

*Performance Peripherals
from ATTO Technology, Inc.*

The ATTO logo is presented in a bold, white, sans-serif font. It is set against a background of horizontal white lines that vary in length, creating a sense of motion or data flow. The lines are contained within a white rectangular area that has a slight perspective, appearing to recede into the distance.

ATTO

*SiliconExpress IV
User Manual*

ATTO Technology, Inc.

**SiliconExpress IV
User's Manual**

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Chapter 1: Introduction

Congratulations on your purchase of the ATTO SiliconExpress IV FAST & WIDE SCSI-2 accelerator card! The SiliconExpress IV card was designed to provide you with the highest possible performance from today's high performance drives.

BusMastering allows the SiliconExpress IV to transfer data directly between the Macintosh system's RAM and the SCSI bus without using the CPU. This takes advantage of the parallel processing capability of the Macintosh NuBus. Utilizing true asynchronous I/O support, multitasking software such as Appleshare® or QuickTime®, can perform disk activity and network I/O simultaneously.

Other Features include:

- Outperforms the Macintosh's built-in SCSI port by 1400 %
- Transfer rates up to 20.0 MB/s for WIDE devices
- Transfer rates up to 10.0 MB/s for Narrow devices
- Eliminates SCSI-2 overhead for faster small block transfers
- Single-ended FAST / WIDE SCSI-2 (16 Bit SCSI)
- Active Termination for increased reliability
- Fast BusMaster that supports NuBus to NuBus transfers
- The 7 inch formfactor supports all Quadras and Power PCs
- "Bus Throttling" capabilities for high performance Video
- Each card can support up to 105 devices through LUNs
- Supports NuBus 90 Block Transfers at Zero Wait States
- Flash ROM allows for easy field upgrade
- Provides the highest data integrity with error recovery
- Full SCSI parity generation and checking
- Supports NuBus '90 2X Block Transfers
- Easily installs into any Macintosh NuBus slot
- Supports all 16 defined NuBus IDs for use in expansion units
- Easy to use control Panels software included
- Full Asynchronous I/O Support
- Supports Multiple Block Sizes for special devices
- Supports Disconnect/Reconnect
- Full OS Command Queuing supports multiple driver calls
- Does Not Disable Existing Macintosh SCSI ports
- Supports ATTO ExpressStripe and ExpressMirror software
- OEM Developer's Kit available

Chapter 2: Cabling and Termination

In general, connecting drives to the SiliconExpress IV is similar to connecting devices to the standard Macintosh SCSI port. However, the SiliconExpress IV represents a significant step in SCSI-2 technology for many Macintosh users. Hence, new SCSI-2 cabling and terminology must be presented to help better understand how things work.

New SCSI-2 TERMINOLOGY

For consistency of the manual:

- a) **NARROW** refers to 8-Bit FAST SCSI-2 or 8-Bit SCSI-1
- b) **WIDE** refers to 16-Bit FAST SCSI-2
- c) **A-Cable** refers to a 50-p cable w/ low-density connectors
- d) **P-Cable** refers to a 68-p cable w/ high-density connectors

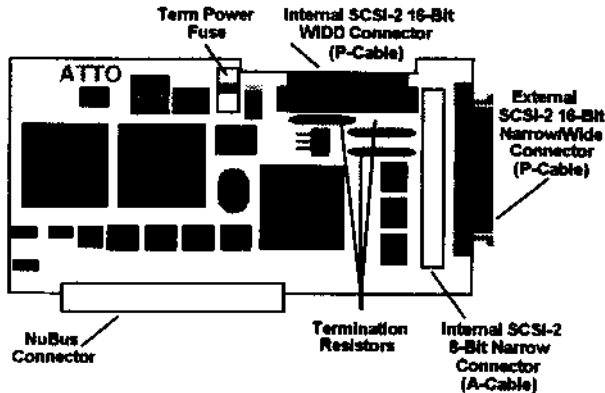


Figure 1: SiliconExpress IV

The SiliconExpress IV uses advanced SCSI-2 cabling and may require you to update your existing cables. While they may be new to you, all the cables and connectors on the board follow the ANSI SCSI-2 specification as standard cables. If you need additional cabling, high quality cables are available through ATTO Technology, or contact your local dealer.

Below is a description of the different connectors and the appropriate cabling requirements for the SiliconExpressIV:

EXTERNAL 16-BIT WIDE SCSI-2 CONNECTOR

To attach external Wide SCSI-2 devices to the SiliconExpress IV card, a standard 68-pin SCSI-2 P-Cable (with latches) is required. This cable is usually provided by the drive manufactures.

If you are connecting existing Narrow devices to the SiliconExpress IV, then use the P to A cable that is supplied.

INTERNAL 16-BIT WIDE SCSI-2 CONNECTOR

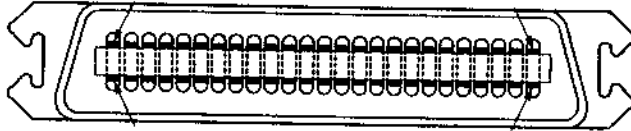
To attach internal Wide SCSI-2 devices to the SiliconExpress IV card a standard 68-pin SCSI-2 ribbon P-Cable is required. This cable is usually provided by the drive manufactures.

INTERNAL 8-BIT NARROW SCSI-2 CONNECTOR

A standard 50-pin SCSI-2 ribbon A-Cable is required to connect internal Narrow SCSI devices to the SiliconExpress IV.



P-Cable (68-Position Cable Plug)



A-Cable (50-Position Cable Plug)

There are a few simple rules you need to follow when attaching drives to your SiliconExpress IV:

- 1) Active termination is preferred for all termination requirements. Due to the faster speed of the SiliconExpress IV, Active termination improves the SCSI-2 signal quality.
- 2) When attaching internal drives to the SiliconExpress IV, use only one of the internal connectors (either the P-cable connector **OR** the A-cable connector).

3) When attaching Both WIDE drives and Narrow drives in a daisy-chain, always attach the WIDE drive first in the chain to the SiliconExpress IV card and then connect the Narrow drive.

4) If you are using **only** external drives **OR** **only** internal drives, you **DO NOT** need to do anything with the termination resistors on the SiliconExpress IV. You can follow the Installation instructions, attach your devices and go.

5) If you are using **BOTH** internal and external Devices, you **MUST** follow the Termination Configuration Procedures as described in Appendix C.

Quick Start Instructions

Step 1: Backup Your Disk

This should always be done as a precaution.

Step 2: System Shut Down

After turning off the computer, leave the power cable plugged into a grounded outlet to discharge static electricity.

WARNING!

If you are using a Macintosh Quadra 900 or Quadra 950, you must unplug the power cord for your computer to avoid damage from the trickle-charge current that is present even when those model Quodras are turned off. For all other Macintosh models, leave the power cord plugged into a live, grounded power outlet so that it can serve as a ground to discharge static electricity.

Step 3: Use Proper Electrostatic Discharge Protection

Step 4: Insert the SiliconExpress IV into any available NuBus slot

Step 5: Connect Internal Drive Cable (Optional)

Remember, when attaching internal drives to the SiliconExpress IV, use only one of the internal connectors (either the P-cable connector **OR** the A-cable connector).

Step 6: Connect External SCSI Cable (Optional)

Step 7: Boot from the SiliconExpress IV (optional)

After installing the SiliconExpress IV, select the drive attached to the SiliconExpress IV as boot device using the Macintosh Startup Device control panel.

Step 8: Configure via control panel

This Control Panel allows you to set preferences for the SiliconExpress IV operation. Install the Control Panel by dragging the file from the diskette into the System Folder.

Chapter 3: Installation

This chapter explains in detail how to unpack and install the SiliconExpress card.

Unpacking

In addition to this SiliconExpress IV Manual, the product packaging contains the following items:

- ATTO SiliconExpress IV card
- Two Software Diskettes:
 - SiliconExpress IV Control Panel* diskette
 - SiliconExpress IV A/V* diskette
- Disk Formatting Utility Software with Manual
- 68pin to 50pin SCSI-2 Adapter Cable P toA Cable
- Warranty Card
- Registration Card

If you are missing any of these items, contact your ATTO Authorized Reseller.

ATTO recommends saving your SiliconExpress IV box and packing material for later handling use.

Installing the SiliconExpress IV Card

The ATTO SiliconExpress IV FAST/WIDE SCSI-2 card is designed to be compatible with a wide range of devices and Macintosh models. Refer to the documentation included with your drive systems on how to unpack and configure the drives.

WARNING!

Before removing the SiliconExpress IV from its box follow the installation procedure listed below to prevent damaging your SiliconExpress IV or your system.

Step 1: Backup Your Disk

Backup any data on the disk which will be attached to the SiliconExpress IV. This should always be done as a precaution for adding any new hardware to your system.

Step 2: System Shut Down

Make sure that your system and all the SCSI peripherals are shut down before attempting to install SiliconExpress IV. After turning off the computer, leave the power cable plugged into a grounded outlet to discharge static electricity.

WARNING!

If you are using a Macintosh Quadra 900 or Quadra 950, you must unplug the power cord for your computer to avoid damage from the trickle-charge current that is present even when those model Quadras are turned off. For all other Macintosh models, leave the power cord plugged into a live, grounded power outlet so that it can serve as a ground to discharge static electricity.

Step 3: Remove the Cover

Remove the cover from your Macintosh system. If you are unsure of the procedure, follow the instructions in your Macintosh manual. Do not use excessive force or you may damage guides inside of your computer.

Step 4: Use Proper ESD Protection

The SiliconExpress IV can be damaged by Electrostatic Discharge (ESD). Touching the metal chassis on the Power Supply (should still be plugged into AC outlet) will remove the static charge from your body. Always do this before touching the SiliconExpress IV or any parts on the motherboard.

Step 5: Choose a NuBus Expansion Slot

The NuBus expansion slots are the narrow plastic connectors located near the rear, of your computers system board. Choose any available slot and push out the plastic cover plate in the back panel that is aligned with the slot. Save the plate for future use.

Step 6: Remove the SiliconExpress IV from bag

The SiliconExpress IV comes wrapped in a protective anti static bag. Open the bag and carefully slide out the SiliconExpress IV. Hold the card by the edges and/or by the metal bracket at the rear of the card.

Step 7: Insert the SiliconExpress IV

Align the SiliconExpress IV over the NuBus slot and gently, but firmly, press down on the card until the NuBus connector is completely seated. Don't force the card down. If you encounter a lot of resistance, remove it and try again making sure the card is properly aligned over the NuBus connector on the motherboard.

Step 8: Connect Internal Drive Cable (Optional)

An internal SCSI cable can be used to connect one of the internal SCSI connectors on the SiliconExpress IV to an internal drive.

The SiliconExpress IV has two internal cable options to connect internal drives; 50-pin for Narrow and FP68-pin for WIDE. Before installing the cable into either connector, make sure the Pin 1 indicator (or key) is properly aligned.

Remember, when attaching internal drives to the SiliconExpress IV, use only one of the internal connectors (either the P-cable connector **OR** the A-cable connector).

Step 9: Replace the Lid

Replace the lid on the Macintosh and re-insert and tighten the security screws if used. Consult your Macintosh owner's manual for additional information.

Hardware installation is now complete, and the Macintosh is ready for you to connect any external devices to the SiliconExpress IV.

Step 10: Connecting External SCSI Devices (Optional)

The external SCSI cable is used to connect external devices to of the SiliconExpress IV. If you have a WIDE drive, use the 68-pin P cable supplied by the device manufacturer to attach the device to the SiliconExpress IV. See Figure 1 for location of external SCSI-2 connector.

If you are attaching a Narrow device, use the FP68-pin to FP50-pin cable supplied with the card for easy connection.

Be sure to firmly attach the cable to the latch blocks on the SiliconExpress IV's external connector.

Step 11: Boot from the SiliconExpress IV

After installing the SiliconExpress IV, select the device attached to the SiliconExpress IV as the boot device using the Macintosh Startup Device control panel, located in the control panel.

If you have connected the only bootable disk in your system to the SiliconExpress IV, you may have to boot from a floppy disk the first time.

After your Macintosh has booted, select the disk attached to the SiliconExpress IV as the startup device and restart your system. The Macintosh will boot as normal from the disk on the SiliconExpress IV.

Chapter 4: Control Panel Software

NOTE

You must restart the computer in order for any new Control Panel settings to take effect.

Shipped with the SiliconExpress IV is a Control Panel Device on diskette. This Control Panel allows you to set preferences for the SiliconExpress IV operation. The settings are retained in the computers non-volatile Parameter RAM (PRAM). Install the Control Panel by dragging the file from the diskette into the System Folder.

The Control Panel screen displays status information for each SiliconExpress IV and the built-in SCSI port. Only one SCSI bus is displayed at a time. The NuBus slot where the SiliconExpress IV resides is displayed at the top of the screen.

The top portion of the Control Panel contains status information retrieved from each SCSI ID with a SCSI INQUIRY command. The left hand column, labeled ID, contains the SCSI ID of the device.

The bottom half of the Control Panel Screen allows you to alter preferences for each device on the SCSI Bus. Each column of check boxes controls the preference settings for a single SCSI ID. When a box is checked in the column for the SCSI ID of the SiliconExpress IV, all of the check boxes in that row will become checked.

NOTE

If you start the computer *without* the SiliconExpress IV card, all settings will be lost. Re-run the Control Panel to reselect preferences.

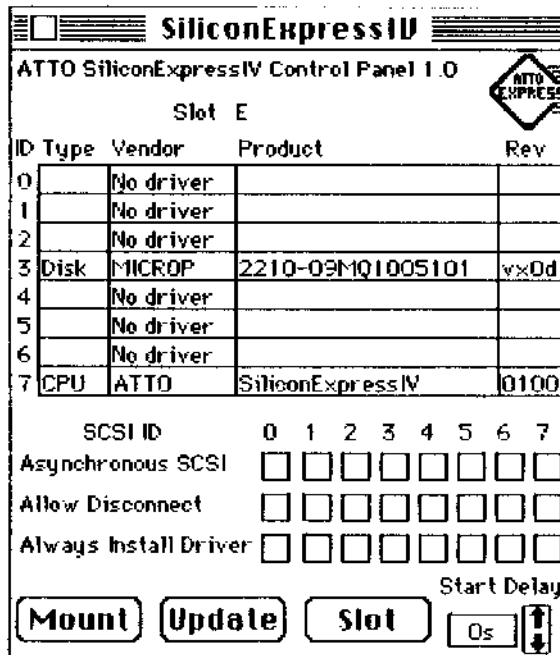


Figure 2: Control Panel Screen

TYPE FIELD

The TYPE field indicates the category of the device at that SCSI ID (disk, tape, etc.). If the device contains removable media, an asterisk (*) will follow the TYPE field (i.e.: DISK*).

VENDOR FIELD

The VENDOR field indicates the manufacturer of the device. For SCSI IDs with no attached device, this field will contain either "DRIVER" or "NO DRIVER" to indicate whether a driver has been installed for this SCSI ID.

PRODUCT FIELD

The PRODUCT field contains the manufacturers name or model number for the device. For SCSI IDs without an attached device and with a driver installed, this field contains the name of the driver. For example, "SiliconExpress_B1" is the name of the driver for SCSI ID 1 (one), connected to the SiliconExpress IV located in NuBus expansion slot B.

REV FIELD

The REV field contains the hardware/firmware revision level of the device. For the SCSI ID of the SiliconExpress IV, this field will contain the hardware and firmware revision of SiliconExpress IV.

ASYNCHRONOUS SCSI

The ASYNCHRONOUS SCSI setting controls whether the SiliconExpress IV communicates to a device using the synchronous or asynchronous SCSI data transfer protocol. When the box is checked, SiliconExpress IV will communicate with the device using the asynchronous data transfer protocol. When the check box is clear, SiliconExpress IV will attempt to negotiate synchronous transfer parameters with the device. The default setting is to attempt synchronous data transfer. Synchronous transfer is preferred since most devices transfer data faster using the synchronous transfer protocol.

ALLOW DISCONNECT

The ALLOW DISCONNECT setting controls whether the SiliconExpress IV will allow the device to use the SCSI disconnect/reconnect mechanism. Allowing SCSI disconnects will increase performance in systems which access several disks simultaneously. Otherwise, allowing disconnect can increase the SCSI Bus overhead time, and decrease performance.

When this box is checked, the SiliconExpress IV will allow the device to disconnect during SCSI command execution. The default setting is *not* to allow SCSI disconnects.

ALWAYS INSTALL DRIVER

The ALWAYS INSTALL DRIVER option controls whether or not the SiliconExpress IV will always install its driver for a specific SCSI ID. During the startup procedure, SiliconExpress IV scans the SCSI Bus looking for devices. If a device is not found with a particular SCSI ID, SiliconExpress IV will not install a driver for that SCSI ID. This helps to conserve system heap space and other valuable system resources. If a device is found at a particular SCSI ID, and the SiliconExpress IV can communicate successfully with it, a driver will be installed, regardless of the setting of this option. When the box is checked (ON), a driver will be installed for that SCSI ID. Having a driver installed for a particular SCSI ID allows a device (with that same SCSI ID) to be installed and mounted. It is also useful for supporting unique devices such as

Digital Audio Tape drives, scanners, printers, etc. When this box is not checked (OFF), SiliconExpress IV will only install a driver for that SCSI ID when it locates a device with which it can successfully communicate.

NOTE

New unprepared drives will not appear on the control panel. The ALWAYS INSTALL DRIVER option must be selected for the SCSI ID of the new unprepared drive. After restarting your Macintosh, the new drive will now appear in the control panel. The included formatting utility can then be used to prepare the drive for use with your Macintosh.

MOUNT BUTTON

Clicking the MOUNT button will cause all devices attached to the SCSI Bus to be mounted. *The Control Panel can only mount devices on a SCSI ID which has a driver installed (See ALWAYS INSTALL DRIVER).* This indicates that SiliconExpress IV must have detected the device during the boot process or the SCSI ID has the ALWAYS INSTALL DRIVER option selected (see above).

UPDATE BUTTON

Clicking the UPDATE Button will cause the *Control Panel* to re-scan the SCSI Bus and display any new status information. Information will only be displayed for devices which have a driver installed.

SLOT BUTTON

The SLOT Button will advance the *Control Panel* display to the next slot which contains a SiliconExpress IV card or advance it to the built-in Macintosh SCSI port.

START DELAY

The START DELAY control will cause the operating system to delay a specified number of seconds during the startup process, primarily to allow devices attached to the SiliconExpress IV time to prepare for use. The range of delay times available is from 0 seconds to 225 seconds, in 15 second increments. To adjust the delay time, click on either the UP arrow or DOWN arrow immediately to the right of the delay time displayed. The START DELAY control is not applicable to the built-in SCSI port.

DISK FORMATTING UTILITY

The disk formatting utility allows you to format and partition new drives using the SiliconExpress IV card. This utility is included because not all SCSI formatters have the ability to access the performance features of the SiliconExpress IV. If using this utility, please refer to the enclosed documentation.

Chapter 4: Troubleshooting

Troubleshooting the installation of any new piece of hardware can be frustrating. Try the following suggestions if you are having problems installing the SiliconExpress IV.

- Check all cable connections to each device. Verify that all cables are in proper working condition.
- Compare the termination of your system to the description in the section on termination. Improper termination can be the cause of many problems.
- Verify the SCSI chain attached to your built-in SCSI port (if any), is terminated properly. If disk(s) were moved to the SiliconExpress IV, termination may require modification. Check the appropriate documentation.
- Try booting with a floppy disk. Some Macintosh ROMs will not boot off of a NuBus card the first time it is installed. Note that if your desired boot device is attached to the SiliconExpress IV, it must be selected as the boot device through the Startup Device control panel.
- If a disk attached to the SiliconExpress IV is the boot disk, be sure it has a blessed (bootable) system folder.
- Verify that all of the devices attached to SiliconExpress IV have unique SCSI ID's. Remember, the SiliconExpress IV has a SCSI ID of 7 by default.
- When using large drives with long spin-up times, try using a START DELAY (see chapter on Control Panel Software).
- Try changing your drive to asynchronous SCSI mode. If this solves the problem it suggests that the SCSI chain is the source of the trouble (i.e.; terminators, cables, devices, etc.). Please see the Control Panel Software chapter.

Appendix A Specifications

Formfactor	Apple 7 inch NuBus
Length	7.0"
Height	4.0"
NuBus Transfer Rate - Standard	20.0 Mbytes/sec
NuBus 1X Block Transfers	37.5 Mbytes/sec
NuBus 2X Block Transfers	64.0 Mbytes/sec
SCSI Transfer Rate (16 -bit) (Synchronous)	20.0 Mbytes/sec
SCSI Transfer Rate (16 -bit) (Asynchronous)	12.0 Mbytes/sec
SCSI Transfer Rate (8 -bit) (Synchronous)	10.0 Mbytes/sec
SCSI Transfer Rate (8 -bit) (Asynchronous)	6.0 Mbytes/sec
SCSI Bus	Single-ended Drivers and Receivers
SCSI Parity	Generated and Checked
Selection Time-out	250 milliseconds
ROM	256Kbytes Flash
SCSI Processor	Embedded
Power Consumption	1.0 Amp at +5.0 VDC 0.05 Amp at +12.0 VDC
Mean Time Before Failure (MTBF)	100,000 Hours
Mean Time To Repair (MTTR)	15 Minutes

Appendix B SiliconExpress IV Accessories

Cable and Termination Options

Cables

- Option 1: FP68-p to FP68-p shielded P-cable
ATTO P/N CBL-FP68E/683 (3 ft)
ATTO P/N CBL-FP68F/686 (6-ft)

- Option 2: FP68-p to FP68-p unshielded Internal P-cable
ATTO P/N CBL-FP68R/681 (1ft)

- Option 3: FP68-p to 50p Centronics shielded cable
P to A Cable
ATTO P/N CBL-FP686/3 (3 ft)
CBL-FP686/6 (6ft)

- Option 4: 50p to 50p Internal A-cable
ATTO P/N CBL-50R/502 (2ft)

Terminators

- Option 1: 10 pin active resistor SIP
ATTO P/N RESSP-101101

- Option 2: FP68-p shielded active terminator (Wide)
ATTO P/N TERMA-068001

- Option 3: 50p Centronics active terminator (Narrow)
ATTO P/N TERMA-050001

Appendix C: Termination Configuration

Figure 1: SiliconExpress IV

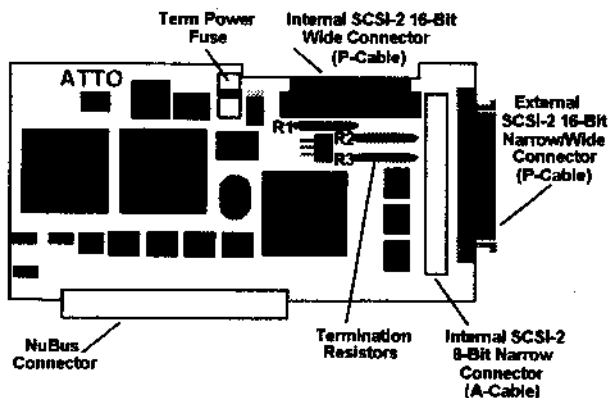


Figure 2. SiliconExpress IV Active Terminator Locations

TERM POWER FUSE (TERMPWR)

The TERM Power Fuse controls the sourcing of the Termination Power (TERMPWR) signal of the SCSI Bus (See Figure 1). The TERM Power Fuse is designed to provide protection for your SCSI drives. When installed, the SiliconExpress IV will provide power to the TERMPWR signal of the SCSI Bus (Pin 26 of the internal 8-Bit SCSI connector and Pins 17, 18, 51, and 52 of the two 16-Bit SCSI connectors). To replace the fuse, simply unplug it from the socket.

NOTE

If the fuse is "blown" contact ATTO Technical Support for replacement. It is not necessary to return the board to ATTO. A fuse will be sent to you for infield replacement.

SELECTING PROPER TERMINATION AND CABLING

The SiliconExpress IV requires termination installed at each end of the SCSI chain. The SiliconExpress IV is equipped with quality Active termination resistors on board (see Figure 2).

There are many configuration possibilities for the SiliconExpress IV. This chapter describes the cabling and termination for most of the cases you may encounter.

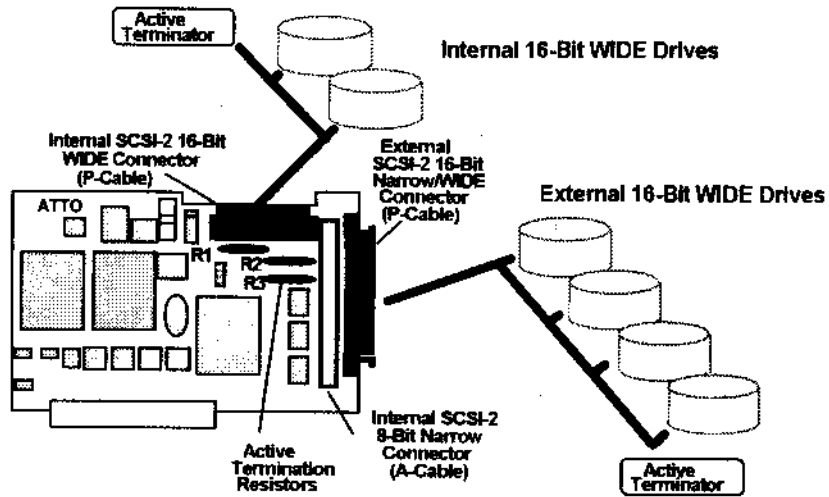
Some combinations of devices may need special cabling (especially internal drives). If you need custom cabling, contact ATTO Technical Support for specifications and recommendations.

There are three (3) on-board resistor packs that you need to configure for proper active termination of the SCSI Bus. R1 and R3 are for 8-Bit (Narrow) termination. R2 is an additional termination resistor required for 16-Bit (WIDE) termination.

If you are using only external devices OR only internal devices, you DO NOT need to do anything with the termination resistors.

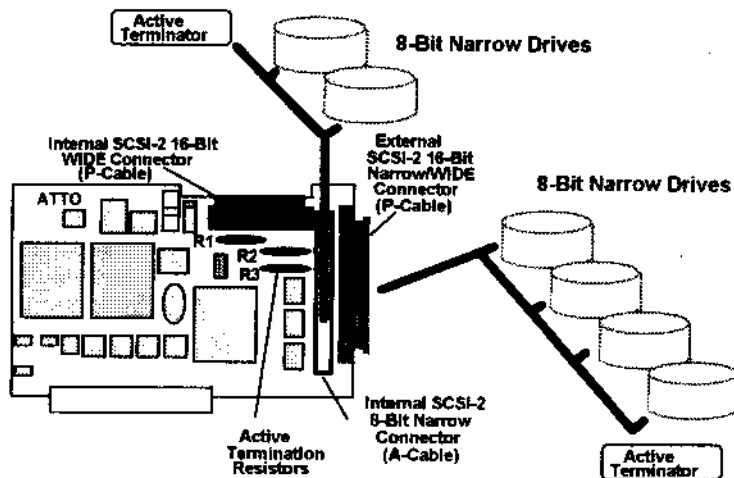
If you are using **BOTH** internal and external Devices, you **MUST** follow the Termination Configuration Procedures as described on the following pages:

I. Wide (16-Bit) Device(s) Internal & External:



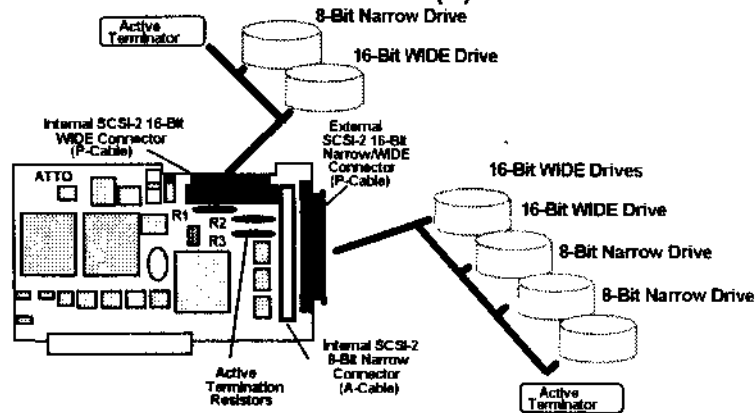
◆ Remove R1 & R2 & R3

II. Narrow (8-Bit) Device(s) Internal & External



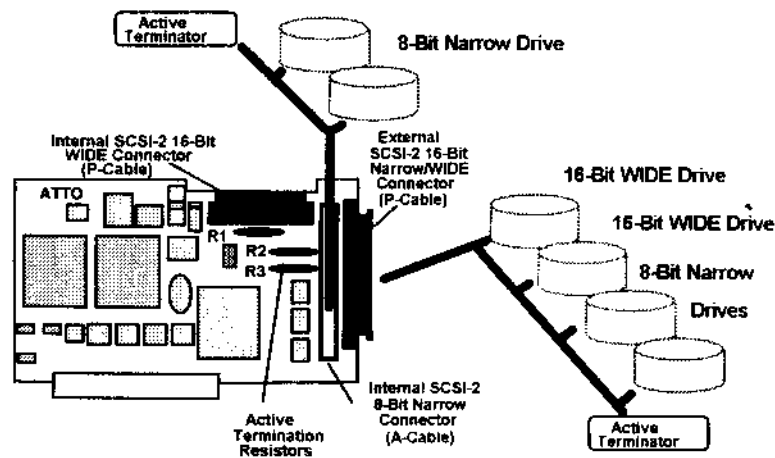
◆ Remove R1 & R3 / R2 Remains Installed

II. Wide and Narrow Device(s) Combined



◆ Remove R1 & R2 & R3

IV. Narrow (8-Bit) Device(s) Internal & Wide (16-bit) Device(s) External



◆ Remove R1 & R3 / R2 Remains Installed

Appendix D

Radio and Television Interference

The equipment described in this guide generates and uses radio frequency energy. If SiliconDisk IV is not installed and used in strict accordance with these instructions it may cause interference with radio and television reception.

WARNING!

This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC rules, which are designed to provide a reasonable protection against such interference when operating in a commercial environment. Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

If this equipment does cause interference to radio and television reception, which can be determined by turning the equipment off and on, you can try to correct the interference by one or more of the following measures:

- Move the receiving antenna.
- Relocate the computer with respect to the receiver, or move the computer away from the receiver.
- Plug the computer into a different outlet so the computer and receiver are on different branch circuits.
- If necessary, consult your dealer, ATTO's Technical Support Staff, or an experienced radio/television technician for additional suggestions.

The booklet "How to Identify and Resolve Radio/TV Interference Problems" prepared by the Federal Communications Commission is a helpful guide. It is available from the US Government Printing Office, Washington, DC 20402, Stock No. 004-000-00345-4.

How To Contact ATTO Technology

For technical support, customer service, and sales information, call Monday through Friday, Eastern Standard Time 8:30AM to 5:30PM . Or, by fax 24 hours a day. We are happy to answer any technical questions or tell you about new products and/or product upgrades. ***Free technical support is provided for all registered customers.***

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