 15h, allowing operation with various write caching programs. The BIOS supports multiple host adapters in a system and allows boards to share the same interrupt.

The BIOS also supports a new Int 13h call to identify which Int 13h drives correspond to which host adapter and SCSI ID. Adaptec's I/O environment software has been

changed to support this function. This eliminates the requirement on previous Adaptec host adapters that Int 13h devices may only be at targets 0 and 1.

The AHA-2740 Series BIOS will perform the steps necessary to support Int 13h for the SCSI drives which were assigned Int 13h IDs. This includes building drive tables in shadow RAM for SCSI drives and updating drive table pointers at the appropriate interrupt vector locations. The drive tables are provided for compatibility and are not actually used by the BIOS during normal operation.

The AHA-2740 Series BIOS will revector Int 13h so that all calls for disk I/O can be filtered by the BIOS. Requests for non-SCSI drives are passed on to the original Int 13h vector, which is stored in shadow RAM. The system drive count (40:75) is updated to reflect the new system drive count.

Once initialization is complete and all appropriate data structures have been set up in shadow RAM, the BIOS will write protect the shadow RAM to prohibit further access. Because an outside agent can always move the BIOS into a write protected area, no write access is made to this area after initialization. Systems that move the BIOS into such an area before initialization will not work with the AHA-2740 Series BIOS.

Boot Issues

Traditionally, computer systems have booted from drive 80h (often referred to as drive *C*). For ISA systems, Adaptec SCSI BIOS ROMs were forced to intercept Int 19h in order to provide booting capability from a SCSI drive. This was mainly because many motherboard BIOS products did not properly issue Int 13h calls to perform the boot. This problem does not apply to EISA systems. Therefore, the AHA-2740 Series BIOS does not have any Int 19h booting code, and Int 19h will be left alone.

The system BIOS is free to implement any boot algorithm it chooses, and SCSI drives will be supported by such schemes as long as Int 13h calls are used to read the boot sector(s). On systems that will only boot from drive 80h (this is very typical) booting from SCSI will be limited to a SCSI drive assigned as drive 80h. Note that this excludes booting from SCSI if there is already a standard controller in the system. The user can control the boot drive by mapping out drives via the AHA-2740 Series CMOS configuration so the desired boot drive is the first drive found by the system.

Int 13h Interface Functionality

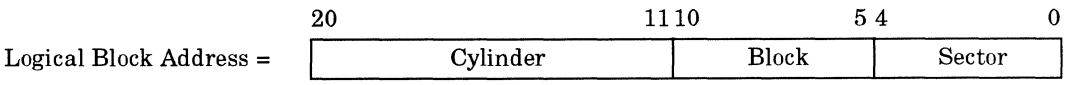
Disk I/O requests are passed from the operating system to the BIOS through Int 13h. CPU registers are used to pass a function code as well as the associated parameters for the function. The AHA-2740 Series BIOS supports SCSI drives under Int 13h by intercepting each request and routing the request based on the drive number. If the drive number corresponds to a SCSI drive, the BIOS services the request through the host adapter. If the drive number specifies a floppy or non-SCSI hard drive, the request is passed to the original Int 13h vector for processing. Most Int 13h requests use the registers listed in Table 5-1 for parameter passing.

Table 5-1. Registers for Parameter Passing

Register	Function
AH	BIOS Function Code
AL	Sector Count
CH	Low Byte of Cylinder Number
CL (Bits 7,6)	High Bits of Cylinder Number
CL (Bits 5-0)	Sector Number (1-based)
DH	Head Number
DL	Drive Number
ES:BX	Data Buffer Address

Physical to Logical Block Address Translation

The starting sector addresses for read, write and verify requests is passed as a physical address including a 10-bit cylinder number, an 8-bit head number, and a 6-bit sector number (which is one-based so the maximum sector number is 63 instead of 64). SCSI devices are addressed by logical block address without regard to the physical geometry of the drive. For this reason, all SCSI devices are defined as drives with 64 heads and 32 sectors/track. An appropriate number of cylinders is used to provide the full capacity of the drive using this physical to logical translation. Each cylinder is exactly 1 MByte using this scheme, and the physical to logical translation can be described by the following simple algorithm.



This provides 21 bits of addressing, which is equivalent to 1 GByte, given that the Int 13h interface assumes a block size of 512 bytes/sector.

Virtual to Physical Buffer Address Translation

A data buffer address is passed to the BIOS via ES:BX. This virtual address can be easily translated into the physical address needed by a Bus Master device when the system processor is in real mode. Because this is the case at system boot time and under normal DOS operation, simple segment arithmetic is normally used to convert ES:BX to a physical address usable by the AHA-2740 Series host adapter:

Physical address = (Segment * 16) + Offset

The 386 processor, however, has given rise to a large number of software products which use the 386 memory management feature to provide virtual 8086 operation. The address passed in ES:BX still appears valid to the BIOS, but the processor is not in fact in Real mode, and normal segment arithmetic will not yield the correct physical location of the data buffer. This issue has been addressed by IBM® and Microsoft® in a specification known as Virtual DMA Services (VDS).

VDS gives the ROM BIOS a method for determining the physical location of a buffer given the selector:offset as well as its layout (it may not be contiguous). The AHA-2740 Series BIOS will fully support the VDS specification so that 386 memory management programs can run without a driver as long as they are VDS compliant.

BIOS Command Return Codes

Any Int 13h request, upon completion, returns control to the requestor with a return code set in the carry flag and a status code placed in AH. The carry flag is set as follows:

CF=1 Error or unusual condition. Status is nonzero.
CF=0 Command completed normally. Status is zero.

Table 5-2 lists status code definitions returned in register AH, as well as the mapping from SCSI error conditions.

Table 5-2. Status Code Definitions

AH (Hex)	Definition
00	No Error: Operation completed successfully
01	Invalid Function Request: The Int 13h function code provided was not valid or the drive number was out of range.
02	Unable to Read Address Mark: One of the following additional sense codes (SCSI ASC) was presented in the sense information returned by the target: 12h - No AM Found on Data Field 21h - Illegal Logical Block Address
03	Write Protect Error: Returned SCSI ASC: 27h - Data Protect
04	Read Error: Returned SCSI ASC: 14h - No Record Found 16h - Data Sync Error

Table 5-2. Status Code Definitions *(Continued)*

AH (Hex)	Definition
10	Uncorrectable ECC Error: Returned SCSI ASC: 10h - ID ECC Error 11h - Unrecovered Read Error
11	ECC Corrected Data Error: Returned SCSI ASC: 17h - Recovered Read Error without ECC 18h - Recovered Read Error with ECC
20	General Controller Failure: Returned SCSI ASC: 01h 03h 05h 06h 07h 08h 09h 1Bh 1Ch 1Dh 40h 41h 42h 43h 44h 46h 47h 48h 49h
40	Seek Operation Failed: Returned SCSI ASC: 15h - Seek Positioning Error 02h - No Seek Complete
80	Time-out: Host adapter not responding to BIOS
AA	Device Not Ready: Returned SCSI ASC: 04h - LUN not ready 28h - Unit Attention, Ready 29h - Unit Attention, Power on 2Ah - Unit Attention, Mode Select Change
BB	Undefined error occurred: A SCSI ASC other than those listed was returned by the target.
CC	Write Fault: Not returned by AHA-2740 Series BIOS
FF	Sense Operation Failed: An error occurred issuing the SCSI request sense command to the target.

Hardware BIOS Commands

(AH) = 00h - Reset Disk System
This function does nothing to SCSI drives. Regardless of drive number, this request is passed to the original Int 13h vector so that floppy and non-SCSI drives may be reset.

(AH) = 01h - Read Status of Last Operation
The status of the last operation performed is returned. The status is reset to zero.

(AH) = 02h - Read Desired Sectors into Memory
The sectors requested are read from the disk to system memory. A Read (Extended) command (SCSI Operation Code 28h) is used to execute this function.

(AH) = 03h - Write Desired Sectors from Memory
The sectors requested are written from system memory to the disk. A Write (Extended) command (SCSI Operation Code 2Ah) is used to execute this function.

(AH) = 04h - Verify Desired Sectors
The sectors requested are verified to be correctly written on the SCSI disk. A Verify command (SCSI Operation Code 2Fh) with the byte check bit set to zero is used to execute this function. If the verify function is not supported by the selected disk, a Read (Extended) command is used and the data is thrown away.

(AH) = 06h - Identify SCSI Devices
This is a special call that is used to return the first supported SCSI drive. If there are only SCSI drives, then the return value will be 80h. If there is a SCSI and a standard controller, then the return value will be 81h.

The ID of the first supported drive is returned in BL. If an error code is returned (CF is set) on this call, it indicates that the SCSI adapter BIOS is not in the Int 13h chain at all. No SCSI drives are supported by the BIOS.

(AH) = 08h - Read Drive Parameters
A SCSI Read Capacity command is used to determine the maximum logical block of the selected SCSI drive. This information is then used to calculate the number of cylinders to be returned to the host system. The number of heads returned will always be 64 and the number of sectors per track will always be 32. The number of drives will reflect the value in 40:75 (system hard drive count). The capacity is rounded to the nearest full MByte, and the cylinder count is returned as the number of MBytes (since each cylinder is 1 MByte). Table 5-3 shows the output of this function.

Table 5-3. Read Drive Parameters

Register	Function Output
AH	Status of Operation
DL	Number of Hard Drives Supported by Int 13h
DH	Maximum Value of Head Number = 63
CH	Low Byte of Cylinder Number
CL (Bits 7,6)	High Bits of Cylinder Number
CL (Bits 5-0)	Sector Number (1-based)
CF	Return Code

(AH) = 09h - Initialize Drive Pair Characteristics
This command does nothing to SCSI drives, since they are self-configuring.

(AH) = 0Ch - Seek
A Seek (Extended) command (SCSI Operation Code 2Bh) is used to perform this function. As the Seek command is not mandatory for SCSI, an invalid command error will not be reported back to the system, but instead the command will complete normally. Any other error will be reported as usual.

(AH) = 0Dh - Alternate Disk Reset
This function does nothing to SCSI drives. Regardless of drive number, this request is passed to the original Int 13h vector so that non-SCSI hard drives may be reset.

(AH) = 10h - Test Drive Ready
A Test Unit Ready command (SCSI Operation Code 00h) is used to execute this function.

(AH) = 11h - Recalibrate
A Rezero command (SCSI Operation Code 01h) is used to execute this function. Since the Rezero command is not mandatory for SCSI compliance, an invalid command

error will not be reported back to the system. Instead, the command will complete normally. Any other error will be reported as usual.

(AH) = 15h - Read DASD Type
A SCSI Read Capacity command is used to determine the maximum logical block of the selected SCSI drive. This information is returned to the host along with the DASD type of the target, which will always be 03h for hard disk.

Table 5-4 lists the output of this function.

Table 5-4. Read DASD Type Information

Register	Function Output
AH	Status of Operation
DL	00h - Drive not present or invalid DL 03h - Fixed Disk Present 01h, 02h - Reserved
CX	Number of blocks on disk
CF	Return Code

The following function codes are *not* supported by the AHA-2740 Series BIOS:

(AH) = 05h	Format Desired Cylinder
(AH) = 06h	Format Desired Cylinder and Set Bad Sector Flags
(AH) = 07h	Format Drive Starting at Desired Cylinder
(AH) = 0Ah	Reserved
(AH) = 0Bh	Reserved
(AH) = 0Eh	Reserved
(AH) = 0Fh	Reserved
(AH) = 12h	Reserved
(AH) = 13h	Reserved
(AH) = 14h	Reserved
(AH) = 16h	Reserved
(AH) = 17h	Reserved
(AH) = 18h	Reserved
(AH) = 19h	Park Heads
(AH) = 1Ah	Format Unit
(AH) = 1Bh-FFh	Reserved

An invalid command error is returned for any of these function codes.

Int 15h Functionality

After issuing an I/O command to the host adapter, the AHA-2740 Series BIOS will use the Int 15h Device Busy (function 90h) to inform the operating system that the BIOS is about to wait for a device.

When the interrupts indicate that the I/O is complete, an Interrupt Complete (function 91h) will be issued by the BIOS, indicating that the wait is complete.

Multiple Adapter Support

When multiple SCSI adapters are installed, the BIOS should be enabled on all boards. Each BIOS is responsible for initializing the board on which it resides. This has the following advantages:

- Full 128 bytes of shadow RAM is available for each board
- Facilitates mixing of different host adapter versions in the same system because each board is initialized by the BIOS belonging to that board

If you disable the BIOS on one of the boards (such as for driver development debugging), the system will use the default SCSI Device Configuration options. Any SCSI device configuration information saved by the EISA Configuration Utility (ECU) will be ignored.

During system boot, BIOSs load in order of the BIOS address, regardless of the EISA slot number. For example, if there are four host adapters with BIOSs at hex addresses of CC000, DC000, E8000, and D0000, the BIOSs will install in the order of CC000, D0000, DC000, and finally E8000.

The EISA architecture can support up to 15 EISA Bus Master cards. The actual number is limited by the number of slots in your EISA system that support bus master and the number of other Bus Master cards used. Most users have the capability to install more AHA-2740 Series host adapter cards than can be used.

Although adapters can share interrupts, you should set each board to a unique interrupt for maximum performance. Use the ECU that came with your system to configure your system and any installed boards.

You also have the option of running multiple host adapters with a single device driver while disabling the host adapter BIOS.

Refer to Chapter Three, *Installation and Configuration*, for more information.

6

Device Drivers

DOS Operation without Drivers

AHA-2740 Series host adapters operate with very high performance characteristics, using drivers that directly access their multi-tasking interface. In addition, AHA-2740 Series host adapters and their BIOS support the Int 13h interface used by MS-DOS®. The Adaptec BIOS supports up to eight hard disk drives per system under DOS version 5.0 and above without the use of special device module software programs and up to two hard disk drives per system under earlier versions of DOS.

If no standard hard disk drives (ST506/412, ESDI, or IDE) are installed in the host computer system, the SCSI drive at SCSI address 0, and LUN 0 (0:0) is used as drive *C*, the boot hard drive. If a drive is installed at SCSI address 1, LUN 0 (1:0), it will be used as drive *D*, the second hard drive.

If one internal hard disk drive is installed in the computer, that drive is assigned as drive *C*. In that case, the SCSI disk drive at address 0:0 will be assigned as drive *D*. If two internal hard disk drives are installed in the computer system, SCSI disk drives can be accessed only by a special device module software program for DOS 4.x and earlier. DOS version 5.0 and above can recognize up to eight hard disk drives.

> Note
> You can use the EISA Configuration Utility (ECU) to control which hard drives are installed by the BIOS.

System Configuration

Standard AT motherboard BIOS supports up to two floppy disk drives and eight hard disk drives under DOS 5.0 and above. DOS uses Int 13h to access the floppy and hard disk services. Int 13h refers to the first and second floppy disk as 0 and 1, respectively, and refers to the first and second hard disks as 80h and 81h, respectively. Floppy disk drive 0 is assigned drive letter *A* and floppy disk drive 1 is assigned drive letter *B*.

The first partition on hard disk drive 0 is assigned drive letter *C* and the first partition on hard disk drive 1 is assigned drive letter *D*. If there is only one physical hard disk, *D* refers to the second partition on that drive. To permit the use of more than two hard disks in your system under versions of DOS prior to 5.0, Adaptec provides host adapter drivers for the AHA-2740 Series. These drivers are loaded via the *config.sys* file when you boot your computer.

Table 6-1 shows how hard disks are addressed in a system running under DOS:

Table 6-1. Hard Disk Drive Addressing

Number of Standard Hard Disks	C	D	Device Driver
2	1st Standard Disk	2nd Standard Disk	SCSI Devices
1	Standard Hard Disk	SCSI ID #0 Disk	Other SCSI Devices
0	SCSI ID #0 Disk	SCSI ID #1 Disk	Other SCSI Devices

AT computers and compatibles come with a setup utility either on floppy diskette or included in the motherboard BIOS. This utility stores the configuration of your system in battery-powered CMOS memory, which is saved when your computer is turned off. The presence of standard hard disks should be reflected in the utility. The presence of SCSI hard disks is *not* entered in setup.

A *standard* hard disk means a disk that uses an ST-506/412 (MFM or RLL), ID or ESDI interface. A *standard* hard disk controller means an adapter card that controls one or two standard hard disk drives and uses the standard AT hard disk register set 1F0h 1F7h (i.e., WD 1003 or Adaptec ACB-2300 series).

The following conditions must be true before your system will boot from a SCSI hard disk drive:

- The setup utility must indicate that no hard disks are installed.
- There must be a bootable SCSI hard disk at SCSI ID 0.

  You normally install the boot device at SCSI ID 0. If for some reason you want to use a different SCSI ID for the boot device, you must change the Include in BIOS Scan settings for devices on the SCSI bus. See Chapter Three, *Installation and Configuration*, for more information.
- There must not be a floppy diskette in floppy disk drive *A*.

Low-level Format

Most SCSI drives are low-level formatted before they are shipped from the factory. In the rare event that your SCSI disk drive requires a low-level format, select **Utilities** on the main configuration menu of your system's ECU, and then select the **Disk Format Utility** option. (For more information, read the *Utilities* section of Chapter Three, *Installation and Configuration.*)

Installation and Initialization Under DOS

You use the DOS *fdisk* and *format* programs to initialize hard disks with the required DOS structures.

Run the DOS *fdisk* program to partition the disk for the number of cylinders to be used by DOS. If you are using DOS 3.2 or earlier, select one less cylinder than the maximum allowable per partition according to DOS. This eliminates the possibility of exceeding the 32 MByte limit. Activate the first DOS partition before leaving *fdisk*, if it is to be the boot partition. Use the menu entry in *fdisk* to display partition data if you are not sure whether a DOS partition exists.

Caution

If the drive you are using was previously formatted or partitioned with a different host adapter or disk controller, a DOS partition may already exist. If such a partition does exist you should delete it and re-create it using the AHA-2740 Series host adapter. Otherwise your system may perform erratically.

After the DOS partition has been created and activated, the drive is ready for a DOS format. Your DOS manual lists and describes the available format options. If the system will boot from a SCSI disk, it is usually easiest to transfer the hidden system files to that disk during the DOS format by using the /s option:

```
format c: /s
```

The host adapter and SCSI disk(s) are now ready for normal DOS operation.

The various Adaptec host adapter families (e.g., AHA-1540/1542, AHA-1740/1742A, AHA-1640, AHA-2740 Series) are DOS format compatible: this means that a disk initialized with one board can be connected to any other board with 100% compatibility (if the normal default translation scheme is used).

Managers

The AHA-2740 Series host adapter BIOS supports up to eight hard disks without a dedicated software driver under DOS 5.0 and above and up to two hard disks under earlier versions of DOS. (A single-channel host adapter can actually support only seven disk drives under DOS 5.0 and above, since the adapter itself uses one SCSI ID.)

You may need a driver to take full advantage of the features and benefits of this high-performance host adapter if your system uses:

- an operating system other than DOS
- more than two hard disks under DOS 4.x or earlier
- SCSI peripherals other than hard disk drives

- any combination of the above items

Adaptec has developed an architecture called Advanced SCSI Programming Interface (ASPI), which is available as a standard to all companies. ASPI divides the driver problem into two levels with a pass-through ASPI layer interface between. The driver component above the layer is called a module and is peripheral-specific. The driver component below the layer is called a manager and is host adapter-specific. Since the ASPI layer is a standard, different modules can work interchangeably with different managers. ASPI details are specific to a given operating system.

Adaptec provides a wide variety of host adapter drivers for various peripherals running under a number of I/O operating system environments. You can order Adaptec software products by calling 800-442-7274 between 5:00 A.M. and 6:00 P.M. Pacific Standard time.

EZ-SCSI for DOS\Windows

Adaptec's EZ-SCSI software product for the DOS/Windows operating system environments includes an ASPI manager for the AHA-2740 Series host adapters, host adapter drivers for hard disk drives and other devices, and several DOS and Windows utilities. EZ-SCSI enables you to quickly and easily install AHA-2740 Series host adapters and other SCSI devices on your computer.

Adaptec EZ-SCSI includes a special version of the *fdisk* program called *afdisk,* which is needed to partition and high-level format the third, fourth, etc., hard disk in your system, if your system is running under DOS 4.x or earlier. If your system is running under DOS 5.0 or above, you can format all your hard disk devices with *fdisk.*

Microsoft Windows 3.0/3.1 and Extended Memory Managers

When you use the high-performance 32-bit first-party (also called Bus Master) Direct Memory Access (DMA) on your AHA-2740 Series host adapter, you may need a driver in order to be compatible with software applications that use the Protected Mode of the 80386 microprocessor. A common example of this is the Standard and Enhanced Modes of Microsoft Windows 3.0 or 3.1, Quarterdeck QEMM™, and Qualitas 386MAX™. The driver provides either VDS (Virtual DMA Services) support or adds a buffer for double buffering to allow these Protected Mode programs to work.

VDS is a software specification developed by Microsoft and adhered to by the major software vendors. It allows the Bus Master host adapter to obtain the physical address to transfer data when the program is running in Protected Mode. When this method is used, a separate data buffer is not required (which takes up memory). Current versions of MS® Windows, QEMM, QRAM™, 386MAX, Move'Em™, and DR DOS® conform to the VDS specification.

The Adaptec ASPI manager for the AHA-2740 Series host adapters and the AHA-2740 Series BIOS both provide VDS support.

Managers for Other Operating Environments

You may not need to install additional environment software in order to use your AHA-2740 Series host adapter. Adaptec is working with major operating system suppliers to provide embedded support in their operating systems. Please contact Adaptec or your operating system vendor for information on the current I/O operating environment software support for environments such as OS/2®, UNIX and NetWare®.

Until embedded support is provided for your operating system, host adapter drivers for the AHA-2740 Series may be available from Adaptec.

7

SCSI Features

Initiator Mode SCSI Description

AHA-2740 Series host adapters provide a very high performance SCSI interface connection. These host adapters meet the ANSI Standard X3T9.2/86-109 Revision 10c, describing the SCSI standard. Additionally, the AHA-2740 Series meets conformance level 2 of the specification by implementing the following SCSI options:

- Accepts or manages the following messages:
  - Command Complete
  - Disconnect
  - Message Reject
  - Identify
  - Tagged Queueing
  - Save Data Pointer
- Performs arbitration

The following alternatives are selected for the AHA-2740 Series SCSI interface connection from those described by X3.131-1986:

- Single-ended SCSI driver/receivers are used.
- The host adapter uses a polyswitch to provide continuous termination power to the SCSI bus.
- Parity is always generated. Parity checking can be disabled through the configuration utility.
- Synchronous data transfer is supported. Negotiation for the synchronous transfer initiated by another SCSI device will be accepted by AHA-2740 Series host adapters at any time.
- Multi-tasking is fully supported.
- Modify Data Pointers is supported to allow Zero Latency Read operations.

In addition to these SCSI functions, the SCSI CCS (Common Command Set) at level 4B is also supported. Although this document was never made a standard, it describes a widely available set of disk drive functions which are supported by the

host adapter. The host adapter BIOS commands are all mapped into SCSI CCS commands to allow the proper support of all the most common SCSI disk drives.

The draft ANSI standard for SCSI-2 has been used as a reference for the implementation of all SCSI functions with the expectation that the host adapter will be fully compatible with the final version of the SCSI-2 standard.

Tagged Queuing

Tagged Queuing allows a SCSI device to return data in a different order than requested by the host adapter. In order to execute a Tagged Queuing command, the tag enable bit in the control byte of the SCB must be set. The type of tag is also indicated by coding bits 0 and 1 of the same byte. A value of 00 means a simple queue is intended; 01 means a head of queue message will be sent; and 10 means an ordered queue message will be sent.

The tag value will be the ID of the SCB. The Tag message will be sent after the ID message with the tag value, if the tag enable bit is set. On reconnection, the search will be made for the disconnected SCB for the Target/Channel/LUN, and if the tag enable bit is set, a Tagged Queue message will be expected. Once the tag value is received, the correct SCB is chosen and the command is resumed.

Zero Latency Read Operation

AHA-2740 Series host adapters implement Zero Latency Read operation through the use of Modify Data Pointer messages. Zero latency can eliminate rotational latency, depending on the length of the data transfer, by supporting out-of-order data transfers.

After seeking to the target track, the drive will begin reading block IDs. If the first block ID is within range of the data transfer, but not the last block of the data transfer, the drive will begin reading the subsequent blocks into its buffer. Before transferring data the drive will issue a Modify Data Pointer message to the host adapter. This supplies a positive argument that is added to the value of the current data pointer. The drive will now send this portion of the data transfer to the host and will resume reading data into its buffer as soon as the first block of the data transfer is detected.

Before sending this data to the host, the drive will issue a second Modify Data Pointer message to the host adapter, which supplies a negative argument. This returns the data pointer to its original position. It also guarantees that a data transfer of one track or less will never require more than a single revolution, since data can now be transferred out of order.

This feature will not be used (i.e., the host adapter will reject the Modify Data Pointer message) if Scatter/Gather is enabled for the command.

SCSI Messages

AHA-2740 Series host adapters support a number of special messages in addition to the messages required by meeting conformance level 2. Those messages are described in detail in the SCSI specification, X3.131-1986, and in this section where they are used. The messages are summarized in the Table 7-1.

Table 7-1. SCSI Messages

Function	Message	Cause
Standard Messages	Command Complete	Normal Sequencing
Error Management	Message Reject Bus Device Reset Abort	Invalid Messages Host Driver Host Driver or Host Adapter
Disconnect/Reconnect	Identify Disconnect Save Data Pointer Restore Pointers	Normal Sequencing Normal Sequencing Normal Sequencing Special Sequencing/ZLR
Synchronous Transfer	Synchronous Data Transfer Request	Initialization Sequencing
Zero Latency Operation	Modify Data Pointers	ZLR Sequencing
Linked Commands	Linked Command Complete Linked Command Complete With Flag	Command Linking Command Linking

Target Mode SCSI Description

> Note
> Target Mode operation is not supported in the first release of AHA-2740 Series host adapters. Please contact your Adaptec field engineer for information about release of the Target Mode feature for these adapter boards.

Initiator Conformance Level Requirements

Initiators that execute commands against an AHA-2740 Series host adapter operating in Target Mode must have the following conformance levels, as described in Appendix E of the SCSI Specification, ANSI X3.131-1986.

- The initiator must use single-ended drivers.
- Termination power must be provided by the host adapter board and must meet the SCSI specification for over-current protection and reverse current diode protection.
- The implementation of parity is optional, but desirable.

- The initiator must meet the requirements of conformance level two. In particular, all LUN addressing must be performed by the Identify message, not by the LUN field in the CDB. Disconnection and reconnection must be supported.

- The initiator and target functions must have the same SCSI ID.

Synchronous Transfer Support

Synchronous transfer is supported by AHA-2740 Series host adapters in Target mode without any instruction or support from the system processor. If an initiator invokes a synchronous transfer negotiation, the host adapter will complete the negotiation of the required transfer offset and period. The host adapter will also attempt to negotiate synchronous transfer during the initial selection period of the first command after an initialization or after a SCSI reset, if Enable Sync Negotiation is selected in the ECU.

SCSI Target Operation in Processor Target Mode

When the AHA-2740 Series host adapter has been set to respond in Processor Target Mode, the host adapter appears on the SCSI bus as a normal processor-type device as defined by the SCSI specification. Up to eight LUNs may be supported. The following five SCSI commands are accepted:

- Test Unit Ready

- Request Sense

- Inquiry

- Send

- Receive

All other commands are rejected with Check Condition status. The sense information will indicate a Sense Key of 05h (Illegal Request) with a Sense Code of 20h (Invalid Command Operation Code).

Commands that do not perform data transfer to or from the host are handled completely by the AHA-2740 Series host adapter with no communication with the host system. Those commands are the Test Unit Ready, Request Sense, and Inquiry commands. The Send and Receive commands must obtain information from the host with the proper direction, the proper initiator address, and the proper LUN number to complete the SCSI operation. The information may be provided to the host adapter before a command is received on the SCSI bus or may be requested after the command is received.

Each time an initiator activates a command to the host adapter, an internal subchannel is activated to manage the command. The subchannel is dedicated to that particular LUN-initiator transaction until all operations associated with the command are completed. Such operations include disconnection to allow time to get information

from the host, pending error conditions, and linked operations. If all subchannels are busy, a selection to the AHA-2740 Series host adapter will result in the host adapter accepting the command and then generating Busy status immediately. If this occurs, the initiator must reissue the command later.

Test Unit Ready

Table 7-2. Test Unit Ready

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Test Unit Ready Operation Code (00h)							
1	LUN (unused = 00)			Reserved (00)				
2	Reserved (00)							
3	Reserved (00)							
4	Reserved (00)							
5	Reserved (00)						Flag	Link

The Test Unit Ready command follows the SCSI specification in all respects. If the host adapter is present, the command will finish normally with Good status and a Command Complete message. The host adapter supports the normal definition of Unit Attention on the first operation after power-on, after a SCSI reset, or after a Bus Device Reset.

Request Sense

Table 7-3. Request Sense

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Request Sense Operation Code (03h)							
1	LUN (unused = 00)			Reserved (00)				
2	Reserved (00)							
3	Reserved (00)							
4	Allocation Length							
5	Reserved (00)						Flag	Link

If the AHA-2740 Series host adapter has returned Check Condition status to a previous command, the Request Sense command will obtain the sense information associated with the error. The sense information will be sent in the extended sense format according to the SCSI standard.

Table 7-4 lists the data format.

Table 7-4. Sense Information Data Format

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Error Code (70h or F0h)							
1	Reserved (0)							
2	00		ILI	0	Sense Key			
3-6	Information Bytes (Residue)							
7	Additional Sense Length (06)							
8-11	Reserved (00000000h)							
12	Additional Sense Code							
13	Additional Sense Code Qualifier							

Table 7-5 lists the errors that are detected and presented by AHA-2740 Series host adapters while they are operating in Processor Target Mode.

Table 7-5. Processor Target Mode Errors

Error	Sense Key (hex)	Additional Sense Code (hex)
No Sense Data	00h	00h
Invalid Command Operation Code	05h	20h
Invalid LUN	05h	25h
Invalid Command Parameter	05h	26h
Power-up Attention	06h	29h
Reset Attention	06h	29h
Interface Parity Error	0Bh	47h
Initiator Detected Error	0Bh	48h
Dumb Initiator	05h	2Bh

One set of error data may be buffered for each initiator-LUN association possible, up to a total of 56 sets of sense data. No Contingent Allegiance or Extended Contingent Allegiance state is established.

The Error Code (Byte 0) will be F0h if the residue field is valid and 70h if the residue field has no information.

The Incorrect Length Indicator (ILI) will be set if an incorrect data transfer length is executed, as described in the section *Incorrect Length Management for Target Mode Operation* later in this chapter.

The residue is set equal to the transfer length requested in the initiator CDB minus the target host's specified data length specified as a 4-byte, two's complement number.

Inquiry

Table 7-6. Inquiry Command Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Inquiry Operation Code (12h)							
1	LUN (unused = 00)			Reserved (00)				
2	Reserved (00)							
3	Reserved (00)							
4	Allocation Length							
5	Reserved (00)						Flag	Link

The Inquiry command provides the information needed to uniquely identify the AHA-2740 Series host adapter as a processor-type device. The information is returned in the SCSI-2 format. The following information is returned to any selecting initiator from any selected host adapter logical unit.

Table 7-7. Inquiry Command Information

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Peripheral Qualifier			Processor Device Type (03h)				
1	Reserved (00)							
2	Reserved (00)						ANSI v(02)	
3	Response Data Format (02h)							
4	Additional Length (1Dh)							
5	Reserved (00)							
6	Reserved (00)							
7	0	0	0	Sync = 1	Link = 1	0	0	0
8-15	Vendor Identification (ASCII) ADAPTEC *bbb*							
16-31	Product Identification (ASCII) AHA-2740*bbbbbbbb*							
32-35	Product Revision Level (ASCII)							

If the Inquiry command is attempted against a logical unit that has not been enabled as a target, byte 0 is returned as 23h, indicating that the LUN is not installed, but would be a processor device if it were installed. The remaining bytes are returned normally.

If a length shorter than the required 36 bytes is specified by the Inquiry command, the number of bytes specified by the command is transferred. If a length longer than 36 bytes is specified, the command will only transmit 36 bytes.

Send

Table 7-8. Send Command Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Send Operation Code (0Ah)							
1	LUN (unused = 00)			Reserved (00)				
2	Transfer Length (MSB)							
3	Transfer Length							
4	Transfer Length (LSB)							
5	Reserved (00)						Flag	Link

The Send command has the format specified by the SCSI standard. This command sends data from the initiator to the target. The information is placed in the area specified by the host. If appropriate information has not already been provided to the host adapter by the host software, an interrupt will be generated by the host adapter requesting information. In this case, the target host adapter disconnects from the SCSI until the information is made available to the host adapter. The information must have the same initiator address, target LUN, and direction as is required to complete the command.

The transfer length in the Send command specifies the length in bytes of data that is sent during the Data Out phase. A transfer length of 0 indicates that no data is sent. Management of incorrect length transfers is described in the section *Incorrect Length Management for Target Mode Operation* later in this chapter.

Receive

Table 7-9. Receive Command Data

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Receive Operation Code (08h)							
1	LUN (unused = 00)			Reserved (00)				
2	Allocation Length (MSB)							
3	Allocation Length							
4	Allocation Length (LSB)							
5	Reserved (00)						Flag	Link

The Receive command has the format specified by the SCSI standard.This command transfers data from the target to the initiator. The information is taken from the area specified by the host. If appropriate information has not already been provided to the host adapter software, an interrupt will be generated by the host adapter requesting information. In this case, the target host adapter disconnects from the SCSI bus until the information is made available to the host adapter. The appropriate information must have the same initiator address, target LUN, and direction as is required to complete the command.

The transfer length in the Receive command specifies the length in bytes of data that is sent during the Data In phase. A transfer length of 0 indicates that no data is sent. Management of incorrect length transfers is described in the next section, *Incorrect Length Management for Target Mode Operation*.

Incorrect Length Management for Target Mode Operation

The messages transmitted using the Send and Receive commands are normally expected to have a length that has previously been agreed to by the initiator system software and the target system software. If the transfer length specified by the command is equal to the transfer length specified by the target system software, normal operation takes place and no errors are posted.

If the transfer length specified by the initiator's command is shorter than the space defined by the target system software, all data bytes expected and required by the initiator will be transmitted. The target host adapter will indicate Good status on the SCSI at the end of the transfer. The target system's software, however, must be notified that the entire amount of data was not transmitted. A target status of Good will be presented.

At the same time, the Incorrect Length Indication bit (bit 5 of byte 2) will be set in the Request Sense data area. Bytes 3 through 6 of the Request Sense data area will contain the residue in two's complement notation of the length requested in the initiator command minus the length of the data area defined by the target system software. In this case, the residue will be a negative number, since the requested length was less than the area specified by the target system software. The host adapter status will be 12h, indicating a Data Over/Under Run.

If the transfer length specified by the initiator's command is longer than the space defined by the target system software, only the bytes within the specified data area will be transmitted. The target host adapter must indicate, by an error condition to the initiator, that not all the requested bytes could be transferred. The target host adapter presents a SCSI status of Check Condition at the end of the data transfer.

The Request Sense information transmitted to the initiator as a result of an immediately following Request Sense command indicates that an incorrect length indication is present by setting bit 5 of byte 2. Bytes 3 through 6 of the Request Sense information transmitted to the initiator will contain the residue in two's complement notation of the length requested in the initiator command minus the length of the data area defined by the target system software. In this case, the residue will be a positive number, since the requested length was greater than the available area.

The target system's software must also be notified that the transfer length requested by the initiator exceeded the assigned buffer area. A Host Status of 12h will be returned, indicating a Data Over/Under Run. At the same time, the information that will later be posted to the initiator by the Request Sense command will be posted to the target system in the Request Sense data area. This includes both the Incorrect Length Indicator and the Residue.

8

Problem Determination

Self Diagnostic Capability

AHA-2740 Series host adapters execute self-diagnostics during BIOS initialization. These diagnostics test the PhaseEngine (sequencer) operation, RAM, and data transfer paths internal to the AIC-7770 chip. The BIOS also performs a checksum on the EPROM and tests the on-board shadow RAM. If the BIOS is disabled, the driver tests the AIC-7770 chip during its initialization. The host system, via the ECU or stand-alone diagnostic programs, may run more extensive diagnostics involving reads and writes to memory.

If the diagnostics fail, the BIOS (or driver) will display the message Initialization failed and will not allow any further operation of the board. If this happens, power-down the host computer, remove the host adapter and inspect it for physical damage such as:

- Chips that are not correctly installed or not firmly seated
- Broken wires
- Missing or damaged components
- Conductive debris on the board

If you see any such physical damage, call Adaptec's main number and ask for the RMA department.

Adaptec host adapters are fully tested, burned-in, cleaned, and inspected before they are shipped. If you keep the board in its protective conductive wrapping until it is installed and follow the installation instructions carefully, it is unlikely that the board will be physically damaged.

If the board does not appear to be physically damaged, re-insert it in the computer and make sure it is seated firmly in the EISA slot on the motherboard. Check the SCSI cable connections and the SCSI termination for the host adapter and all devices on the bus. Read the checklist at the end of this chapter. The *AHA-2740/2742/2740T/2742T Installation Guide* and the *AHA-2740/2742/2740T/2742T User's Manual* both contain helpful installation and troubleshooting information.

If the host adapter diagnostics fail again when you power up the computer, call Adaptec's Technical Support number. A Technical Support representative will try to determine the cause of the problem and will, if necessary, arrange for an RMA for the host adapter.

Indicator Light

The red LED on the AHA-2740 Series host adapter lights up when the host adapter is performing activities on the SCSI interface or when other SCSI devices are using the SCSI bus. The LED is such a useful activity indicator that a connector is included on the host adapter so you can attach a cable to an externally visible LED.

The LED lights up whenever there is activity on the SCSI bus–that is, whenever the SCSI BSY signal is present on the bus. If the light stays on when there is no activity on the bus, this may indicate that the bus is hung, the processor has failed, unexpected activity is occurring, or the SCSI cables are incorrectly installed. If the SCSI cables are installed in a reversed position, the host adapter is forced into a solid SCSI reset state which halts normal operation.

Problems Detected During Operation

The information in this section is intended for programmers preparing device drivers, error recovery procedures and programs that present error information. It is not intended for routine users of the AHA-2740 Series host adapters.

Host Adapter Status Error Indications and Corrective Actions

Some host adapter status indications signal normal completion states; others indicate three general groups of errors, as described below:

- One group describes software errors in the requests made to the host adapter. Even though most of these errors are caused by software design problems, the AHA-2740 Series host adapter may need to be replaced as an isolation step, since there is a small chance that hardware failures in the host adapter caused the software error.

- A second group describes errors detected by the host adapter firmware in the host adapter hardware. The most likely failing component in this case is the host adapter itself, although certain system or cable failures may also generate a host adapter hardware error.

- A third group of errors describes the appearance of unexpected or incorrect sequences executed by the attached SCSI devices. In this case, the cables are the most likely failure point, the peripheral device is the second most likely, and the host adapter third. The host adapter status code should be returned to the host video display to indicate to the operator which errors have occurred and under what conditions.

Table 8-1 lists the host adapter status indications that signal an error.

Table 8-1. Host Adapter Error Indicators and Corrective Actions

Number	Type	Error	Description and Corrective Action
05h	SCSI	Yes	Target Aborted by Host Adapter: The host adapter failed to connect to the target due to a problem during selection or reselection. Verify that SCSI cables are properly connected. Replace the cables if necessary.
11h	SCSI	No	Selection Time Out: The host adapter attempted to select a device that was not installed or that did not respond to selection due to a power, parity or addressing failure. Verify correct address values set to SCSI devices. Verify that the SCSI cable routing includes the required devices. Verify that the SCSI cables are properly connected. Replace the cables if necessary. Verify that the SCSI Selection Time-Out value has been correctly established by Adapter command.
12h	Host	No	Data Over Run/Under Run: Data length or direction specified by SCB did not agree with the data length actually provided by the attached peripheral device. Often a normal error or accompanied by a check condition indicating transfer truncation. Verify program requested correct length or direction. Verify peripheral provided expected data length, number of blocks, or block length.
13h	SCSI	Yes	Unexpected Bus Free: The target dropped BSY without executing the proper messages first. This normally indicates that the BSY and/or other portions of the SCSI bus failed or that the target encountered such an invalid sequence that no recovery was possible. Some targets may have sense information available to qualify the error condition. Verify that the SCSI cables are properly connected. Replace the cables if necessary. Replace peripheral. Replace the host adapter.
14h	SCSI	Yes	Target Bus Phase Sequence Failure: The initiator detected an invalid phase or an invalid phase sequence. If this occurs, it is likely that the host adapter forces a SCSI reset on the bus as the first phase of the recovery process. Verify that the SCSI cables are properly connected. Replace the cables if necessary. Replace peripheral. Replace the host adapter.
17h	Host	Yes	Linked SCB Does Not Have Same LUN: This indicates that the host software generated an invalid combination of link commands. Generally, this only occurs during initial debug processes of new operating systems. Replace the host adapter. Replace the host computer system. Contact the software developer for design support.
18h	Host	Yes	Invalid Target Direction Parameters Received from Host: This indicates that the host software generated an invalid Target Direction Parameter. Generally, this only occurs during initial debugging of new operating systems. Replace the host adapter. Replace the host computer system. Contact the software developer for design support.

Table 8-1. Host Adapter Error Indicators and Corrective Actions *(Continued)*

Number	Type	Error	Description and Corrective Action
19h	Host	Yes	Duplicate SCB Received in Target Mode: This indicates that the host system was not keeping correct management information for Target mode operation and incorrectly generated a second SCB identical to one already active. Generally, this only occurs during initial debugging of new operating systems. Replace the host adapter. Replace the host computer system. Contact the software developer for design support.
1Bh	SCSI	Yes	Auto Request Sense Failed: The host adapter either detected a problem when executing the Request Sense command in response to a check condition from a target, or the target reported a check condition in the Request Sense command. The sense information is not guaranteed to be valid. Verify that SCSI cables are properly connected. Replace the cables if necessary.
20h	Host	Yes	Host Adapter Hardware Error: The host adapter detected an error internal to the AIC-7770 during operation. Replace the host adapter.

SCSI Error Indications and Corrective Actions

Error conditions detected by SCSI peripherals usually cause a Check Condition status byte to be presented. When this happens, the host adapter automatically retrieves the sense information from the SCSI peripheral by executing a Request Sense command according to the SCSI standard.

For single-threaded BIOS operation the information returned is mapped into the appropriate categories of error conditions. For multi-tasking operation, the information returned is made available in the area allocated for sense data. In either case, most operating systems make an intelligent attempt to retry the operation at least once. Such retry operations may require the management of queued operations that have already started execution. The attempt to retry the operation is rarely successful, since SCSI peripheral devices have very extensive automatic retry and correction mechanisms designed to be executed before the error information is returned in the first place.

Since the retry attempt is usually not successful, the host software and operating systems should make every attempt to present key information about the error to the system operator or customer engineer for analysis. In small systems, it may be enough to present the important sense data together with the command that created the error. Some simpler systems may perform a preliminary analysis of the error information and generate a code or text that describes the error and indicates the corrective action. In very complex systems, a logging process may take place, allowing a software engineer to analyze the data at some future time. In all systems, such information is very important for host program verification and for system integrity verification, even if the designers choose not to make the information available to anyone other than the design and maintenance engineers.

The SCSI Sense Data is generally self-descriptive. The errors can be mapped into four major categories, each of which has its own diagnostic procedure.

- The first category includes errors caused by incorrect command or parameter bytes or by incorrect command sequences. These errors typically are presented only during the early development stages of an operating system or device driver, since a properly operating program will not generate invalid commands.

- The second category includes sense codes associated with peripheral status presentation. These sense codes are not really errors; they merely inform the host program of an unusual but not unexpected condition. Such sense codes include indications that a device is not ready, that the device has just become ready, that a device has reached the end of its media (End of Tape or Blank Check), or that the expected data length and actual data length differed. These sense codes are normally used by the device driver to execute the correct operation in response to the condition. Such sense codes are not normally presented to the system user except as text that requests some action. As one example, an End Of Tape condition may require the system user to replace the tape cartridge.

- The third category of errors points to a particular hardware failure in the peripheral device or its supporting electronics. Such error conditions usually require the adjustment, repair, or replacement of the peripheral device or some of its components. In some cases, the error condition may also indicate possible cable or host adapter failures. These errors must be presented to system users so they can take appropriate action.

- The fourth category of errors points to a media failure in the peripheral device. Such errors include bits that cannot be recovered from magnetic media and imperfections in the surface of optical media. Most such errors are recovered using the extensive retry and correction algorithms programmed into the peripheral device. In some peripheral device technologies, the errors may be caused by noise conditions or by marginal electronic failures in the read or write path.

  Those rare errors that cannot be recovered usually indicate that some data important to the operating system or application has been lost. The system must make this error information available to the system user so the user can replace the media or recover the data from a backup copy. In addition, logging the errors that were successfully recovered by the peripheral device is often useful as an indicator of the overall reliability of the device or of the requirement for periodic maintenance.

Problems Detected During Installation

This section may be useful to correct problems related to installation of the host adapter. Some of the information in this section is also included in the *AHA-2740/2742/2740T/2742T User's Manual.*

If the system will not boot from the floppy diskette drive after initial hardware installation, check the following items:

- If the AHA-2740 Series host adapter LED and the SCSI drive LED are always on, the SCSI cable's pin 1 orientation has probably been reversed between the host adapter and the drive.

- Is the AHA-2740 Series BIOS message displayed on the screen? If not, the system is not recognizing the BIOS.

  Check for BIOS address conflicts between the AHA-2740 Series host adapter and other option boards.

  Try a different BIOS address. See the *System Configuration* section in Chapter Three, *Installation and Configuration.*

- If you see the message Host adapter not found, then the host adapter has detected an internal failure. Make sure the host adapter is seated firmly in the EISA slot. If the message still appears, contact Adaptec Technical Support as described at the beginning of this chapter.

- If you see the message Host adapter found but not configured, run the ECU to configure the host adapter.

Booting the System from a SCSI Drive

- Make sure that both standard hard disks are mapped out of the system.

- Make sure that the SCSI boot drive address is set to SCSI ID 0:0 and that there are no SCSI ID conflicts. Check the drive installation manual for information about setting the SCSI ID for that device. You can also use the Adaptec EZ-SCSI *showscsi* utility to determine the SCSI addresses of peripherals on the SCSI bus.

- Make sure that SCSI parity is consistently enabled or disabled on all devices on the SCSI bus.

- Verify that the host adapter and the SCSI devices are properly configured and installed.

- Be sure to cycle the power off and on after changing any values on a host adapter, setup program, or SCSI device to be sure that a DOS *format* operation has been successfully completed.

- Make sure that the SCSI bus is properly terminated.

- Make sure that the intended boot disk has an active DOS partition and a DOS format. See Chapter Three, *Installation and Configuration*, and the DOS manual for more information.

- Check the cabling.

Using a SCSI Drive as *D:* and a Standard Drive as *C:*

- Make sure that the second hard disk is mapped out of the system.

- Make sure that the SCSI drive to be used as drive *D*: is set to SCSI ID 0:0. Check the drive manual for information on setting the SCSI ID for that device. You can also use the Adaptec EZ-SCSI *showscsi* utility to determine the SCSI addresses of peripherals on the SCSI bus.

- Make sure that SCSI parity is consistently enabled or disabled on all devices on the SCSI bus.

- Verify that the host adapter and the SCSI devices are properly configured and installed.

- Be sure to cycle the power off and on after changing any values on a host adapter, *Setup* program, or SCSI device to be sure that the new initial values are loaded.

- Make sure that the SCSI bus is properly terminated.

- Make sure that the disk has a DOS partition and a DOS format. See Chapter Three, *Installation and Configuration*, and the DOS manual for more information.

- Check the cabling.

Using a SCSI Drive as *D:* and Another SCSI Drive as *C:*

- Make sure that both standard hard disks are mapped out of the system with the AT setup program.

- Make sure that the SCSI drive to be used as drive *D* is set to SCSI ID 0:1 or 1:0. Check the drive manual for information on setting the SCSI ID for that device. You can also use the Adaptec EZ-SCSI *showscsi* utility to determine the SCSI addresses of peripherals on the SCSI bus.

- Be sure to cycle the power off and on after changing any values on a host adapter, setup program, or SCSI device to be sure that the new initial values are loaded.

- Make sure that SCSI parity is consistently enabled or disabled on all devices on the SCSI bus.

- Verify that the host adapter and the SCSI devices are properly configured and installed.

- Make sure that the SCSI bus is properly terminated.
- Make sure that the disk has a DOS partition and a DOS format. See Chapter Three, *Installation and Configuration*, and the DOS manual for more information.

System Hangs, or Host Adapter Can't Always Find the Drives

- Check SCSI parity for consistency.
- Check SCSI termination.
- Check cable length and integrity.
- If the host adapter *and* drive light remain on during a hang condition, make sure that the SCSI drive conforms to the *Common Command Set Revision 4B* (CCS 4B).
- If only the host adapter LED remains on during a hang, it is probably a host adapter system interference problem. The host adapter may be installed in a motherboard slot that does not support First Party DMA transfers.

❐

Appendices

A

Memory Cycle Timing Diagrams

Clock Timing

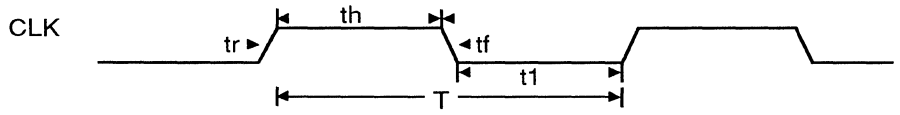


Figure A-1. Clock Parameters

Parameter	Description	Time (ns)	
		min	max
th	Clock high time	7	
t1	Clock low time	8	
tr	Clock rise time		3
tf	Clock fall time		3
T	Clock period (nominal)	25	

SCSI Bus Timing

SCSI Data Transfers

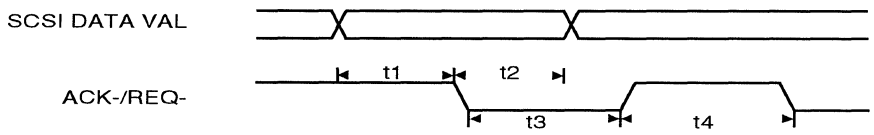


Figure A-2. SCSI Data Transfers

Parameter	Description	Time (ns)	
		min	max
t1	SCSI Data setup to ACK/REQ active		
	Normal timing	55	
	Fast timing	25	
t2	SCSI Data hold from ACK/REQ inactive		
	Normal timing	95	
	Fast timing	35	
t3	ACK-/REQ- Pulse Width		
	Normal timing	90	
	Fast timing	30	
t4	ACK-/REQ- Negation Period		
	Normal timing	90	
	Fast timing	30	

EISA Master Bus Timing

EISA Arbitration

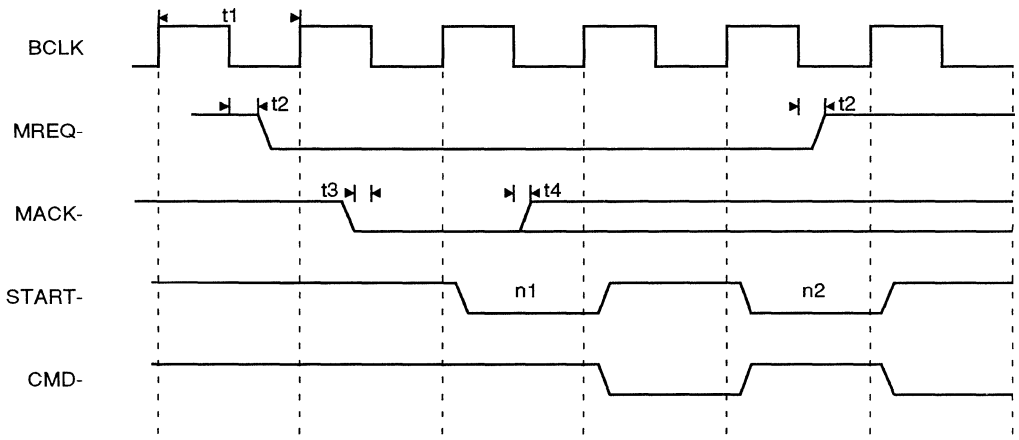


Figure A-3. EISA Arbitration

Parameter	Description	Time (ns)	
		min	max
t1	BCLK period	120	
t2	MREQ- hold from BCLK falling	2	33
t3	MACK- setup BCLK falling	10	
t4	MACK- hold from BCLK falling	25	
n1	First START		
n2	Last START		

EISA Arbitration Burst Transfer

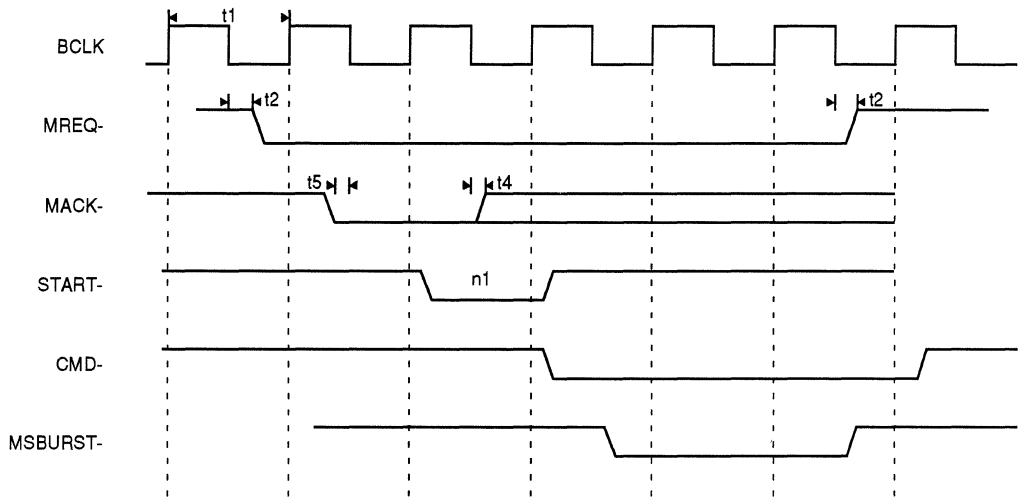


Figure A-4. EISA Arbitration Burst Transfer

Parameter	Description	Time (ns)	
		min	max
t1	BCLK Period	120	
t2	MREQ- hold from BCLK falling	2	33
t3	MACK- setup to BCLK falling	10	
t4	MACK- hold from BCLK falling	25	
n1	First START		

EISA Arbitration Downshift Burst

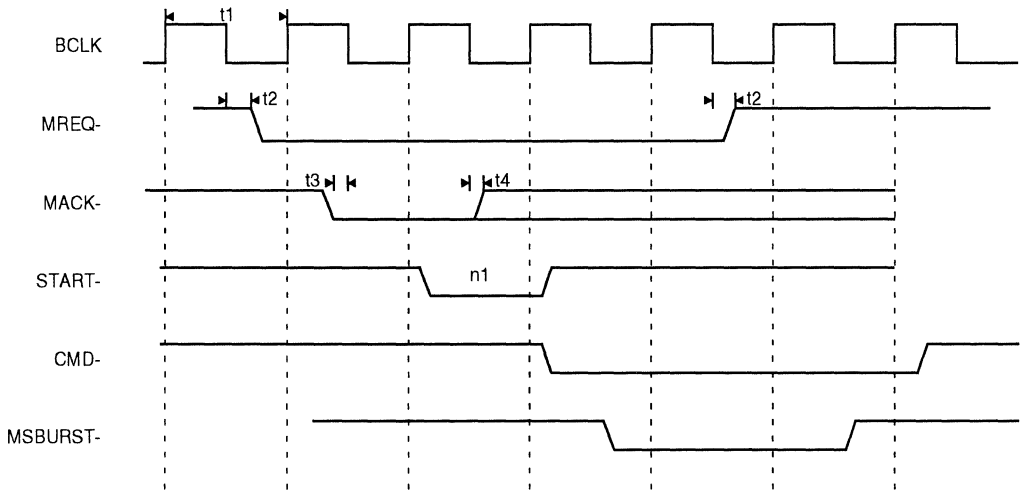


Figure A-5. EISA Arbitration Downshift Burst

Parameter	Description	Time (ns)	
		min	max
t1	BCLK period	120	
t2	MREQ- hold from BCLK falling	2	33
t3	MACK- setup to BCLK falling	10	
t4	MACK- hold from BCLK falling	25	
n1	First START		

EISA Two Cycle Transfer – 32-bit

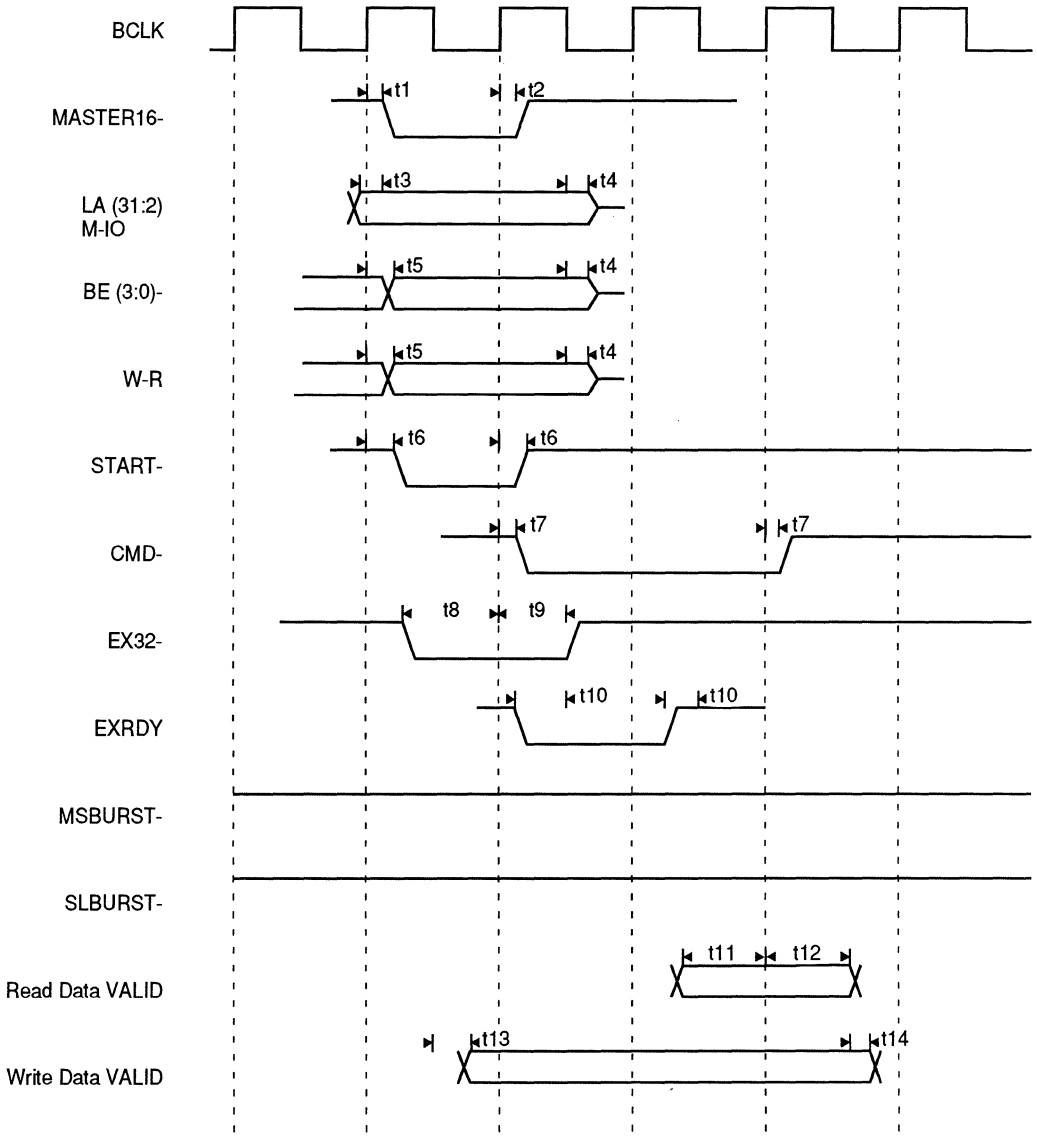


Figure A-6. EISA Two Cycle Transfer – 32-bit

Parameter	Description	Time (ns)	
		min	max
t1	MASTER16- assert delay from BCLK rising	2	50
t2	MASTER16- float delay from BCLK rising	2	40
t3	LA, M-IO setup to START-	10	
t4	LA, M-IO float delay from BCLK falling	2	50
t5	BE-, W-R delay from BCLK rising	25	
t6	START- delay from BCLK rising	2	25
t7	CMD- delay from BCLK rising	2	25
t8	EX32- setup to BCLK rising	25	
t9	EX32- hold from BCLK rising	55	
t10	EXRDY setup to BCLK falling	15	
t11	Read data setup to BCLK rising	15	
t12	Read data hold from BCLK rising	4	
t13	Write data delay from BCLK falling	2	40
t14	Write data float delay from BCLK falling	2	50

EISA Burst Transfer – 32-bit Burst

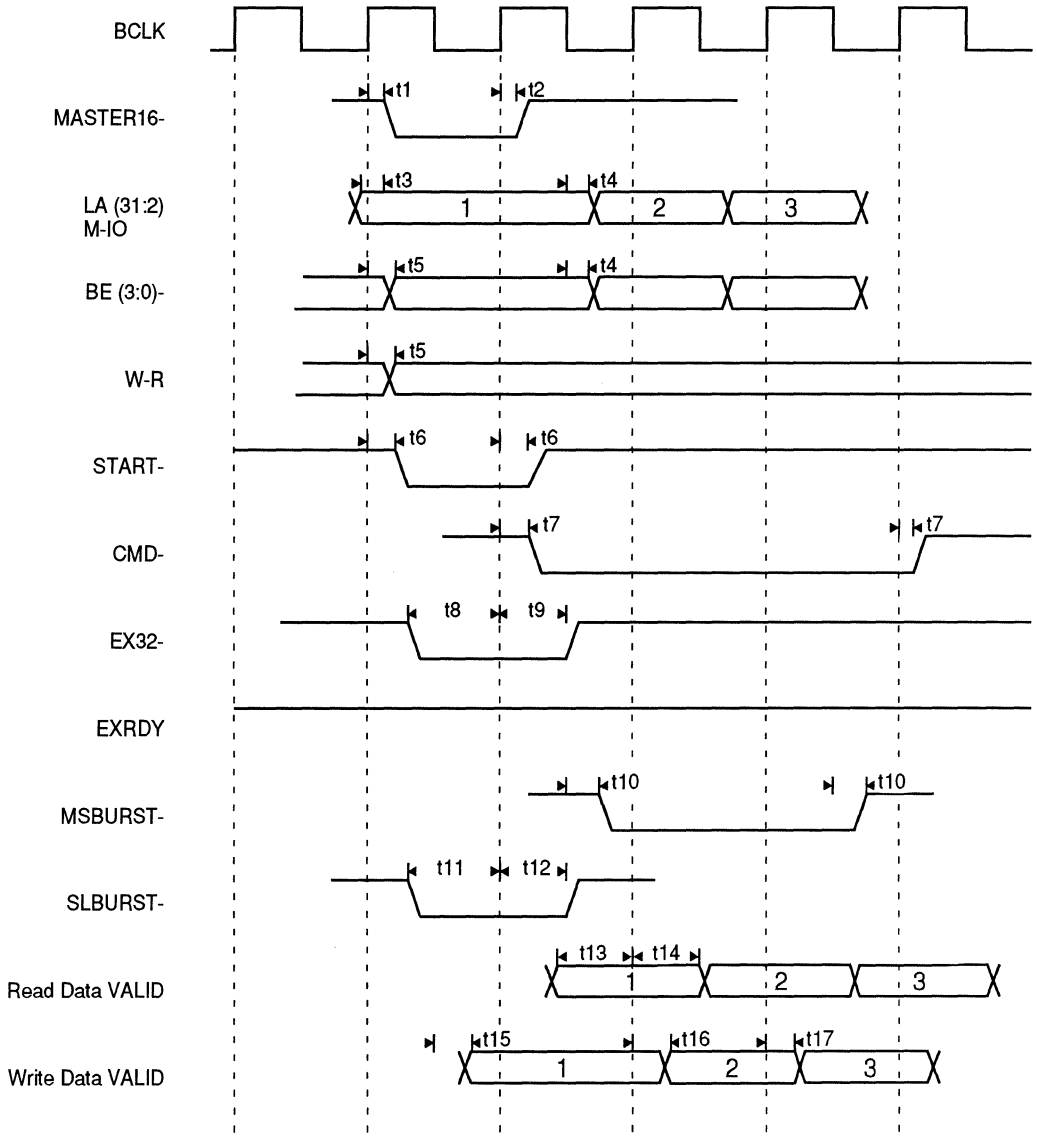


Figure A-7. EISA Burst Transfer – 32-bit

Parameter	Description	Time (ns)	
		min	max
t1	MASTER16- assert delay from BCLK rising	2	50
t2	MASTER16- float delay from BCLK rising	2	40
t3	LA, M-IO setup to START-	10	
t4	LA, BE- delay from BCLK falling	2	45
t5	BE-, W-R delay from BCLK rising		25
t6	START- delay from BCLK rising	2	25
t7	CMD- delay from BCLK rising	2	25
t8	EX32- setup to BCLK rising	25	
t9	EX32- hold from BCLK rising	55	
t10	MSBURST- delay from BCLK falling	2	35
t11	SLBURST- setup to BCLK rising	15	
t12	SLBURST- hold from BCLK rising	25	
t13	Read data setup to BCLK rising	15	
t14	Read data hold from BCLK rising	5	
t15	Write data delay from BCLK falling	2	40
t16	Write data delay from BCLK rising	5	40
t17	Write data hold from BCLK rising	5	

EISA Burst Transfer – 16-bit Downshift (No System Copy)

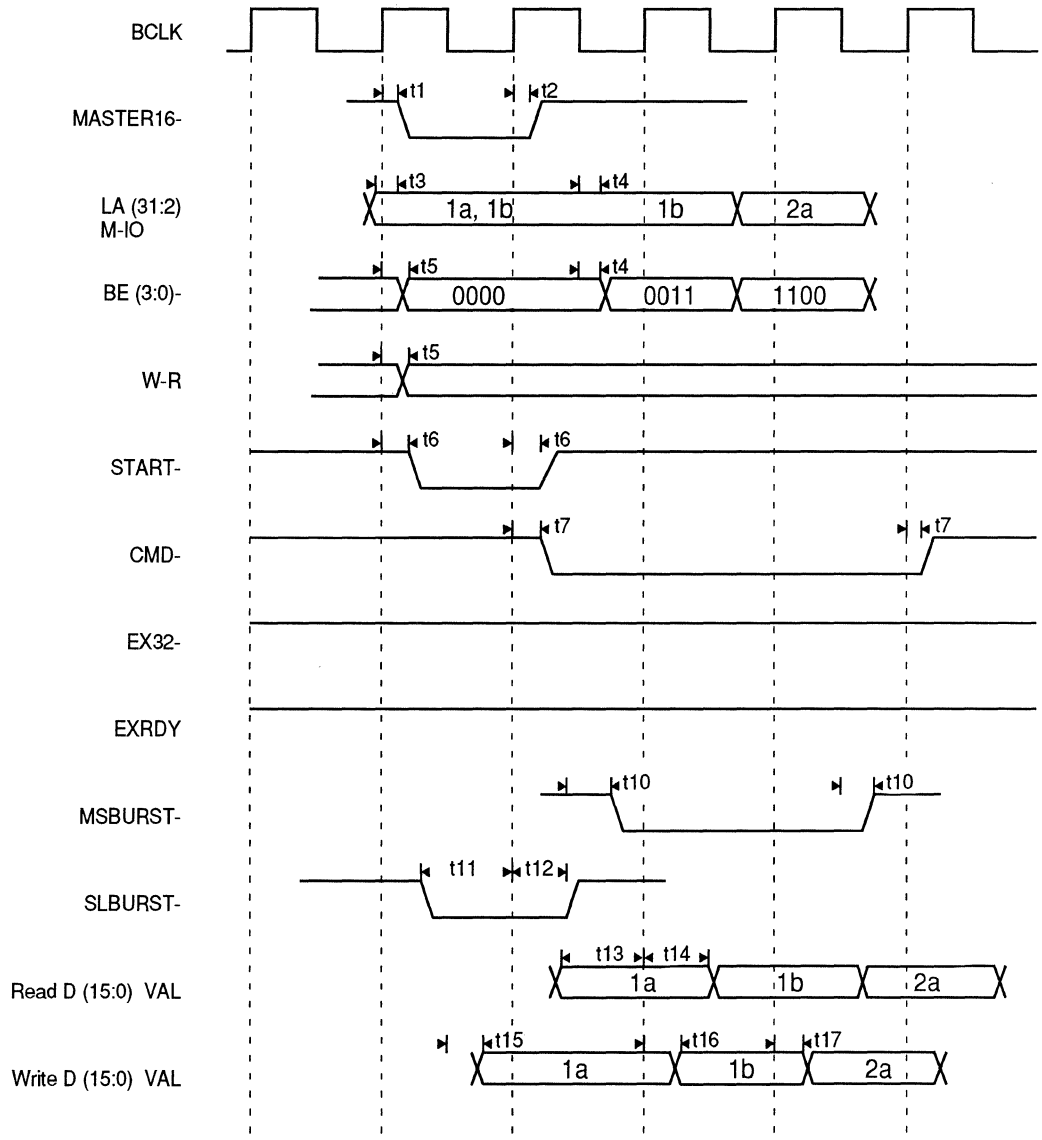


Figure A-8. EISA Burst Transfer – 16-bit (No System Copy)

Parameter	Description	Time (ns)	
		min	max
t1	MASTER16- assert delay from BCLK rising	2	50
t2	MASTER16- float delay from BCLK rising	2	40
t3	LA, M-IO setup to START-	10	
t4	LA, BE- delay from BCLK falling	2	45
t5	BE-, W-R delay from BCLK rising		25
t6	START- delay from BCLK rising	2	25
t7	CMD- delay from BCLK rising	2	25
t8	EX32- setup to BCLK rising	25	
t9	EX32- hold from BCLK rising	55	
t10	MSBURST- delay from BCLK falling	2	35
t11	SLBURST- setup to BCLK rising	15	
t12	SLBURST- hold from BCLK rising	25	
t13	Read data setup to BCLK rising	15	
t14	Read data hold from BCLK rising	5	
t15	Write data delay from BCLK falling	2	40
t16	Write data delay from BCLK rising	5	40
t17	Write data hold from BCLK rising	5	

EISA Burst Transfer – 16-bit Downshift (System Copy)

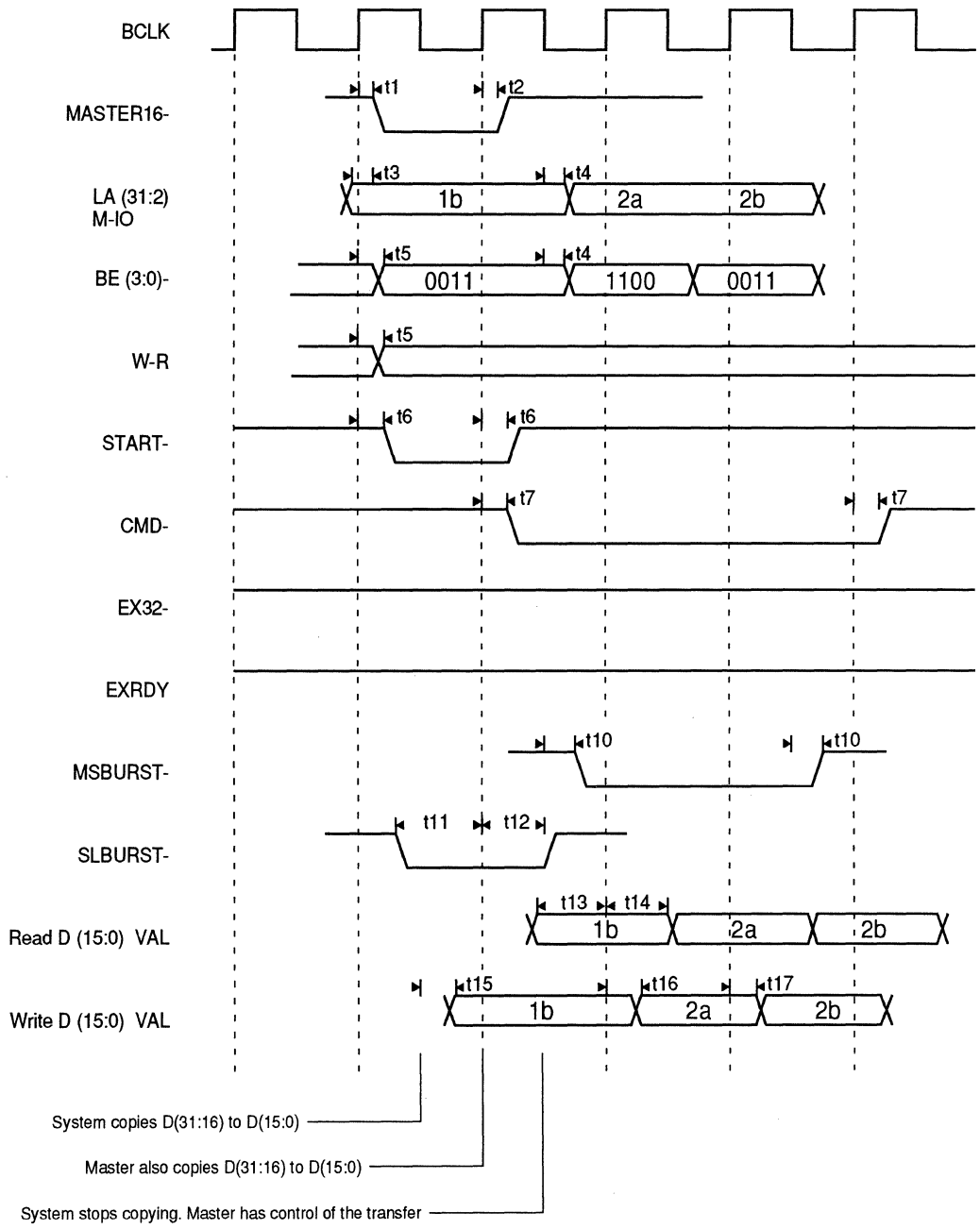


Figure A-9. EISA Burst Transfer – 16-bit (System Copy)

Parameter	Description	Time (ns)	
		min	max
t1	MASTER16- assert delay from BCLK rising	2	50
t2	MASTER16- float delay from BCLK rising	2	40
t3	LA, M-IO setup to START-	10	
t4	LA, BE- delay from BCLK falling	2	45
t5	BE-, W-R delay from BCLK rising		25
t6	START- delay from BCLK rising	2	25
t7	CMD- delay from BCLK rising	2	25
t8	EX32- setup to BCLK rising	25	
t9	EX32- hold from BCLK rising	55	
t10	MSBURST- delay from BCLK falling	2	35
t11	SLBURST- setup to BCLK rising	15	
t12	SLBURST- hold from BCLK rising	25	
t13	Read data setup to BCLK rising	15	
t14	Read data hold from BCLK rising	5	
t15	Write data delay from BCLK falling	2	40
t16	Write data delay from BCLK rising	5	40
t17	Write data hold from BCLK rising	5	

EISA Two Cycle Transfer – 16-bit Translate

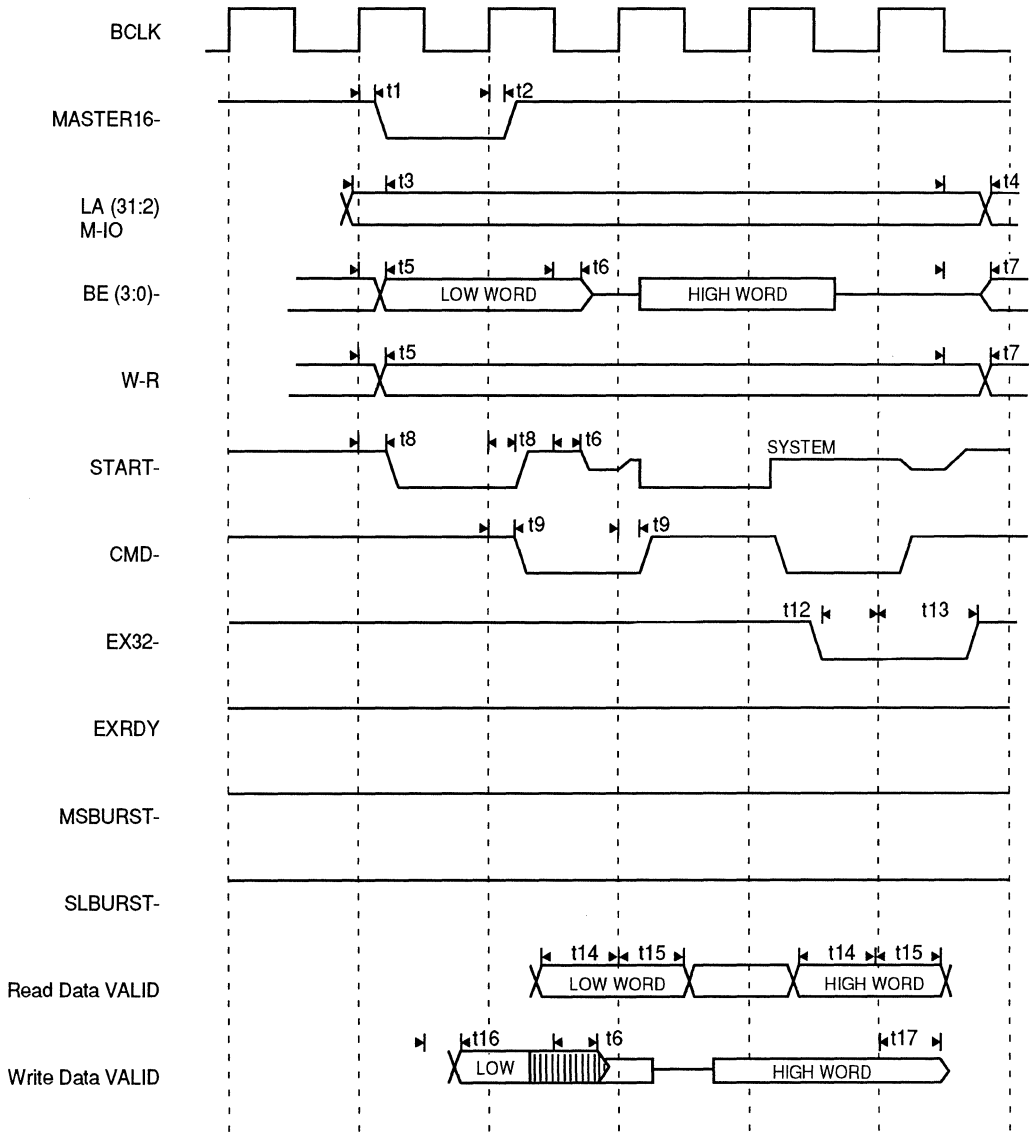


Figure A-10. EISA Two Cycle Transfer – 16-bit Translate

Parameter	Description	Time (ns)	
		min	max
t1	MASTER16- assert delay from BCLK rising	2	50
t2	MASTER16- float delay from BCLK rising	2	40
t3	LA, M-IO setup START-	10	
t4	LA, BE- delay from BCLK falling	2	45
t5	BE-, W-R delay from BCLK rising		25
t6	Float delay from BCLK falling	2	50
t7	BE-, W-R delay from BCLK falling	2	85
t8	START- delay from BCLK rising	2	25
t9	CMD- delay from BCLK rising	2	25
t10	—		
t11	—		
t12	EX32- setup to BLCK rising	15	
t13	EX23- hold from BCLK rising	50	
t14	Read data setup to BCLK rising	15	
t15	Read data hold from BCLK rising	4	
t16	Write data delay from BCLK falling	2	40
t17	Write data hold from BCLK rising	30	

EISA Slave Bus Timing

EISA I/O Slave – 8-bit Write

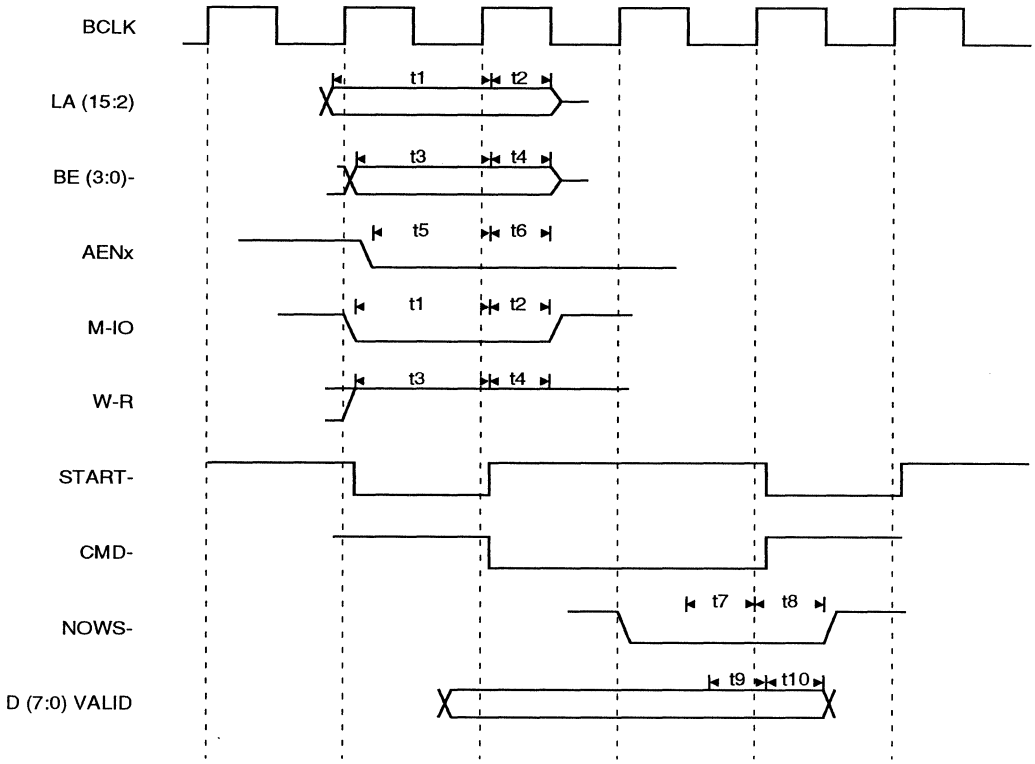


Figure A-11. EISA I/O Slave – 8-bit Write

Parameter	Description	Time (ns)		
		min	typ	max
t1	LA, M-IO setup to START- negated	120		
t2	LA, M-IO hold from START- negated	15		
t3	BE(3:0), W-R setup to START- negated	80		
t4	BE(3:0), W-R hold from START- negated	15		
t5	AENx setup to START negated	95		
t6	AENx hold from START negated	25		
t7	NOWS- setup to BCLK rising edge	15		
t8	NOWS- hold from BCLK rising edge	5		
t9	DATA setup to CMD- negated	100		
t10	DATA hold from CMD- negated	25		

EISA I/O Slave – 8-bit Read

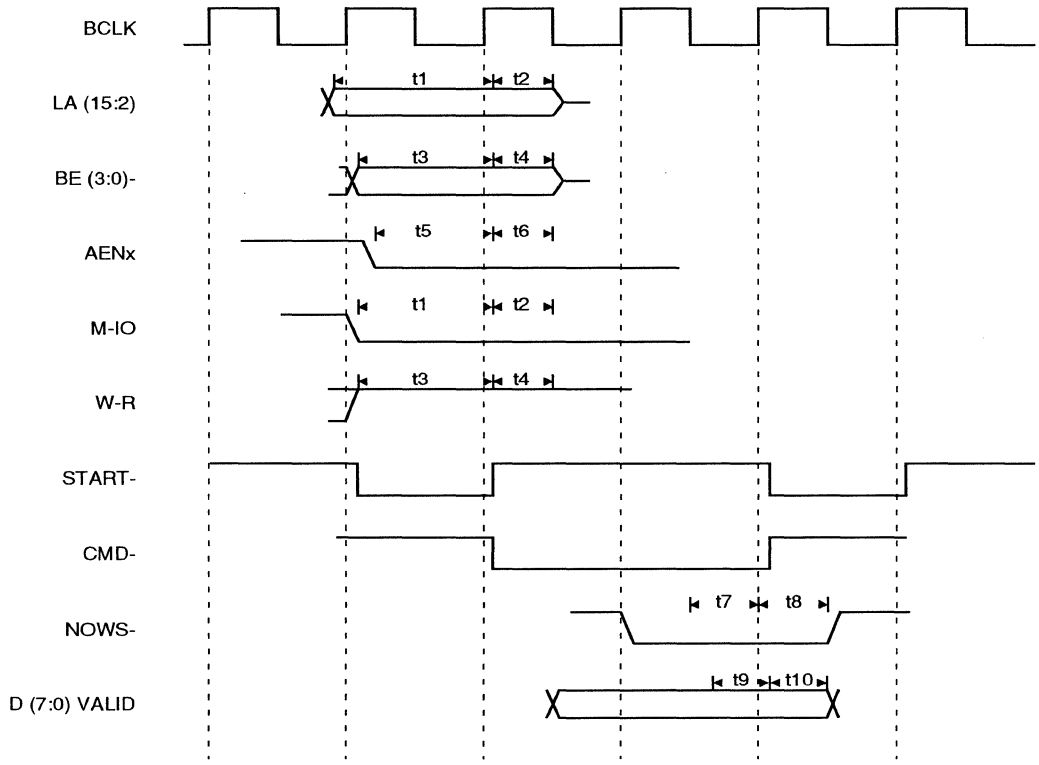


Figure A-12. EISA I/O Slave – 8-bit Read

Parameter	Description	Time (ns)		
		min	typ	max
t1	LA, M-IO setup to START- negated	120		
t2	LA, M-IO hold from START- negated	15		
t3	BE(3:0), W-R setup to START- negated	80		
t4	BE(3:0), W-R hold from START- negated	15		
t5	AENx setup to START negated	95		
t6	AENx hold from START negated	25		
t7	NOWS- setup to BCLK rising edge	15		
t8	NOWS- hold from BCLK rising edge	5		
t9	DATA setup to BCLK rising edge	100		
t10	DATA hold from BCLK rising edge	25		

B

Connector Pinout

Table B-1. Internal Connector Pin Assignment

Signal Name	Pin	Pin	Signal Name
Ground	1	2	-DB(0)
Ground	3	4	-DB(1)
Ground	5	6	-DB(2)
Ground	7	8	-DB(3)
Ground	9	10	-DB(4)
Ground	11	12	-DB(5)
Ground	13	14	-DB(6)
Ground	15	16	-DB(7)
Ground	17	18	-DB(P)
Ground	19	20	Ground
Ground	21	22	Ground
Ground	23	24	Ground
Open	25	26	Term Power (Fused)
Ground	27	28	Ground
Ground	29	30	Ground
Ground	31	32	-ATN
Ground	33	34	Ground
Ground	35	36	-BSY
Ground	37	38	-ACK
Ground	39	40	-RST
Ground	41	42	-MSG
Ground	43	44	-SEL
Ground	45	46	-C/D
Ground	47	48	-REQ
Ground	49	50	-I/O

Table B-2. External Connector Pin Assignment

Signal Name	Pin	Pin	Signal Name
Ground	1	26	-DB(0)
Ground	2	27	-DB(1)
Ground	3	28	-DB(2)
Ground	4	29	-DB(3)
Ground	5	30	-DB(4)
Ground	6	31	-DB(5)
Ground	7	32	-DB(6)
Ground	8	33	-DB(7)
Ground	9	34	-DB(P)
Ground	10	35	Ground
Ground	11	36	Ground
Ground	12	37	Reserved
Open	13	38	Term Power (Fused)
Ground	14	39	Reserved
Ground	15	40	Ground
Ground	16	41	-ATN
Ground	17	42	Ground
Ground	18	43	-BSY
Ground	19	44	-ACK
Ground	20	45	-RST
Ground	21	46	-MSG
Ground	22	47	-SEL
Ground	23	48	-C/D
Ground	24	49	-REQ
Ground	25	50	-I/O

C

Register Information

Table C-1. Expansion Board IDs

Definition	Signal	EISA Slot	Write/Read
Host ID 0	BID0	zC80	R
Host ID 1	BID1	zC81	R
Host ID 2	BID2	zC82	R
Host ID 3	BID3	zC83	R

Table C-2. Register Groups

Register Group	Signal	EISA Slot	Write/Read
SCSI Interface Registers		zC00-zC1F	W/R
Scratch RAM		zC20-zC5F	W/R
Sequencer		zC60-zC7F	W/R
EISA Host Interface Registers		zC80-zC9F	W/R
SCB Array		zCA0-zCBF	W/R
Floppy I/O Address		z3F0-z3F7	W/R

Refer to the *AIC-7770 Data Book* for more information about AHA-2740 Series registers.

❒

D

EISA Free-form Data

SCSI Subsystem Data Structure

The configuration overlay file included on the ASW-C274 diskette uses a free-form data area to configure the SCSI bus and the specific structure within the free-form data area. This data area is not specified by the EISA specification. Adaptec uses a two-byte data structure for each device (SCSI ID #*n*), as shown in Table D-1.

Table D-1. Adaptec Free-form Data Structure

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
AIC-7770 Configuration Flag								Free-form Data Length (= 27h)							
Number of SCSI Buses								BIOS Control Flag							
Reserved (= 0)								Number of Devices per SCSI Bus							
Reserved (= 0)								Reserved (= 0)							
Device Configuration Flag for Target 0															
Device Configuration Flag for Target 1															
Device Configuration Flag for Target 2															
Device Configuration Flag for Target 3															
Device Configuration Flag for Target 4															
Device Configuration Flag for Target 5															
Device Configuration Flag for Target 6															
Device Configuration Flag for Target 7															
Device Configuration Flag for Target 8 or Channel B, Target 0															
Device Configuration Flag for Target 9 or Channel B, Target 1															
Device Configuration Flag for Target 10 or Channel B, Target 2															
Device Configuration Flag for Target 11 or Channel B, Target 3															
Device Configuration Flag for Target 12 or Channel B, Target 4															
Device Configuration Flag for Target 13 or Channel B, Target 5															
Device Configuration Flag for Target 14 or Channel B, Target 6															
Device Configuration Flag for Target 15 or Channel B, Target 7															

Here is an explanation of each free-form data field.

- **Free-form Data Length**: This 8-bit value specifies the number of bytes stored in free-form data. This value does not include this byte.

- **AIC-7770 Configuration Flag**: This 8-bit value indicates whether the AIC-7770 is configured for single 8-bit (AHA-2740/2742) or twin 8-bit (AHA-2740T/2742T). The possible values are:

Value	Configuration
00	Single 8-bit
08	Twin 8-bit

- **BIOS Control Flag**: This 8-bit value indicates the BIOS configuration options set by the user via the ECU.

7	6	5	4	3	2	1	0
				R_ALL	R_BOOT	DOS_5.0	GBYTE

If GBYTE (bit 0) is set, then the BIOS is configured to support drives with greater than 1 GByte capacity.

If DOS_5.0 (bit 1) is set, then the BIOS is configured to attach up to 8 disks to Int 13. If this bit is cleared, up to 2 disks will be attached to Int 13.

If R_BOOT (bit 2) is set, then the BIOS is configured to attach a removable drive to Int 13 only if the removable drive is configured to be the boot device.

If R_ALL (bit 3) is set, then the BIOS is configured to attach all removable drives to Int 13.

- **Number of SCSI Buses**: This 8-bit value indicates the number of SCSI buses for which the AIC-7770 is configured. If this value is 1, the AIC-7770 is configured for single 8-bit SCSI (AHA-2740/2742). If this value is 2, the AIC-7770 is configured for two 8-bit SCSI buses (AHA-2740T/2742T only).

- **Number of Devices per SCSI Bus**: This 8-bit value indicates the number of targets that can be attached to the SCSI bus(es). This value will be 8.

- **Device Configuration Flag**: This 16-bit value indicates device configuration options set by the user via the ECU. There is one value for each possible SCSI target (8 targets maximum for AHA-2740/2742; 16 maximum for AHA-2740T/2742T):

F	E	D	C	B	A	9	8	7	6	5	4	3	2	1	0
				DISC	START	SCAN	ERR		SYNC_RATE						SYNC

If SYNC is set, the AIC-7770 firmware will initiate synchronous negotiation.

SYNC_RATE indicates the transfer rate for which the AIC-7770 firmware will negotiate during synchronous negotiation. The possible values and their corresponding transfer rates are as follows:

Sync_rate	Transfer Rate (Mhz)
000	10.0
001	8.0
010	6.7
011	5.7
100	5.0
101	4.4
110	4.0
111	3.6

If ERR is set, the BIOS will report an error if the target is not available.

If SCAN is set, the BIOS will scan the entire bus for that device's ID.

If START is set, the BIOS will issue a Start Unit command to the device.

If DISC is set, the AIC-7770 firmware will allow the device to disconnect from the SCSI bus.

If your EISA system and your ECU do not support the free-form data area you can still use the host adapter board, but only at the default settings for the SCSI bus, as shown in the *System Configuration* section of Chapter Three.

Glossary

A

Adaptec EZ-SCSI
A user-friendly software program that automatically installs SCSI devices such as fixed disks and CD-ROM drives on a computer. Adaptec EZ-SCSI copies the required software programs to the computer's fixed disk and edits the configuration files so the host adapter can access the devices.

Advanced SCSI Programming Interface
See ASPI.

AHA-1510/1520/1522
A family of Adaptec host adapters designed for computers that use the ISA (or AT) bus. These non-Bus Master host adapters are generally used in workstations running in the DOS environment.

AHA-1540/1542
A family of Bus Master Adaptec host adapters designed for computers that use the ISA (or AT) bus. These host adapters support advanced SCSI features and Bus Master data transfer. They also have an on-board BIOS and floppy controller.

AHA-1640
An Adaptec host adapter designed for computers that use the Micro Channel® bus. Supports advanced SCSI features and Bus Master data transfer. This host adapter can support up to seven SCSI devices.

AHA-1740/1742/1744
A family of Bus Master Adaptec host adapters designed for computers that use the EISA bus. These high performance host adapters can transfer data at up to 33 MBytes per second.

AHA-2740/2742/2740T/2742T
A family of full-performance Bus Master EISA-to-Fast SCSI host adapter boards. The AHA-2742/2742T boards have on-board floppy disk controllers. The AHA-2740T/2742T boards support TwinChannel SCSI.

AIC-7770
Adaptec's single-chip EISA-to-Fast SCSI host adapter. This chip is the primary hardware element on the AHA-2740 Series host adapters.

ASPI
Advanced SCSI Programming Interface. A standard SCSI software interface that acts as a liaison between host adapters and SCSI device drivers. ASPI enables host adapters and device drivers to share a single SCSI hardware interface.

ASPI Manager
A software module that provides an interface between ASPI modules, a host adapter board, and the SCSI devices connected to the adapter. A single ASPI manager can handle multiple input/output requests from multiple ASPI modules. ASPI managers are written for a specific operating system—such as DOS, OS/2 or NetWare—and for a specific family of host adapter boards.

Asynchronous Data Transfer
A data transfer method that involves interlocking a signal to the initiator and a signal to the SCSI target in such a way that each step of the data transfer must occur before the next step can begin. Asynchronous data transfer is usually slow. The rate is not affected by external timing constraints such as cable length and circuit response time.

AT Bus
See ISA.

B

BIOS
Basic Input/Output System. Software coded into computer chips for various purposes. The BIOS on the motherboard of a computer is the special program used to boot the computer. The AHA-2740 Series BIOS initializes the host adapter and other SCSI devices, supports the standard Int 13h interface and enables booting from a disk device installed on the host adapter.

Bus
A pathway for data in a computer system. All PCs have an expansion bus, which is designed to host add-on (expansion) devices, such as modems, host adapter boards and video adapters. Expansion devices use the bus to send data to and receive data from the PC's CPU or memory. ISA, EISA and Micro Channel are the major bus standards used in computers.

Bus Device Reset
A SCSI message that clears all activity in the SCSI peripheral device target to which it is addressed.

Bus Mastering
A high performance method of data transfer in which the host adapter's on-board processor handles the transfer of data directly to and from a computer's memory without intervention from the computer's microprocessor. This is the fastest method of data transfer available for multi-tasking operating systems. The AHA-2740 Series host adapters support bus mastering. (Also called Bus Master DMA or First Party DMA.)

Byte
An eight-bit unit of data. A byte is normally the smallest addressable unit of memory and the smallest unit of transfer on the SCSI.

C

CCB
See Command Control Block

CCS
See Common Command Set

CDB
See Command Descriptor Block

Command Control Block
A software object prepared by the host microcomputer software for the host adapter to provide it all the control information it needs to execute a SCSI command. In the AHA-2740 Series host adapters, CCBs are processed in the on-board PhaseEngine (sequencer).

Command Descriptor Block
A block of information passed across the SCSI bus to provide the command, parameter, and address information needed for the target to execute the desired functions. Prepared by the host software and placed in the CCB to be passed to the target by the host adapter.

Common Command Set
A de facto standard SCSI command set for communication with hard disk drives. The Common Command Set (CCS) is the basis for the SCSI-2 command set for all types of peripheral devices.

Configuration
The operation of configuring a device on the EISA bus through accessing registers in the device by the host. It replaces the method of using jumpers common on ISA bus devices.

D

Device Driver
A software program that enables a computer to communicate with peripheral devices such as fixed disk drives and CD-ROM drives. Each kind of device requires a different driver. Device driver programs are stored on a computer's fixed disk and are loaded into memory at boot time.

Direct Memory Access
A mechanism that allows hardware control of the transfer of streams of data to or from the main memory of a computing system. The mechanism may require setup by the host software. After initialization, it automatically sequences the required data transfer and provides the necessary address information.

Disconnect/Reconnect
Disconnect occurs when a target releases control of the SCSI bus, allowing the bus to go to the Bus Free phase. Reconnect occurs when a target selects an initiator to continue an operation after a disconnect.

DMA
See Direct Memory Access

DOS Partition
A section of a disk storage device, created by the DOS *fdisk* program, in which data and/or software programs are stored. Computers have a primary DOS partition that contains the special files needed to boot the computer. A computer's disk devices may also have extended DOS partitions. Each DOS partition is assigned a unique drive letter, such as *C* or *D*. A single disk device can have multiple partitions.

E

ECU
EISA Configuration Utility. The configuration program included with all EISA class computers that allows you to configure the computer's motherboard and option boards. The ASW-C274 software shipped with AHA-2740 Series host adapters includes an overlay file used by your computer's ECU.

EISA
Extended Industry Standard Architecture. A kind of computer bus. EISA, an extension of the 16-bit ISA bus standard, allows expansion devices like network cards, video adapters and modems to transfer data to and over the computer bus 32 bits at a time. This standard was introduced in 1988.

EPROM
Erasable Programmable Read Only Memory. An integrated circuit used to store the host adapter BIOS.

EZ-SCSI
See Adaptec EZ-SCSI.

F

FIFO
First In/First Out. A queuing order in which items are removed from the queue for execution in the same order in which they are placed in the queue. An integrated circuit that buffers data in such a manner that each byte placed in the buffer is removed from the buffer in the same order.

Firmware
The software that controls and manages the host adapter. It is *firm* as opposed to *soft* because it is designed into the host adapter and cannot be modified by the user.

G

GByte
GigaByte. A measure of computer storage. One GByte equals a thousand MBytes, or approximately one billion bytes. (A byte is the amount of storage needed to hold one character.)

H

Hardware Specific Module
A software module used to manage the functions of the AHA-2740 Series host adapters. This module contains the microcode program used by the PhaseEngine on the host adapter and downloads it when the system is initialized.

HIM
See Hardware Specific Module.

Host
A microcomputer in which a host adapter is installed. The host uses software to request the services of the host adapter in transferring information to and from peripheral devices attached to the SCSI bus connector of the host adapter.

Host Adapter
A printed circuit board that installs in a standard microcomputer and provides a SCSI bus interface to SCSI devices that are connected to the microcomputer.

I

IBM PC-AT Compatible
Any computer system that emulates exactly the IBM PC/AT and that uses an ISA backplane bus.

Industry Standard Architecture
See ISA.

Initiator
A SCSI device that requests an operation to be performed by another SCSI device (the target). The initiator provides all the command information and parameters required to perform the operation, but the details of the operation are actually sequenced by the target. The host adapter is sometimes called the initiator.

I/O Operating Environment Software
Additional software that may be required in certain operating system environments in order to use some kinds of SCSI devices with the AHA-2740 Series of host adapters. For example, additional software is needed in order to install CD-ROM drives on the SCSI bus in the DOS/Windows environment.

IRQ
Interrupt Request Channel. The IRQ of a host adapter can be changed to several different settings by changing configuration settings on the adapter board.

ISA
Industry Standard Architecture. A type of computer bus used in most PCs. ISA enables expansion devices like network cards, video adapters and modems to send data to and receive data from the computer's CPU and memory 16 bits at a time. Expansion devices are plugged into sockets in the computer's motherboard. ISA is sometimes called the AT bus, because it was introduced with the IBM PC-AT in 1983.

K

KByte
KiloByte. A measure of computer storage. One KByte equals 1024 bytes. (A byte is the storage needed to hold one character.)

L

Logical Unit
A physical or virtual device addressed through a target—for example, a CD-ROM in a CD-ROM drive.

Logical Unit Number
An encoded three-bit identifier for a logical unit.

LU
See Logical Unit

LUN
See Logical Unit Number

M

Manager
See ASPI Manager.

MByte
MegaByte. A measure of computer storage. One MByte equals 1,048,576 bytes. (A byte is the storage needed to hold one character.)

Micro Channel
A 32-bit computer bus standard introduced by IBM with the PS/2 series of computers. Micro Channel is an extension of the 16-bit ISA standard, allowing expansion devices to move data 32 bits at a time on the bus while remaining backward-compatible with standard ISA expansion devices. (Also called Micro Channel architecture.)

Multi-tasking Operation
The execution of commands in such a way that more than one command is in progress at the same time, allowing the system to take advantage of overlapping activities by using resources that are temporarily not required for other operations. More than one program or more than one portion of a program may be operating in parallel.

Multi-threaded I/O
A method by which data is accessed simultaneously from multiple SCSI devices to increase a system's data transfer rate. For example, if the system needs data from two disk devices it requests data from the first device, which temporarily disconnects from the SCSI bus while it seeks the data. During this delay the system requests data from the second device, and while that device disconnects from the bus to seek the data the first device starts sending the requested data over the bus, etc. The AHA-2740 Series host adapters and all other Adaptec host adapters fully support multi-threaded I/O.

P

PC-AT
A family of small computers sold by IBM, also called the Personal Computer/AT family of computers. The name is trademarked by IBM.

Peripheral
A SCSI device installed on a computer system.

PhaseEngine
A customized, programmable 29-bit RISC processor included on the AIC-7770 chip, which is part of all AHA-2740 Series host adapters. The PhaseEngine (sequencer) controls multi-tasking, multi-threaded SCSI phase operations. It off-loads I/O transactions from the host CPU and greatly increases the speed of SCSI command processing by independently handling these transactions.

Port I/O Address
A window through which software programs send commands to an installed host adapter board.

R

RAM
Random Access Memory. Memory of which any byte can be accessed directly in a single memory cycle. Information can be read from and written to the memory.

Removable Media
Disk media such as the cartridges used with Iomega's Bernoulli drives that can be removed from a disk drive after data is copied to them. The media can then be stored or can be inserted in another removable disk drive.

ROM
Read-Only Memory. Memory in which any byte can be read but not written.

S

Scatter/Gather
A device driver feature that allows the host adapter to modify the transfer data pointer so that a single host adapter can transfer many segments of memory in a single transfer, thereby minimizing interrupts and overhead.

SCB
SCSI Control Block. The mechanism used in emulation mode to transfer control information to and from the board.

SCSI
Small Computer Systems Interface. A computer bus interface standard that defines standard physical and electrical connections for devices. SCSI provides a standard interface that enables many different kinds of devices, such as disk drives, magneto-optical disks, CD-ROM drives, and tape drives to interface with the host computer.

SCSI Bus
One or more SCSI peripheral devices and a host adapter, connected by electrical cables in a daisy-chain configuration. The bus may include both internal and external SCSI devices. In systems that have more than one host adapter, each adapter has its own separate SCSI bus. The AHA-2740T/2742T TwinChannel host adapters feature two Fast SCSI channels and can support two SCSI buses. The AHA-2740/2742 host adapters support one SCSI bus each.

SCSI Device
A device such as a host adapter board, fixed disk drive or CD-ROM drive that conforms to the SCSI interface standard and is attached to a SCSI bus cable. The device may be an initiator, a target, or capable of both types of operation.

SCSI ID
An identifier assigned to SCSI devices that enables them to communicate with a computer when they are attached to a host adapter via the SCSI bus. Each SCSI bus has eight available SCSI IDs with the numbers 0 through 7. Usually the host adapter itself is assigned SCSI ID 7, and fixed disk devices are assigned to SCSI IDs 0 and 1.

Single-Ended
A term referring to the electrical characteristics of the signals used on the SCSI bus interface. Single-ended signals occupy a single conductor and are references to a common ground carried on the cable between the SCSI components attached.

Single-Threaded Operation
Operation of the computing system such that only one program can be operating or active at a time. The computing system must wait until all resources are available before starting an operation and cannot start another operation until the first one is completed. No overlapping of latencies or program operation occurs.

Synchronous Data Transfer
A method of data transfer on the SCSI bus involving clocking data on to the bus with a fixed-length fixed-frequency strobe pulses. The acknowledgments may be delayed several clock periods from the data requests. Synchronous data transfer can be used only for data transmission on the SCSI bus. It is prohibited for command, message, and status transmission.

Synchronous Data Transfer Negotiation
The message exchange between the initiator and the target that allows the negotiation of the data transfer frequency and delay between requests and acknowledgments required for synchronous data transfer. Once negotiated, synchronous data transfer parameters remain unchanged until certain reinitialization activities occur.

T

Tagged Queuing
A SCSI-2 feature that allows the SCSI device to return data in a different order than requested by the SCSI host adapter.

Target (or Target Device)
A SCSI device that performs an operation requested by an initiator. The target may be a peripheral device such as a disk drive performing a service for an initiator. The

target may also be a host adapter performing a processor-type device service for an initiator.

Termination
A physical requirement of the SCSI bus. The first and last devices on the SCSI bus must have terminating resistors installed, and the devices in the middle of the bus must have terminating resistors removed.

TwinChannel
A term used to describe the AHA-2740T/2742T host adapters, which have two independent SCSI channels and can therefore support two SCSI buses.

W

Word
A 2-byte (16-bit) unit of data.

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