Activator and APS Programming System

Installation and User's Guide

Actel

Windows® & UNIX® Environments

Actel Corporation, Sunnyvale, CA 94086

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Introduction

The *Activator and APS Programming System Installation and User's Guide* contains information about programming Actel devices using an Activator device programmer and the APS programming software. The guide is divided into two main sections: Activator installation and setup instructions and APS software usage. The installation and setup instructions include information about installing the Activator device programmers and the Adaptec AVA™-1505 AT®-to-SCSI host adapter (1505 card). The APS software usage section contains information about using an Activator with the APS programming software to program and debug Actel devices.

Document Organization

The *Activator and APS Programming System Installation and User's Guide* is divided into the following chapters:

Chapter 1 - Hardware Description contains hardware handling procedures and descriptions of the Activator 2, 2s, and the 1505 card.

Chapter 2 - Hardware Installation on a PC contains information and procedures to install an Activator on a PC.

Chapter 3 - Hardware Installation on a Workstation contains information and procedures to install an Activator on a UNIX workstation.

Chapter 4 - Programming an Actel Device contains information and procedures to program Actel devices using APS programming software.

Chapter 5 - Device Programming Failure Guidelines describes conditions that can cause an Actel device to fail.

Chapter 6 - Debugging a Device with an Activator contains information and procedures to debug Actel devices using an Activator and APS programming software.

Chapter 7 - Silicon Explorer Diagnostic Tool contains information and procedures to use the Silicon Explorer Diagnostic Tool.

Appendix A - Troubleshooting describes some common hardware and software problems and solutions to those problems.

Appendix B - AVI File description contains an example and description of an AVI log file.

Appendix C - Product Support provides information about contacting Actel for customer and technical support.

Document Assumptions

The information in this manual is based on the following assumptions:

1. You have installed the Designer Series software, including APSW.
2. You are familiar with PCs and Windows operating environments.
3. You are familiar with UNIX workstations and UNIX operating systems.
4. You are familiar with FPGA architecture and FPGA design software.

Document Conventions

The following conventions are used throughout this manual.

Information that is meant to be input by the user is formatted as follows:

```
keyboard input
```

The contents of a file is formatted as follows:

```
file contents
```

Messages that are displayed on the screen appear as follows:

```
Screen Message
```

Designer Series Manuals

The Designer Series software includes printed and on-line manuals. The on-line manuals are in PDF format on the CD-ROM in the "/doc" directory. These manuals are also installed onto your system when you install the Designer software. To view the on-line manuals, you must have Adobe® Acrobat Reader® installed. Actel provides Reader on the Designer Series CD-ROM.

The Designer Series includes the following manuals, which provide additional information on designing Actel FPGAs:

Designing with Actel. This manual describes the design flow and user interface for the Designer Series software, including information about using the ACTgen Macro Builder and ACTmap VHDL Synthesis software.

Actel HDL Coding Style Guide. This guide provides preferred coding styles for the Actel architecture and information about optimizing your HDL code for Actel devices.

ACTmap VHDL Synthesis Methodology Guide. This guide contains information, optimization techniques, and procedures to assist designers in the design of Actel devices using ACTmap VHDL.

Cadence® Interface Guide. This guide contains information and procedures to assist designers in the design of Actel devices using Cadence CAE software and the Designer Series software.

Mentor Graphics® Interface Guide. This guide contains information and procedures to assist designers in the design of Actel devices using Mentor Graphics CAE software and the Designer Series software.

MOTIVE™ Static Timing Analysis Interface Guide. This guide contains information and procedures to assist designers in the use of the MOTIVE software to perform static timing analysis on Actel designs.

Synopsys® Synthesis Methodology Guide. This guide contains preferred HDL coding styles and information and procedures to assist designers in the design of Actel devices using Synopsys CAE software and the Designer Series software.

Viewlogic® Powerview Interface Guide. This guide contains information and procedures to assist designers in the design of Actel devices using Powerview CAE software and the Designer Series software.

Viewlogic Workview® Office Interface Guide. This guide contains information and procedures to assist designers in the design of Actel devices using Workview Office CAE software and the Designer Series software.

VHDL Vital Simulation Guide. This guide contains information and procedures to assist designers in simulating Actel designs using a Vital compliant VHDL simulator.

Verilog® Simulation Guide. This guide contains information and procedures to assist designers in simulating Actel designs using a Verilog simulator.

Activator and APS Programming System Installation and User's Guide. This guide contains information about how to program and debug Actel devices, including information about using the Silicon Explorer diagnostic tool for system verification.

Silicon Explorer Quick Start. This guide contains information about connecting the Silicon Explorer diagnostic tool and using it to perform system verification.

Designer Series Development System Conversion Guide UNIX® Environments. This guide describes how to convert designs created in Designer Series versions 3.0 and 3.1 for UNIX to be compatible with later versions of Designer Series.

Designer Series Development System Conversion Guide Windows® Environments. This guide describes how to convert designs created in Designer Series versions 3.0 and 3.1 for Windows to be compatible with later versions of Designer Series.

FPGA Data Book and Design Guide. This guide contains detailed specifications on Actel device families. Information such as propagation delays, device package pinout, derating factors, and power calculations are found in this guide.

Macro Library Guide. This guide provides descriptions of Actel library elements for Actel device families. Symbols, truth tables, and pin loading are included for all macros.

On-Line Help

The Designer Series software comes with on-line help. On-line help specific to each software tool is available in Designer, ACTgen, ACTmap, and APSW.

1

Hardware Description

This chapter contains device handling guidelines and descriptions of the Activator 2, 2s, Adaptec AVA-1505 AT-to-SCSI host adapter (1505 card), and Adapter Module. The Activator 2 or 2s programmers and the Adapter Module, and the 1505 card if you are using a PC, are used when programming Actel devices.

Unpacking Your Activator

Unpack your Activator carefully and set it up in a clean operating environment. Never expose the unit to excessive heat, such as direct sunlight or heating vents and other heat-generating devices. Make sure you allow adequate ventilation on all four sides of the unit. The programmer is also equipped with rubber feet to raise it above the operating surface, allowing further ventilation. Make sure you do not block ventilation to the bottom of the unit.

Device Handling

Actel devices are CMOS devices and require proper grounding and Electro Static Device (ESD) handling procedures. Although all Actel parts have static discharge protection built in, you should always follow ESD handling procedures when handling Actel devices.

You should always wear grounded wrist straps at an ESD workstation when handling devices. A calibrated ionizer should be on and functioning properly at the workstation. An ionizer air stream should be directed over the parts at all times.

Always keep the devices in their anti-static carrying cases until they are used, and keep the surrounding environment clean and free of dust and debris. Periodically check the Adapter Module sockets to make sure that they are free of dirt or other debris that would prevent good electrical pin connections between the device and socket.

When loading a device in the Adapter Module socket, be sure that pin 1 on the device is oriented according to the diagram on the Adapter Module. Damage can occur if the FPGA is loaded incorrectly.

Activator 2 and 2s Rear Panels

Actel offers two programming units, the Activator 2 and the Activator 2s. The Activator 2 is a four-device programmer, with interchangeable Adapter Modules that support all of Actel's device packages. The Activator 2s is a single socket version of the Activator 2.

This section describes and illustrates the connectors on the rear panels of the Activator 2 and 2s. The connectors are shown in Figure 1-1 below and Figure 1-2 on page 3.

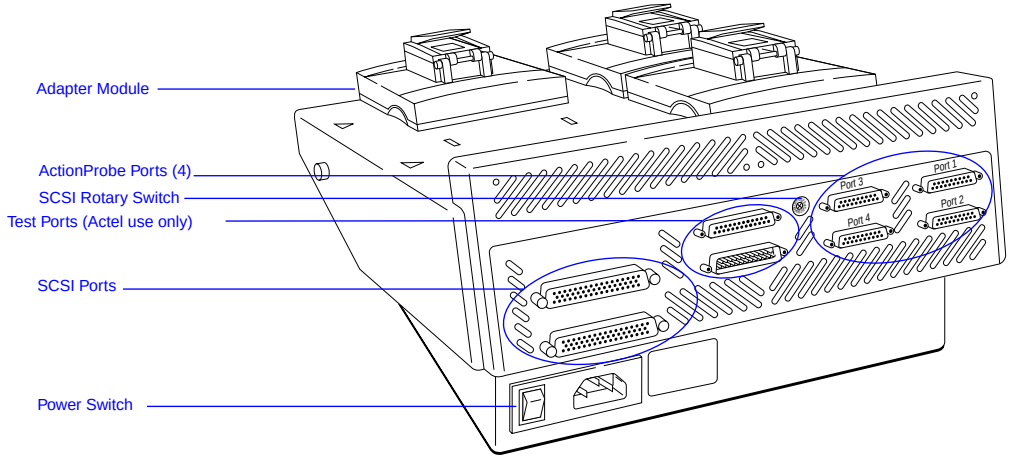

Figure 1-1. Activator 2 Rear Panel Connectors

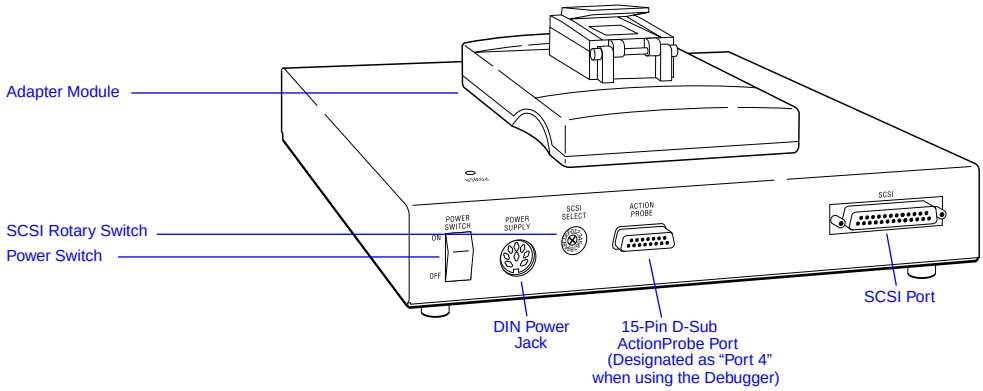

Figure 1-2. Activator 2s Rear Panel Connectors

Common Connectors

The following connectors are common to the Activator 2 and 2s.

ActionProbe Port

The ActionProbe Port supports in-circuit debugging using the ActionProbe diagnostic tool. The Activator 2s has one port. The Activator 2 has four ports, one for each programming socket. The ActionProbe has been replaced with the Silicon Explorer, which uses a serial port. If you are using an ActionProbe, refer to the documentation included with it for information about using the ActionProbe tool.

Adapter Module

The Adapter Module is plugged into the Activator and used to program Actel devices. The Activator 2s can accept one Adapter Module. The Activator 2 can accept four. Refer to "Adapter Modules" on page 4 for information about Adapter Modules.

Power Switch

The power switch is used to turn the Activator on and off.

SCSI Rotary Switch

The SCSI rotary switch is used to select the SCSI bus ID. Refer to Chapter 2, "Hardware Installation on a PC" on page 7 or Chapter 3, "Hardware Installation on a Workstation" on page 21 for information about setting the SCSI rotary switch.

SCSI Port

The SCSI port is used to communicate with the computer through the SCSI interface. The Activator 2s has one SCSI port. The Activator 2 has two ports that are connected in parallel.

Activator 2 Connectors

In addition to the common connectors, the Activator 2 has the following connector.

Test Port

The two Test Ports are used for factory diagnostic testing and are not available for customer use. Do not connect any devices to these ports.

Activator 2s Connectors

In addition to the common connectors, the Activator 2s has the following connector:

DIN Power Jack

The DIN power jack is used to connect the power supply (supplied by Actel) to the Activator 2s.

Adapter Modules

The Activator 2 has four sockets for Adapter Modules and can program up to four Actel devices simultaneously. The Activator 2s has one socket for a single Adapter Module. Each device package type has an Adapter Module designed specifically for that device. Contact your local sales representative for availability of Adapter Modules.

If the Adapter Module does not match the package type of the design being programmed, the APS software displays the message “wrong adapter type” for each incorrect socket. In each case, replace the wrong adapter with the correct one. Refer to “Installing and Removing an Adapter Module” on page 19 or page 28 for information about installing and removing Adapter Modules from an Activator.

PC Adaptec AVA-1505 AT-to-SCSI Host Adapter

The 1505 card, included with the Activator, interfaces with the Activator 2 or 2s. The 1505 card, shown in Figure 1-3, has an external 25-pin DB25 SCSI connector.

A jumper block (J1) is located on the left-center of the 1505 card. This block is used to configure the I/O address and interrupt number (IRQ), if necessary. The default I/O address is 340H-35FH. The default IRQ is IRQ11.

CAUTION: The external 25-pin DB25 edge connector can be confused with a parallel port connector. Make sure you plug the Activator into the 25-pin DB25 connector on the 1505 card.

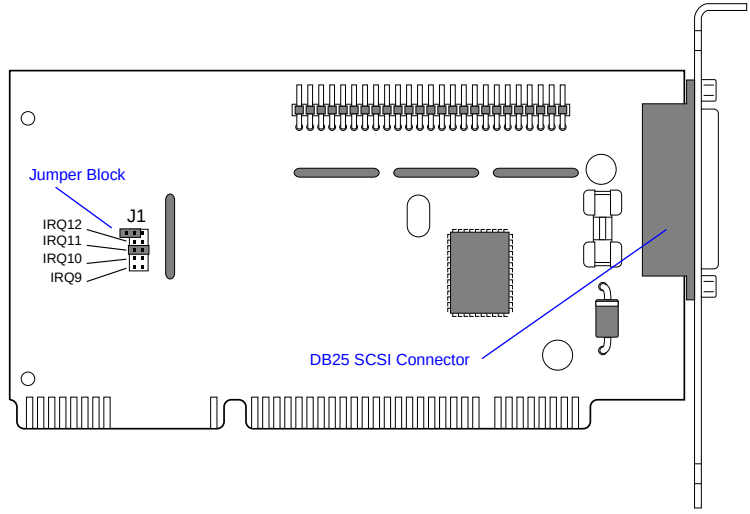

Figure 1-3. Adaptec AVA-1505 AT-to-SCSI Host Adapter

2

Hardware Installation on a PC

This chapter contains information and procedures to install an Activator 2 or 2s on a PC, including information about configuring your 1505 card, installing the appropriate software driver(s), hooking up an Activator and installing and removing an Adapter Module. Refer to the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* (Actel part number AVA-1505, included with the 1505 card) for additional information about installing and configuring the 1505 card.

Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation

This section contains background information and describes the procedures for installing and configuring the 1505 card on a PC. If your PC already contains an Adaptec SCSI host adapter card, you can use it instead of installing the 1505 card provided by Actel. Go to "Connecting an Adaptec SCSI Card to the Activator" on page 16 for configuration information.

Background Information

PCs use interrupt numbers (IRQs) and I/O addresses to distinguish between different add-in cards. Each add-in card must be assigned a IRQ and I/O address. If more than one card uses the same IRQ or address, conflicts between the cards may occur. Newer Plug and Play cards can be configured by software to use unique IRQs and I/O addresses. However, non-Plug and Play, or legacy, cards cannot. When installing a legacy card, the user must determine what IRQs and I/O addresses are in use by the other cards in the PC so that a unique IRQ and I/O address can be selected for the legacy card. The 1505 card is a legacy card.

All PCs (486 and newer) contain an ISA (or AT) bus. Additionally, Pentium® PCs usually include an additional bus, the PCI bus, used for Plug and Play cards. The 1505 card uses the ISA bus, not the PCI bus. If your Pentium PC contains a PCI bus, then it has reserved certain IRQs for use only by the PCI bus. To use the 1505 card, you must configure your computer to access the ISA bus for the IRQ used by the 1505 card. This is done by changing the setup information in your PC's BIOS, typically during boot-up.

Installation Steps

Regardless of which Windows operating environment you are working under (95 or NT), you must perform the following steps to successfully install the 1505 card into a PC:

1. Select a unique IRQ and a unique I/O address for the 1505 card.
2. Install the 1505 card into your PC.
3. If your computer is a Pentium PC with a PCI bus, configure the selected IRQ to use the ISA bus, not the PCI bus.
4. Configure the software driver(s), with the IRQ and I/O address of the driver(s) matching the IRQ and I/O address set on the 1505 card.
5. If an Activator is sharing the 1505 card with other SCSI devices, configure the termination resistors on the 1505 card and the other SCSI devices.
6. Connect the Activator to the 1505 card.

Installing the 1505 Card Under Windows 95

This section describes how to install the 1505 card under Windows 95.

Select a Unique IRQ and I/O Address

The default settings on the 1505 card should work. However, you may have an add-in card installed on you PC with IRQ and I/O address settings that conflict with the default settings on the 1505 card. The conflict may affect your video, network connection, or hard drive. If there is a conflict, you must change the IRQ and I/O address of either the 1505 card or an installed add-in card.

To select the IRQ and I/O address for the 1505 card:

1. **Open the Device Manager window.** Double-click the System icon located in the Control Panel program group. The System Properties window is displayed. Click the Device Manager tab to display the Device Manager window.

2. **Determine what IRQs and I/O addresses are in use by installed add-in card(s).** Double-click the Computer icon. The Computer Properties window is displayed. Choose the Interrupt request (IRQ) radio button to view the IRQs already in use. Choose the Input/output (I/O) radio button to view the I/O addresses already in use.

3. **Set the IRQ and I/O address for the 1505 card.** The default interrupt number is IRQ11, but can be set from IRQ9 to IRQ12. The default I/O address is 340h-35Fh, but can be set to 140h-15Fh. Refer to the "Jumper Block Settings" section in the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* for information about changing the IRQ and I/O address on the 1505 card.

   If all the interrupts between IRQ9 and IRQ12 are being used, you must change the IRQ settings on another card to free up one of these interrupts for the 1505 card.

Install the SCSI Board Into your PC

Turn off your computer, remove its cover, and install the 1505 card into an ISA expansion slot in the PC. After installing the card, replace the cover and turn the PC on. Refer to the "Inserting the Board" section in the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* for additional information about installing the 1505 card.

Configure the Selected IRQ to Use the ISA Bus

If your computer is a Pentium PC with a PCI bus, you must change the CMOS setup in your BIOS so that the IRQ used by the 1505 card accesses the ISA bus rather than the PCI bus. You can usually change the BIOS setup during boot-up. Refer to the documentation provided by your computer or BIOS manufacturer for information about changing your BIOS setup.

If you don't know if your Pentium uses a PCI bus, refer to the documentation provided by your computer manufacturer or contact your computer manufacturer.

IMPORTANT:

If your computer uses the PCI bus and you do not change your BIOS, even if you have no hardware conflicts, the Activator will not work.

Note: If you remove the 1505 card from your PC, make sure you change the BIOS settings for that IRQ back to use the PCI bus.

Run the Add New Hardware Wizard

Windows 95 comes with an Add New Hardware wizard that detects new add-in cards and drivers. This wizard automatically assigns an IRQ and I/O address to the new card. These settings may not match the card's actual configuration. If the settings on the card do not match the settings in the wizard, you must change the settings in the wizard or on the 1505 card.

Note: The settings that are selected in the Add New Hardware wizard must match the actual settings on the 1505 card, your BIOS, and the settings in your config.sys. file. Refer to "Configure the Selected IRQ to Use the ISA Bus" on page 9 for information about configuring your BIOS and "Configure the Software Driver" on page 10 for information about configuring your software driver.

To run the Add New Hardware wizard:

1. **Invoke the Add New Hardware wizard.** Double-click the Add New Hardware icon located in the Control Panel group. The Add New Hardware wizard is displayed.
2. **Follow the instructions on the screen.** Select "No" when asked if you want Windows to search for your new hardware and "SCSI controllers" when asked for the type of hardware you want to install. Choose "Adaptec" and "AVA-1505 SCSI Host Adapter" when asked to select Manufacturer and Model for your hardware.
3. **Note the IRQ and I/O address.** If the IRQ and I/O address match the settings you selected for the card, click the Next button. If the settings do not match, then change the software settings to match the 1505 card settings (see "Configure the Software Driver" in the following section) or change the card settings to match the software settings (see "Select a Unique IRQ and I/O Address" on page 8).

Configure the Software Driver

Actel uses the driver installed by Windows 95 when you add the 1505 card using the Add New Hardware wizard. If the settings on your 1505 card match the setting assigned to the card by the wizard, you do not need to configure the software driver. If the settings do not match, use the following procedure to configure the software driver.

1. **Open the Device Manager window.** Double-click the System icon located in the Control Panel program group. The System Properties window is displayed. Click the Device Manager tab to display the Device Manager window.
2. **Open the 1505 card Properties window.** Double-click the SCSI controllers icon. Double-click the 1505 card icon (it may show up as the "Adaptec 1505 SCSI Adapter" driver, the "Adaptec AIC-6260/6360" driver, or as the "ISA SCSI" driver). The SCSI Controller Properties window is displayed.
3. **Change the I/O address settings.** Click the Resources tab. Make sure the Use automatic settings box is not checked. Choose Input/Output Range in the Resource settings window and click the Change Settings button. Change the I/O address to match the settings you selected on the 1505 card. Click OK.
4. **Change the IRQ settings.** Choose Interrupt Request in the Resource settings window and click the Change Settings button. Change the IRQ to match the settings you selected on the 1505 card. Click OK.

To verify that the software driver is configured properly:

1. **Open the Device Manager window.** Double-click the System icon located in the Control Panel program group. The System Properties window is displayed. Click the Device Manager tab to display the Device Manager window.
2. **View the 1505 card properties.** Double-click the SCSI controllers icon. The 1505 card icon is displayed (it may show up as the "Adaptec 1505 SCSI Adapter" device, the "Adaptec AIC-6260/6360" device, or as the "ISA SCSI" device). If there is a yellow dot with an exclamation point next to the name, then you have a hardware conflict.

   Review the IRQs and I/O addresses used by the other add-in cards to determine where the conflict is occurring. If you change the 1505 card settings, remember to change the BIOS and software settings to match, as described in the preceding sections. After each change, check the Device Manager again until you resolve the conflict.

Configure the Termination Resistors

If an Activator is sharing a 1505 card with other SCSI devices, the devices must be terminated properly. Refer to the "Terminating the SCSI Bus Cable" section in the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* for information about terminating SCSI devices.

If you do not have other SCSI devices connected to the 1505 card, the termination resistors do not need to be changed.

Connect the Activator to the 1505 Card

Once you have installed the 1505 card, you must connect the Activator to your PC through the 1505 card. Go to "Connecting an Adaptec SCSI Card to the Activator" on page 16 for the procedure.

Installing the 1505 Card Under Windows NT

This section describes how to install the 1505 card under Windows NT.

Select a Unique IRQ and I/O Address

The default settings on the 1505 card should work, However, you may have an add-in card installed on you PC with IRQ and I/O address settings that conflict with the default settings on the 1505 card. The conflict may affect your video, network connection, or hard drive. If there is a conflict, you must change the IRQ and I/O address of either the 1505 card or an installed add-in card.

To select the IRQ and I/O address for the 1505 card:

1. **Open the Windows NT Diagnostics Window.** Choose Windows NT Diagnostics from the Administrative Tools (Common) menu in the Programs menu.
2. **Determine what IRQs and I/O addresses are in use by installed add-in card(s).** Click the Resources tab. The Resources window is displayed. Click the IRQ button to display the interrupts being used. Click the I/O Port button to display the addresses being used.

3. **Set the IRQ and I/O address for the 1505 card.** The default interrupt number is IRQ11, but can be set from IRQ9 to IRQ12. The default I/O address is 340h-35Fh, but can be set to 140h-15Fh. Refer to the "Jumper Block Settings" section in the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* for information about changing the IRQ and I/O address on the 1505 card.

   If all the interrupts between IRQ9 and IRQ12 are being used, you must change the IRQ settings on another card to free up one of these interrupts for the 1505 card.

Install the SCSI Board Into your PC

Turn off your computer, remove its cover, and install the 1505 card into an ISA expansion slot in the PC. After installing the card, replace the cover and turn the PC on. Refer to the "Inserting the Board" section in the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* for additional information about installing the 1505 card.

Configure the Selected IRQ to Use the ISA Bus

If your computer is a Pentium PC with a PCI bus, you must change the CMOS setup in your BIOS so that the IRQ used by the 1505 card accesses the ISA bus rather than the PCI bus. You can usually change the BIOS setup during boot-up. Refer to the documentation provided by your computer or BIOS manufacturer for information about changing your BIOS setup.

If you don't know if your Pentium uses a PCI bus, refer to the documentation provided by your computer manufacturer or contact your computer manufacturer.

IMPORTANT:

If your computer uses the PCI bus and you do not change your BIOS, even if you have no hardware conflicts, the Activator will not work.

Note: If you remove the 1505 card from your PC, change the BIOS settings for that IRQ back to PCI bus use.

Install the Windows NT Driver

After installing and configuring the 1505 card, you must install two drivers under Windows NT. The first driver is provided by Microsoft. The second driver is provided by Actel. Go to "Install the Software Driver" on page 15 for installation instructions for the Actel driver.

To install the Windows NT driver:

1. **Open the Add SCSI Adapters window.** Double-click the SCSI Adapters icon located in the Control Panel program group.
2. **Add the 1505 card driver.** Click the Drivers tab. The Drivers window is displayed. Choose "Adaptec AIC-6X60 ISA Single-Chip SCSI Controller" from the list of devices. Put the Windows NT 4.0 CD-ROM into the drive and Click OK. The NT driver is installed.
3. **Re-boot the PC.** You must re-boot for this driver to take effect.

To verify that the Windows NT driver is installed correctly:

1. **Open the Add SCSI Adapters window.** Double-click the SCSI Adapters icon located in the Control Panel program group.
2. **View the 1505 care properties.** Click the Drivers tab. The Drivers window is displayed. Look for the "Adaptec AIC-6X60 ISA Single-Chip SCSI Controller" driver. Its status should be "Started."

If there is a yellow dot with an exclamation point next to the driver name, then you have a hardware conflict. Review the IRQs and I/O addresses used by the other add-in cards to determine where the conflict is occurring. If you change the 1505 card settings, remember to change the BIOS and software settings to match, as described in the preceding sections. After each change, check the Device Manager again until you resolve the conflict.

Install the Software Driver

In addition to the Windows NT driver, you must install the Adaptec ASPI driver provided by Actel.

To install the Adaptec ASPI driver:

Insert the Designer Series CD-ROM into the drive and execute the following program on the CD-ROM:

```
\ASPI_NT\ASPIINST.EXE
```

After installation your computer will re-boot.

To verify that the software driver is configured properly:

Double-click the Devices icon located in the Control Panel program group. Look for the "Aspi32" driver. Its status should be "Started" and "Automatic."

Configure the Termination Resistors

If an Activator is sharing a 1505 card with other SCSI devices, the devices must be terminated properly. Refer to the "Terminating the SCSI Bus Cable" section in the *Adaptec AVA-1505 AT-to-SCSI Host Adapter Installation Guide* for information about terminating SCSI devices.

If you do not have other SCSI devices connected to the 1505 card, the termination resistors do not need to be changed.

Connect the Activator to the 1505 Card

Once you have installed the 1505 card, you must connect the Activator to your PC through the 1505 card, as described on page 16.

Connecting an Adaptec SCSI Card to the Activator

You can only use an Adaptec SCSI card with an Activator 2 or 2s. If you have an existing Adaptec SCSI card installed, you can use it instead of the 1505 card to interface with an Activator.

To connect a SCSI card to an Activator:

Connect the SCSI card to the Activator using the appropriate SCSI cable for the board's external SCSI connector and the Activator 2 or 2s connector (female DB50 for Activator 2, DB25 for Activator 2s).

IMPORTANT: Activators contain termination resistors and must be the last device in the SCSI chain.

If SCSI ID number 5 is not available on your SCSI bus, set the rotary switch on the back of your Activator to an available SCSI ID, and modify the "Windows Programming" icon in the Designer Series Program Group using the following procedure:

1. **Open the Designer Series program group.** Right-click the Start button and select the Open All Users command (Open command for Windows 95). Double-click the Programs icon. Double-click the Designer Series icon.
2. **Modify the Windows Programming icon.** Click the Windows Programming icon. Choose the Properties command from the File menu. Click the Shortcut tab. Type the following in the Target box:

   ```
   c:\actel\bin\apsw.exe devactivator2:4
   ```

   The "4" represents the SCSI ID you want to set the Activator to use.

Installing the Activator

The following procedure describes how to install an Activator 2 or 2s on a PC:

1. **Turn off the PC.**
2. **Verify that the Activator power switch is OFF.** See Figure 1-1 on page 2 or Figure 1-2 on page 3 for the location of the power switches.
3. **Verify that the SCSI rotary switch is set to an available ID.** The location of this switch is shown in Figure 1-1 on page 2 or Figure 1-2 on page 3. The default ID is 5. refer to "Connecting an Adaptec SCSI Card to the Activator" on page 16 for information about changing the SCSI ID.
4. **Connect the Activator to the PC using the supplied cable.** Connect one end of the cable to the SCSI connector on the Activator rear panel (you can use either connector on the Activator 2) and tighten the locking screws. Connect the other end of the cable to the 1505 card in the PC and tighten the locking screws. The Activator is terminated internally and must be the last device on the SCSI chain. See Figure 2-1 for the location of the SCSI connectors.

CAUTION: The SCSI connector on the 1505 card is a female DB25 that can be confused with a parallel port connector. Make sure you plug the cable into the 1505 card or you could damage the connectors.

5. **Connect power to the Activator.**

   Activator 2

   Insert the power cord into the power connector located on the rear panel and plug the other end into an AC power outlet.

   Activator 2s

   Insert the 8-pin DIN connector from the power supply into the DIN power jack located on the rear panel. Connect an AC power cord to the power supply and plug the other end into an AC power outlet (Figure 2-2).

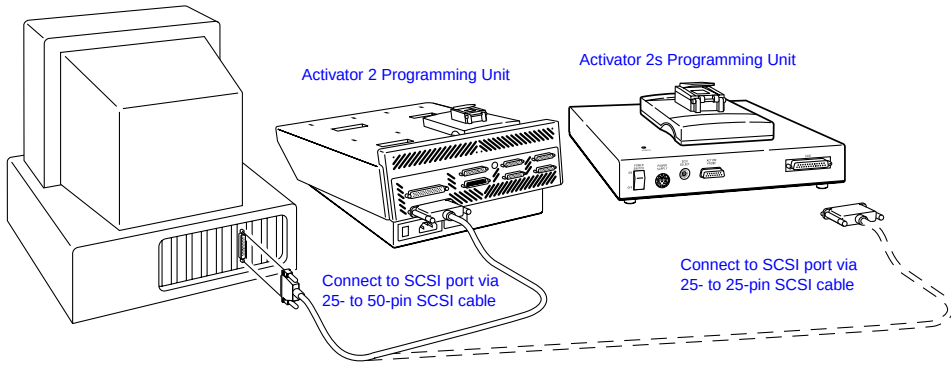

Figure 2-1. Activator 2 and 2s PC Connections

Note: The power supplies are rated for 100–240 VAC at 50 or 60 Hz. The Activator 2s power switch will remotely power down the power supply. Only a small voltage will remain to detect power up.

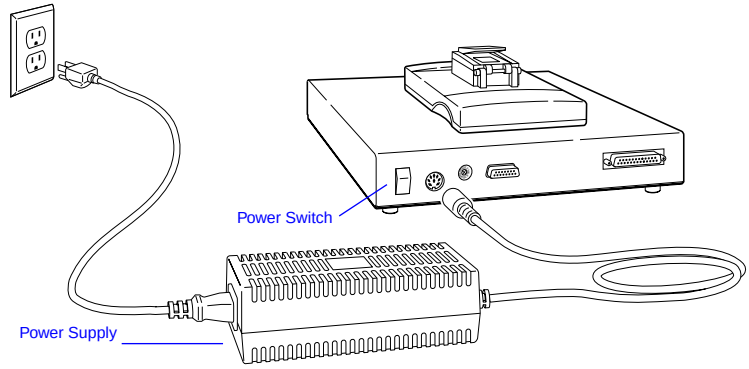

Figure 2-2. Power Supply Connected to Activator 2s

6. **Turn on the Activator power.** After a brief delay, the green power light should turn on and remain on continuously as long as the power is turned on.

7. **Turn on the PC.** You are now ready to program a device using APSW. Refer to chapter 4, “Programming an Actel Device” on page 29 for information about programming a device.

Verifying Hardware Installation (NT 4.0)

Use the following procedure to verify that the Activator installed correctly:

1. **Open the Devices window.** Double-click the SCSI Adapters icon located in the Control Panel program group. The SCSI Adapters window is displayed. Click the Devices tab to display the Devices window.
2. **View the 1505 card.** Double click the "Adaptec AIC-6X60 ISA Single-Chip SCSI Controller" device driver. If eight unnamed tape drive icons appear, the Activator hardware installation was successful. If the icons do not appear, make sure the SCSI cable connection are correct, all cable connections are seated together firmly, and the power is connected properly and is turned on. Also make sure the SCSI ID rotary switch on the Activator is set to an available ID and matches what is set in the Windows Programming icon.

Installing and Removing an Adapter Module

The following procedure describes how to install an Adapter Module into and remove an Adapter Module from an Activator.

To install an Adapter Module:

1. **Position the two metal guides on the Adapter Module into the corresponding slots on the Activator.**
2. **Press down on the Adapter Module to seat the connector firmly on the bottom of the module.** Do not force the Adapter Module, it should fit easily. Be sure to keep the connector area clean.

To remove an Adapter Module:

1. **Pull the top of the Adapter Module toward you until the connector comes free.** Indentations are provided on the Adapter Module to facilitate this step.
2. **Slide the Adapter Module upward to free the two metal guides.**

3

Hardware Installation on a Workstation

This chapter contains information and procedures to install an Activator 2 or 2s on a workstation running SunOS, Solaris, or HP-UX. This includes information about creating a link to an Activator.

Installing an Activator on a SunOS Workstation

The following procedure describes how to install an Activator 2 or 2s on a SunOS workstation:

1. **Shutdown, then power down the workstation.** When shutting the system down, turn off power to the workstation before turning off power to the Activator.

WARNING: Do not connect SCSI cables to the Activator while the workstation or other peripherals are turned on; data loss may result.

2. **Verify that the Activator is OFF.** See Figure 1-1 on page 2 or Figure 1-2 on page 3 for the location of the power switches.

3. **Set the position of the SCSI rotary switch.** The location of this switch is shown in Figure 1-1 on page 2 or Figure 1-2 on page 3. If you want to map the Activator to "rst1," set the rotary switch to position 5. If you want to map the Activator to device "rst0," set the rotary switch to position 4.

4. **Connect the Activator to the workstation using the supplied SCSI cable.** Connect one end of the cable to a SCSI connector on the Activator rear panel (you can use either connector on the Activator 2) and tighten the locking screws. Connect the other end of the cable to the SCSI connector of the workstation and tighten the locking screws or make sure the micro-miniature SCSI connector has snapped into place. See Figure 3-1 on page 22 for the location of the SCSI connectors.

   The Activator is terminated internally. If several devices are daisy-chained to the SCSI port, it must be the last device in the chain.

   Note: Daisy chaining may require a cable with a different type of connector. The Activator SCSI cable is a standard cable with no scrambling. However, other connector combinations can be purchased. The cable length must not exceed 6 feet.

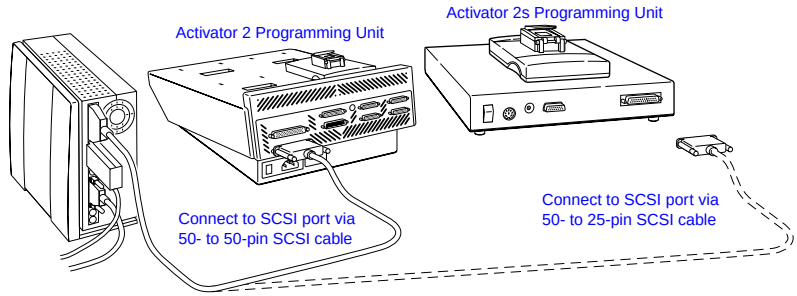

Figure 3-1. Activator 2 and 2s Workstation Connections

5. **Connect power to the Activator.**

   Activator 2

   Insert the power cord into the power connector located on the rear panel and plug the other end into an AC power outlet.

   Activator 2s

   Insert the 8-pin DIN connector from the power supply into the DIN power jack located on the rear panel. Connect an AC power cord to the power supply and plug the other end into an AC power outlet (see Figure 2-2 on page 18).

   Note: The power supplies are rated for 100–240 VAC at 50 or 60 Hz. The Activator 2s power switch will remotely power down the power supply. Only a small voltage will remain to detect power up.

6. **Turn on the Activator power.** After a brief delay, the green power light should turn on and remain on continuously as long as the power is on.

7. **Power up the Workstation.**

You must create a link to the Activator to complete installation. Go to "Creating a Link to the Activator" on page 23 for the procedure.

Creating a Link to the Activator

Once you have installed the Activator on the workstation, you must create a symbolic link to the Activator to complete installation. Use the following procedure to create a symbolic link:

1. **Log in as ROOT.**
2. **Create a symbolic link to the Activator.** To map the Activator to "rst1," verify that the Activator SCSI rotary switch is set to position 5 and type the following command at the prompt:

   ```
   ln -s /dev/rst1 /dev/activator2
   ```

   Note: Because "rst0" is usually used for a tape drive or another storage unit, the Activator SCSI rotary switch is by default set to position 5 for use with "rst1."

   To map the Activator to "rst0," verify that the Activator SCSI rotary switch is set to position 4 and type the following command at the prompt:

   ```
   ln -s /dev/rst0 /dev/activator2
   ```

You are now ready to program a device using APSW. Refer to chapter 4, "Programming an Actel Device" on page 29 for information about programming a device.

Installing an Activator on a Solaris Workstation

The following procedure describes how to install an Activator 2 or 2s on a Solaris workstation:

1. **Shutdown, then power down the workstation.** When shutting the system down, turn off power to the workstation before turning off power to the Activator.

WARNING: Do not connect SCSI cables to the Activator while the workstation or other peripherals are turned on; data loss may result.

2. **Verify that the Activator is OFF.** See Figure 1-1 on page 2 or Figure 1-2 on page 3 for the location of the power switches.

3. **Set the position of the SCSI rotary switch.** The location of this switch is shown in Figure 1-1 on page 2 or Figure 1-2 on page 3. The switch is set to position 5 by default, but it must be set to another position. Actel recommends setting it to position 3 or 4. The switch settings correspond to device files, which may require a system administrator to create.

4. **Connect the Activator to the workstation using the supplied SCSI cable.** Connect one end of the cable to a SCSI connector on the Activator rear panel (you can use either connector on the Activator 2) and tighten the locking screws. Connect the other end of the cable to the SCSI connector of the workstation and tighten the locking screws or make sure the micro-miniature SCSI connector has snapped into place. See Figure 3-1 on page 22 for the location of the SCSI connectors.

   The Activator is terminated internally. If several devices are daisy-chained to the SCSI port, it must be the last device in the chain.

   Note: Daisy chaining may require a cable with a different type of connector. The Activator SCSI cable is a standard cable with no scrambling. However, other connector combinations can be purchased. The cable length must not exceed 6 feet.

5. **Connect power to the Activator.**

   Activator 2

   Insert the power cord into the power connector located on the rear panel and plug the other end into an AC power outlet.

   Activator 2s

   Insert the 8-pin DIN connector from the power supply into the DIN power jack located on the rear panel. Connect an AC power cord to the power supply and plug the other end into an AC power outlet (see Figure 2-2 on page 18).

   Note: The power supplies are rated for 100–240 VAC at 50 or 60 Hz. The Activator 2s power switch will remotely power down the power supply. Only a small voltage will remain to detect power up.

6. **Turn on the Activator power.** After a brief delay, the green power light should turn on and remain on continuously as long as the power is on.
7. **Power up the workstation.**
8. **Interrupt the boot sequence.** On a Type 4 keyboard, press the "L1" and "A" keys simultaneously. On a type 5 keyboard, press the "Stop" and "A" keys simultaneously.
9. **Initiate a reconfiguration boot.** Type "boot -r" at the ok prompt.
10. **Verify that the Activator driver is installed.** After the system boots, check the "/dev/rmt" directory. You should see multiple tape devices called "0mn," "0m," etc.
11. **Create a link to the Activator.**

You must create a link to the Activator to complete installation. Go to "Creating a Link to the Activator" below for the procedure.

Creating a Link to the Activator

Once you have installed the Activator on the workstation, you must create a symbolic link to the Activator to complete installation. Use the following procedure to create a symbolic link:

1. **Log in as ROOT.**
2. **Create a symbolic link to the Activator.** Type the following command at the prompt:

   ```
   ln -s <device_file> /dev/activator2
   ```

   For example, if you have set the SCSI rotary switch to position 3, verify the device file "/dev/rmt/3mn" exists, then create a symbolic link as follows:

   ```
   ln -s /dev/rmt/3mn /dev/activator2
   ```

   If "/dev/rmt/3mn" does not exist, or if you don't know which SCSI ID to set the rotary switch to, contact your system administrator for help.

You are now ready to program a device using APSW. Refer to chapter 4, "Programming an Actel Device" on page 29 for information about programming a device.

Installing an Activator on an HP-UX Workstation

The following procedure describes how to install an Activator 2 or 2s on an HP-UX workstation:

1. **Shutdown, then power down the workstation.** When shutting the system down, turn off power to the workstation before turning off power to the Activator.

WARNING: Do not connect SCSI cables to the Activator while the workstation or other peripherals are turned on; data loss may result.

2. **Verify that the Activator is OFF.** See Figure 1-1 on page 2 or Figure 1-2 on page 3 for the location of the power switches.

3. **Set the position of the SCSI rotary switch.** The location of this switch is shown in Figure 1-1 on page 2 or Figure 1-2 on page 3. The switch is set to position 5 by default, but it must be set to another position. Actel recommends setting it to position 3 or 4. The switch settings correspond to device files, which may require a system administrator to create.

4. **Connect the Activator to the workstation using the supplied SCSI cable.** Connect one end of the cable to a SCSI connector on the Activator rear panel (you can use either connector on the Activator 2) and tighten the locking screws. Connect the other end of the cable to the SCSI connector of the workstation and tighten the locking screws or make sure the micro-miniature SCSI connector has snapped into place. See Figure 3-1 on page 22 for the location of the SCSI connectors.

   The Activator is terminated internally. If several devices are daisy-chained to the SCSI port, it must be the last device in the chain.

   Note: Daisy chaining may require a cable with a different type of connector. The Activator SCSI cable is a standard cable with no scrambling. However, other connector combinations can be purchased. The cable length must not exceed 6 feet.

5. **Connect power to the Activator.**

   Activator 2

   Insert the power cord into the power connector located on the rear panel and plug the other end into an AC power outlet.

   Activator 2s

   Insert the 8-pin DIN connector from the power supply into the DIN power jack located on the rear panel. Connect an AC power cord to the power supply and plug the other end into an AC power outlet (see Figure 2-2 on page 18).

   Note: The power supplies are rated for 100–240 VAC at 50 or 60 Hz. The Activator 2s power switch will remotely power down the power supply. Only a small voltage will remain to detect power up.

6. **Turn on the Activator power.** After a brief delay, the green power light should turn on and remain on continuously as long as the power is on.

7. **Power up the workstation.**

You must create a link to the Activator to complete installation. Go to "Creating a Link to the Activator" below for the procedure.

Creating a Link to the Activator

Once you have installed the Activator on the workstation, you must create a symbolic link to the Activator to complete installation. Use the following procedure to create a symbolic link:

1. **Log in as ROOT.**

2. **Create a symbolic link to the Activator.** Type the following command at the prompt:

   ```
   ln -s <device_file> /dev/activator2
   ```

   For example, if you have set the SCSI rotary switch to position 3, verify the device file "/dev/rmt/3mn" exists, then create a symbolic link as follows:

   ```
   ln -s /dev/rmt/3mn /dev/activator2
   ```

If "/dev/rmt/3mn" does not exist, or if you don't know which SCSI ID to set the rotary switch to, contact your system administrator for help.

You are now ready to program a device using APSW. Refer to chapter 4, "Programming an Actel Device" on page 29 for information about programming a device.

Installing and Removing an Adapter Module

The following procedure describes how to install an Adapter Module into and remove an Adapter Module from an Activator.

To install an Adapter Module:

1. **Position the two metal guides on the Adapter Module into the corresponding slots on the Activator programmer.**
2. **Press down on the Adapter Module to seat the connector firmly on the bottom of the module.** Do not force the Adapter Module, it should fit easily. Be sure to keep the connector area clean.

To remove an Adapter Module:

1. **Pull the top of the Adapter Module toward you until the connector comes free.** Indentations are provided on the Adapter Module to facilitate this step.
2. **Slide the Adapter Module upward to free the two metal guides.**

4

Programming an Actel Device

This chapter discusses the recommended programming flow and describes the procedure for programming an Actel device using an Activator connected to a PC or workstation and the APSW programming software.

Programming Flow

The recommended programming flow for an Actel device has two steps: program a device, and save the AVI file. These steps are described in the following sections.

Program a Device

Use an Activator to program your device. Make sure you follow ESD device handling procedures when removing a device from its packaging and when placing it into an Activator. Refer to "Device Handling" on page 1 and "Removing a Device from the Carrying Case" on page 34 for information about handling and unpacking Actel devices.

Save the AVI File

Once you have programmed your device, save your AVI file. When you program a chip, the programming history is saved in the <design_name>.avi file. The AVI file contains programming data for each antifuse programmed, including the number of programming pulses applied and fuse current readings. This file is overwritten each time you select the Activate command. Refer to Appendix C, "AVI File Description" on page 79 for information about the AVI file.

If your device fails to program, refer to Chapter 5, "Device Programming Failure Guidelines" on page 43 for information about programming failures and maximum allowed programming failure guidelines.

APSW Description

This section describes the APSW interface including information about using the interface to program Actel devices. Figure 4-1 shows the main window for APSW.

Figure 4-1. APSW Main Window

Open

The Open button or menu command opens a programming file.

To open a programming file:

Click the Open button or choose the Open command from the File menu. The Open dialog box is displayed. Type in the design name or browse to the directory that contains the <design_name>.adb (or .afm) file and select it. Click OK.

Activate

The Activate button or menu command is used to program a device. Refer to “Programming a Device” on page 35 for detailed information about using the Activate command to program an Actel device.

Blankcheck

The Blankcheck button or menu command executes a test to determine if a device has already been programmed. Blankcheck displays a report for each Activator socket that has an adapter module plugged into it (the Activator 2S only has one socket). Blankcheck is performed automatically before the chip is programmed whenever the Activate command is used.

The result of executing Blankcheck is either “blank” or “not blank” followed by the Silicon Signature, Checksum, and Security Fuse status read from the device. Only blank devices of the correct type (according to the design parameters) result in a blank status. A Security Fuse status of 0 indicates that the security fuse has not been programmed; a 1 indicates that the security fuse has been programmed.

To run Blankcheck:

Click the Blankcheck button, or choose the Blankcheck command from the Tools menu.

Checksum

The Checksum button or menu command verifies that the current programming file is the same one that was used to program the device. The Checksum command compares the checksum number, computed from the programming file, to the checksum number programmed into the chip. If the two numbers are the same, APSW displays “PASSED.” If the two numbers are not the same, the program displays “FAILED,” with additional comments to briefly explain why it failed.

Note: If you have already programmed the Probe fuse on an ACT 1 device, you cannot read the Checksum from the device.

To run Checksum:

Click the Checksum button, or choose the Checksum command from the Tools menu. The checksum number is displayed in the APSW window, along with a “Passed” or “Failed” message. If Checksum fails, a message is displayed that describes why it failed.

Action Probe

The Action Probe button or menu command initializes the Action Probe software and opens the Explore window for debugging a programmed device using the Actel Silicon Explorer diagnostic tool. The Silicon Explorer allow you to probe the internal signals of the device while it operates in your system. Refer to Chapter 7, "Silicon Explorer Diagnostic Tool" on page 57 for information.

To run Action Probe:

Click the Action Probe button, or choose the Action Probe command from the Tools menu.

Note: If you have already programmed the Probe fuse on an ACT 1 or 40MX device or the Security fuse on any other Actel device, you cannot use the Action Probe software to debug the device.

Debugger

The Debugger button or menu command initializes the Debugger test environment. The Debugger environment allows you to test a programmed device before you place it in your system circuit. With Debugger, you can probe the chips internal nodes by applying stimulus through an Activator. Debugger commands are entered through the Command box located at the top of the APSW window. If the Action Probe software has already been initialized, Debugger is also initialized and available for use. When you use Debugger with an Activator 2s, APSW recognizes the Adapter Module as port 4. Refer to Chapter 7, "Debugging a Device with an Activator" on page 45 for information about using Debugger.

To run Debugger:

Click the Debugger button, or choose the Debugger command from the Tools menu.

Note: If you have already programmed the Probe fuse on an ACT 1 or 40MX device or the Security fuse on any other Actel device, you cannot use the Action Probe software to debug the device.

Command Box

The Command box is used to enter Debugger command-line commands. Refer to "Debugger Command-Line Commands" on page 47 for information.

Programming a Device with APSW

This section contains information about programming files and describes the procedure for programming an Actel device with APSW.

Supported Device Files

To program devices with APSW, you must have an Actel programming file. APSW can read the following programming file types:

- Actel database file (ADB) for a design that has a completed layout
- Actel programming file (AFM) exported from Designer using the Fuse command
- FUS and DEF files produced from pre-Designer 3.0 software

Note: If Layout has been completed in Designer, you do not need to execute the Fuse command. APSW automatically extracts programming information from the ADB file.

User-Defined Silicon Signature

To specify a user-defined Silicon Signature to be programmed into a device, enter the signature from within Designer using one of the following methods:

1. **Create an AFM file containing a Silicon Signature.** Select the Fuse command, enter the Silicon Signature, then export the .afm file. Refer to the *Design with Actel* manual for information about how to use the Fuse command to generate an AFM file.
2. **Set the SIG variable.** Choose Set from the Options menu, and enter the desired value.

   Note: The Silicon Signature must be a hexadecimal number, no more than 5 digits long.

Removing a Device from the Carrying Case

Use the following ESD procedure to remove an Actel device from the insulative individual carrying case before placing it in an Adapter Module.

IMPORTANT:

You should always wear a grounded wrist strap at an ESD workstation when handling Actel devices. A calibrated ionizer should be on and functioning properly at the workstation. An ionizer air stream should be directed over the devices at all times.

1. **Slowly remove the individual carrying case from the carrier box.** The individual carrying case may build a charge while being removed from the foam in the carrier box.
2. **Ionize the individual carrying case.** Hold the individual carrying case approximately three feet from the ionizer. Expose each side of the case to the air stream for 30 to 60 seconds.
3. **Remove the device from the individual carrying case.** Open the case, remove the device and place the device on top of ESD sensitive foam.

The device can now be placed in the Adapter Module or repackaged in a static dissipative container.

Programming Checklist

Before executing any commands in APSW, verify the following:

1. The Activator is powered on and the green LED is lit.
2. The appropriate Adapter Module(s) is plugged into the socket(s) on the Activator.
3. A device is inserted in the Adapter Module, with pin 1 oriented as indicated in the diagram printed on the Adapter Module.

   Note: Insert a device into the Adapter Module socket after the Module is plugged in and the Activator is powered up.

Programming a Device

Programming typically requires from 5 to 15 minutes for commercial and RadTolerant devices and 30 to 60 minutes for RadHard devices, depending on design complexity, the Actel device you have chosen, and your system environment. During programming, the Activator dynamically verifies that each antifuse is programmed correctly. In addition, test vectors are applied to verify that only the selected antifuses are programmed. Due to the unique, high-density architecture of Actel devices, you can verify the programmed state of all antifuses only during programming, not after. The following procedure describes how to program a device.

1. **Invoke APSW.**

   Workstation

   Type the following command at the prompt:

   ```
   apsw
   ```

   PC

   Double click the "Windows Programming" icon located in the Designer Series program group.

   The APSW window is displayed (see Figure 4-1).

2. **Open your design.** Click the Open button or choose the Open command from the File menu. The Open dialog box is displayed. Type in the design name or browse to the directory that contains the <design_name>.adb (or .afm) file and select it. Click OK.

3. **Choose fuse programming options.** Click the Activate button or choose the Activate command from the Tools menu. The Activate Options dialog box is displayed.

4. **Program your device.** You can program Array fuses only, the Security fuse(s) only, or both Array fuses and the Security fuse(s). For ACT 1 and 40MX devices, the dialog box shown in Figure 4-2 is displayed. For all other devices, the dialog box shown in Figure 4-3 is displayed. Choose the desired fuse programming options and click OK. Refer to "Programming Security Fuses" on page 36 for a discussion about programming security fuses.

IMPORTANT: The Program or Security fuse must be the last fuse programmed.

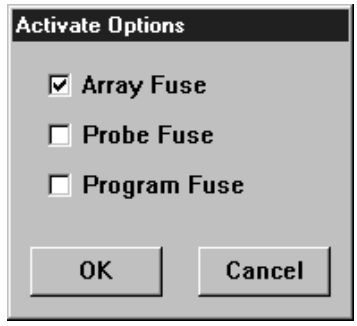

Figure 4-2. Activate Options for ACT 1 and 40MX Devices

Figure 4-3. Activate Options for all Other Devices

An Output Window is displayed on the screen and the programming sequence begins. The status bar in the Output Window displays the percentage complete of the programming sequence. When the device is 100% programmed, the finished programming status "Passed" or "Failed" is displayed in the window.

5. **Save the AVI file.** Exit APSW and move or rename the AVI file for the design. The AVI file is written to the same directory as your programming file. Refer to Appendix C, "AVI File Description" on page 79 for information about AVI files.

Programming Security Fuses

You can program the Security fuse(s) on an Actel device that has had its Array fuses previously programmed. The ability to program the Security fuse(s) after programming Array fuses is designed to allow you to debug your device design with the Debugger or Silicon Explorer diagnostic tool. After you debug your design, you can program the Security fuses to secure the device from further probing.

ACT 1 and 40MX Security Fuse Configurations

The ACT 1 devices contain two security fuses: Probe and Program. Programming the Probe fuse disables the Probe Circuitry, which disables the use of the Debugger and Silicon Explorer diagnostic tools. Programming the Program fuse prevents further programming of the device, including programming the Probe fuse. Table 4-1 summarizes the effects of programming the Security fuses on the PRA, PRB, SDI, and DCLK pins.

Table 4-1. ACT 1 and 40MX Security Fuse Configurations

Mode[1]	Program	Probe	PRA, PRB	SDI, DCLK
low	no	no	user-defined I/O	user-defined input[2]
low	no	yes[3]	user-defined I/O	user-defined input[2]
low	yes[4]	no	user-defined I/O	user-defined I/O
low	yes[4]	yes[3]	user-defined I/O	user-defined I/O
high	no	no	Probe Circuit outputs[5]	Probe Circuit inputs[6]
high	no	yes[3]	Probe Circuit disabled	Probe Circuit disabled
high	yes[4]	no	Probe Circuit outputs[5]	Probe Circuit inputs[6]
high	yes[4]	yes[3]	Probe Circuit disabled	Probe Circuit disabled

In the normal operating mode (MODE=0), all undefined device pins in a design are automatically configured as active LOW outputs.

Two exceptions are the SDI and DCLK pins. If the Program fuse is not programmed and SDI and DCLK are undefined, they are configured as inactive inputs. In this case, SDI and DCLK pins should be tied to

ground. If the Program fuse is programmed and SDI and DCLK are undefined, they will become active LOW outputs.

Legend for Table 4-1

1. The MODE pin switches the device between the normal operating mode (MODE=0) and the Probe Circuit mode (MODE=1).
2. The Program fuse must be programmed if the SDI or DCLK pins are to be used as an output or a bi-directional pin.
3. If the Probe fuse is programmed, the Probe Circuit is permanently disabled, which disables the Debugger and Silicon Explorer diagnostic tools.
4. If the Program fuse is programmed, all programming of the device is disabled, including programming the array fuses and the Probe fuse.
5. The PRA output and a separate I/O buffer share the use of a single device pin. The PRA output and the output function of the I/O buffer are multiplexed. The same is true for PRB. The Probe Mode that is loaded into the Mode Register will determine which output buffer is active during probing. There are three possible Probe Modes: "PRA only," "PRB only," and "PRA and PRB."

   When the "PRA only" mode is selected, the PRA output becomes active and the output function of the I/O buffer associated with the PRA pin is inhibited. However, the input buffer portion of the I/O buffer associated with the PRA pin is still active. Any internal signal that appears on the PRA output is fed back through that input buffer to the internal Logic Modules. This could interfere with the expected function of the design during probing. Actel recommends that you use an input latch on PRA and PRB to prevent the feedback while probing. PRB will function as a normal I/O in the "PRA only" mode.

   The "PRB only" mode is functionally equivalent to the "PRA only" mode. PRA also functions as a normal user I/O in the "PRB only" mode.

   When the "PRA and PRB" mode is selected, both the PRA and PRB outputs become active and the output function of the I/O buffers associated with both pins are inhibited. However, the input buffer

of the I/O buffers associated with both pins are still active. Any internal signals that appear on the PRA and PRB outputs are fed back through the input buffers to the internal Logic Modules. This could interfere with the expected function of the design while probing. Actel recommends that you use an input latch on PRA and PRB to prevent the feedback during probing.

6. The SDI input and a separate I/O buffer share the use of a single device pin. The SDI input and the input function of the I/O buffer are connected in parallel. When the Mode pin is high, both inputs are active. The same is true for DCLK. External Probe Circuit control signals sent to those pins are also sent to the internal Logic Modules. This could interfere with the expected function of the design while probing. Actel recommends that you use an input latch on SDI and DCLK to prevent the external Probe Circuit control signals from effecting the functionality of your design during probing.

   If either SDI or DCLK are configured so that the output function of the I/O buffer is active, the Program fuse must be programmed. In this configuration, the signals from your design are fed back to the Shift Register and will interfere with the function of the Probe Circuitry. In addition, the I/O drivers will conflict the external SDI and DCLK drivers. Damage to both drivers could occur.

Non-ACT 1/ 40MX Security Fuse Configurations

All Actel devices other than ACT 1and 40MX devices contain one Security fuse. Programming the Security fuse disables the Probe Circuitry, which disables the use of the Debugger and Silicon Explorer diagnostic tools. Table 4-2 summarizes the effect or programming the security fuse on the PRA, PRB, SDI, and DCLK pins.

Table 4-2. Non ACT 1/40MX Security Fuse Configurations

Mode[1]	Security	PRA, PRB	SDI, DCLK
low	don't care	user-defined I/O	user-defined I/O
high	no	Probe Circuit outputs[3]	Probe Circuit inputs[4]
high	yes[2]	Probe Circuit disabled	Probe Circuit disabled

In the normal operating mode (MODE=0), all undefined device pins in a design are automatically configured as active LOW outputs. You do not need to program the Security fuse to enable SDI and DCLK as active LOW outputs.

Legend for Table 4-2

1. The MODE pin switches the device between the normal operating mode (MODE=0) and the Probe Circuit mode (MODE=1).
2. If the Security fuse is programmed, the Probe Circuit is permanently disabled which disables the Debugger and Silcon Explorer diagnostic tools.
3. The PRA output and a separate I/O buffer share the use of a single device pin. The PRA output and the output function of the I/O buffer are multiplexed. The same is true for PRB. The Probe Mode that is loaded into the Mode Register will determine which output buffer is active during probing. There are three possible Probe Modes: "PRA only," "PRB only," and "PRA and PRB."

   When the "PRA only" mode is selected, the PRA output becomes active and the output function of the I/O buffer associated with the PRA pin is inhibited. However, the input buffer portion of the I/O buffer associated with the PRA pin is still active. Any internal signal that appears on the PRA output is fed back through that input buffer to the internal Logic Modules. This could interfere with the expected function of the design during probing. Actel recommends that you use an input latch on PRA and PRB to prevent the feedback while probing. PRB will function as a normal I/O in the "PRA only" mode.

   The "PRB only" mode is functionally equivalent to the "PRA only" mode. PRA also functions as a normal user I/O in the "PRB only" mode.

   When the "PRA and PRB" mode is selected, both the PRA and PRB outputs become active and the output function of the I/O buffers associated with both pins are inhibited. However, the input buffer of the I/O buffers associated with both pins are still active. Any internal signals that appear on the PRA and PRB outputs are fed back through the input buffers to the internal Logic Modules. This could interfere with the expected function of the design while

probing. Actel recommends that you use an input latch on PRA and PRB to prevent the feedback during probing. An input latch is an integral part of the I/O buffers in the RH1280 and A1280A devices.

4. The SDI input and a separate I/O buffer share the use of a single device pin. The SDI input and the input function of the I/O buffer are connected in parallel. When the Mode pin is high, both inputs are active. The same is true for DCLK. External Probe Circuit control signals sent to those pins are also sent to the internal Logic Modules. This could interfere with the expected function of the design while probing. Actel recommends that you use an input latch on SDI and DCLK to prevent the external Probe Circuit control signals from effecting the functionality of your design during probing. An input latch is an integral part of the I/O buffers in the RH1280 and A1280A devices.

   The output function of the I/O buffers associated with SDI and DCLK do not interfere with the function of the Probe Circuitry while in the Probe Mode. When the Mode pin is driven high, these outputs are inhibited. The I/O drivers do not interfere with the external drivers. However, these outputs are not observable in the Probe Mode.

5
Device Programming Failure Guidelines

This chapter contains programming failure guidelines, Activator failure guidelines, information about testing an Activator, and information about returning failed devices. Refer to Appendix A, "Troubleshooting" on page 71 for an explanation of programming failure error messages that may be displayed during programming of an Actel device.

Programming Failure Guidelines

Programming failures are a normal and expected result of antifuse-based FPGA design. Actel performs extensive testing to measure the characteristics of the antifuses, and programs a sample of devices from every lot to ensure high programming results. However, Actel cannot guarantee that all devices will program successfully, and you should expect some programming failures.

The guaranteed quality and reliability of the devices that program successfully are unrelated to the programming yield. All devices that pass the programming function are fully guaranteed to meet all electrical, timing, and radiation specifications.

Device Failure Rates

Commercial devices typically exhibit a 1-2% programming failure rate. If programming failures exceed the guidelines listed in the following table, contact your local sales representative or the Actel Customer Application Center at 1-800-262-1060.

Sample Size	Maximum Failures
13	3
31	5
63	8
100	10

Activator Programming Failures

The Activators are designed to program all Actel devices. If you are experiencing a programming failure rate of greater than 2% for your devices, follow the steps below before returning the devices to Actel:

1. Check the SCSI interface and power cables to see if intermittent connections are occurring.
2. If you have access to another computer, try installing the Activator and programming software onto that computer, and programming devices to see if the yield improves.
3. If the yield problem still exists, the problem could be with the Activator. Call Actel's Customer Applications Center at 1-800-262-1060 for further assistance.

Returning Failed Devices

If a device fails to program, you can take the following actions:

1. For normal device failure rates, return parts for replacement by requesting an RMA number through Actel's sales representatives, distributors, or customer service.
2. For device failure rates greater than those specified earlier, call the Actel Customer Applications Center at 1-800-262-1060 with information concerning any problems observed. If needed, a failure analysis can be performed.

6
Debugging a Device with an Activator

This chapter describes how to use the Debugger tool in APSW and an Activator to functionally debug your programmed Actel device. This includes descriptions of available debugging commands and command file usage and examples.

Functional Debugging with an Activator

Functional debugging of a device with the Debugger tool in APSW is done with a device placed in an Adapter Module and plugged into an Activator. Functional debugging is used to test a programmed device by applying a stimulus to the input pins and observing the functional behavior at all internal nodes or nets and output pins.

Functional debugging is not the same as simulating. A programmed chip is required. The output results are determined from the silicon device, not from a model stored in memory. Functional debugging can be performed two ways. You can apply stimulus to the input pins by executing command-line commands or by creating command files and reading the files into APSW.

If you execute command-line commands, each command is executed before the next command can be entered. After each command is executed, output results are printed on the screen, or to a file if specified. Refer to “Debugger Command-Line Commands” on page 47 for a description of the command-line commands.

If you have a large number of commands to execute, you can create a command file. A command file contains a set of commands that are executed on your device. A command file can also contain input test vectors. If you provide expected outputs with a test vector file, Debugger compares the chip output results with the expected outputs automatically. The Debugger saves any differences it finds for further analysis. Debugger then prints the output results on the screen, or to a file if specified in the command file. Refer to “Using Command Files to Debug a Device” on page 51 for information about using command files.

Running Debugger From APSW

Use the following procedure to initialize Debugger and debug your device.

1. **Invoke APSW.**

   Workstation

   Type the following command at the prompt:

   ```
   apsw
   ```

   PC

   Double click the "Windows Programming" icon in the Designer Series program group.

   The APSW window is displayed (see Figure 4-1 on page 30).

2. **Open the design to be debugged.** Click the Open button or choose the Open command from the File menu. The Open dialog box is displayed. Type in the design name or browse to the directory that contains the "<design_name>.adb" (or .afm) file and select it. Click OK.

3. **Verify that you have a programmed device placed in an Adapter Module plugged into the Activator.** Click the Blankcheck button or choose the Blankcheck command from the Tools menu. If a "not blank" message is displayed, the device has been programmed.

4. **Debug your device.** Click the Debugger button to initialize the tool. The message "Debugger initialization complete" is displayed when the Debugger is finished loading. Execute single command-line commands or load a command file using the loadfile command in the Command box. Refer to page 47 for information about command-line commands. Refer to "Using Command Files to Debug a Device" on page 51 for information about creating command files.

Debugger Command-Line Commands

Command-line commands can be executed in APSW by typing the command in the Command box at the top of the APSW window and pressing Enter. Table 6-1 lists the command, syntax, and function of the command.

Table 6-1. Command-Line Commands and Functions

Command	Function
Assign	**`assign <n> <vector_1> ... <vector_n>`** Assigns the value <n> to each electrical node, or vector of nodes, the next time you execute the Step command. Each node must be a chip I/O or no assignment occurs. The format of <n> is as follows: 0=decimal; 0b=binary; 0h=hexadecimal; 0o=octal; "01x2"=string. You can also assign a string-type constant to a vector. Valid characters are 1, 0, Z, z, X, and x. The character must be enclosed in double quotation marks. For example: assign "1Zx0" IN.
Comp	**`comp <n> <vector_1> ... <vector_n>`** Compares <n> to each node or vector, and prints a message for each node in the list whose value is not equal to <n>.
CompFile	**`compfile "<PATH\filename>"`** Opens the specified file to be used with the Fcomp command. The argument must be enclosed in double quotes.
Debg Socket	**`dbg-socket <n>`** Chooses the socket on the Activator 2 to use during debug. The value of <n> can be 1, 2, 3, or 4. If only 1 Adapter Module is plugged in, you do not need to use this command.

Table 6-1. Command-Line Commands and Functions (Continued)

Command	Function
Define *Macro*	**`define <name> <command> ... <command>`** Defines a macro. When invoked, commands specified in the macro are executed.
Emit	**`emit "<example_text_string>"`** Prints its argument to the screen and log file. The argument must be enclosed in double quotes.
Fassign	**`fassign <vector_1> ... <vector_n>`** Reads the value <n> from the input file defined by the Infile command. Assigns the value <n> to each electrical vector the next time you use the Step command. Each vector must be a chip I/O or no assignment occurs.
Fcomp	**`fcomp <vector_1> ... <vector_n>`** Compares <n> to each node or vector, and prints a message for each node in the list whose value is not equal to <n>. The value checked is read from the next line in the file opened with the Compfile command.
Fprint	**`fprint <vector_1> ... <vector_n>`** Prints the current values of all nodes in the Tablist to the file opened with the Outfile command.
ICP	**`icp <internal_node_1> <internal_node_2>`** Used for In-Circuit-Probing with an ActionProbe. It brings <internal_node_1> out to the probe A pin. The second argument is optional. If given, <internal_node_2> is brought out to the probe B pin.

Table 6-1. Command-Line Commands and Functions (Continued)

Command	Function
Infile	`infile "<PATH/infile_name>"` Opens an input file used with the Fassign command. The argument must be enclosed in double quotes.
LoadFile	`loadfile "<PATH/filename>"` Loads the specified command file and executes all the commands in the file. The PATH consists of the full path for the command file. All commands in the command file must be enclosed in parentheses.
OutFile	`outfile "<PATH/filename>"` Opens the specified file to be used with the Fprint command. The argument must be enclosed in double quotes.
Print	`print <vector_1> ... <vector_n>` Prints the values of the specified vector(s). If no vector is specified, the current values of all nodes in the Tablist are printed.
Repeat	`repeat <n> <function>` Repeats a sequence for <n> cycles. The <function> can be a debugger command or a user-defined macro.
Step	`step <n>` Debugs for <n> cycles. If <n> is not specified, a default of one cycle is used.

Table 6-1. Command-Line Commands and Functions (Continued)

Command	Function
Stimulus High	`h <vector_1> ... <vector_n>` Assigns the value logical 1 to each electrical node or vector of nodes the next time you use the Step command. Each node must be a chip I/O or no assignment occurs.
Stimulus High-Z	`z <vector_1> ... <vector_n>` Sets all listed nodes to Z (high impedance) the next time you use the Step command. Each node must be a chip I/O or no assignment occurs.
Stimulus Low	`l <vector_1> ... <vector_n>` Assigns the value logical 0 to each electrical node or vector of nodes the next time you use the Step command. Each node must be a chip I/O or no assignment occurs.
TabAdd	`tabadd <vector_1> ... <vector_n>` Adds the named nodes or vectors to the list of nodes printed with the Print command. Names can be dropped by recreating the list using the Tablist command.
TabList	`tablist <vector_1> ... <vector_n>` Initializes the Tablist to the specified nodes and vectors. If no arguments are given, prints the current contents of the Tablist.
Vector	`vector <name> <node list>` Defines a vector <name> whose elements are the listed nodes.

Using Command Files to Debug a Device

A command file contains a series of Debugger command-line commands that when loaded into Debugger are automatically executed. Use command files to run a large number of command-line commands on your device during debug.

To create a command file use a text editor or a word processor and save the file as ASCII text. Each command in the command file must be enclosed in parentheses. Use the loadfile command to load a command file into Debugger.

Two examples are shown to illustrate how to create and use command files to debug a device. Refer to "Debugger Command-Line Commands" on page 47 for information about the available command-line commands.

Command File Example 1

The following example shows a command file followed by an explanation of the file, an input file, an output file, and a comparison file:

```
(vector P P0 P1 P2 P3 P4 P5 P6 P7)
(vector Q Q0 Q1 Q2 Q3 Q4 Q5 Q6 Q7)
(tabadd PE CEP CET UD P CLK Q TC)
(infile "/designs/example/example.pat")
(outfile "/designs/example/example.out")
(compfile "/designs/example/example.cmp")
(define (clk10)(repeat 10(1 CLK)(step)(h CLK)(step)(fprint)
  (fcomp Q))
(define (up) (1 CET CEP) (h PE UD)(step)(clk10))
(define (down) (h PE) (1 CEP CET UD)(step)(clk10))
(define (load) (1PE CLK) (fassign P)(step)(h CLK)(step))
(load)
(up)
(load)
(down)
```

The first "vector" command defines eight parallel load input bits as vector P. The second vector command defines counter outputs as vector Q.

The “tabadd” command causes the signals PE, CEP, CET, UD, P, CLK, Q, and TC to be displayed or printed when the “print” or “fprint” command is executed.

The “infile” command defines and opens a file containing input test vectors (see “Example Input File” on page 52). The “outfile” command defines and opens a file for receiving Debugger output results (see “Example Output File” on page 53). The “compfile” command defines and opens a file containing the expected output values to be compared to the actual output values (see “Example Comparison File” on page 53).

The “define” commands create the following user macros:

clk10. The clk10 macro provides 10 clock pulses to the CLK input, prints all of the nodes specified in the tabadd command to the outfile, and compares the status of the vector Q to the expected results.

up. The up macro specifies the counter to count up for 10 cycles.

down. The down macro specifies the counter to count down for 10 cycles.

load. The load macro reads a load vector P from the infile and loads the counter.

The “load,” “up,” “load,” and “down” commands execute the macros, as follows: “load” loads [00000000] into the counter, “up” cycles the counter up 10, “load” loads [11111111] into the counter, and “down” cycles the counter down 10.

Example Input File

The following input file (infile) was used in this example.

```
0b00000000
0b10000000
0b01000000
0b11000000
```

Example Comparison File

The following comparison file (compfile) was used in this example.

```
00010001
10010001
01010001
01111111
10111111
00111111
11011111
01011111
10011111
00011111
11101111
01101111
10101111
```

Example Output File

The following output file (outfile) was created as a result of the command file used in this example.

```
1001000000001100000010
1001000000001010000010
1001000000001110000010
1001000000001001000010
1001000000001101000010
1001000000001011000010
1001000000001111000010
1001000000001000100010
1001000000001100100010
1001000000001010100010
1000111111111011111110
1000111111111101111110
1000111111111001111110
1000111111111110111110
1000111111111010111110
1000111111111100111110
1000111111111000111110
1000111111111111011110
1000111111111011011111
1000111111111101011111
```

Command File Example 2

The following example is a command file for an 8-bit counter circuit:

```
(define (clock) (emit "Clocking\n") (h clock) (step) (l clock)
(step))
(define (clear) (l clr) (step) (h clr) (step)
  (emit "The Counter is Cleared\n"))
(vector outputs out7 out6 out5 out4 out3 out2 out1 out0)
(vector inputs in7 in6 in5 in4 in3 in2 in1 in0)
(emit "Enabling Counter B\n")
(h cen1)
(step)
(clear)
; Set input signals
(h in1 in3 in5 in7)
(l in0 in2 in4 in6)
(step)
(print inputs outputs)
(repeat 5 (clock) (print outputs))
```

The "define" commands create the "clock" and "clear" macros.

The "vector" command is used to define the "inputs" and "outputs" vectors.

The "emit" command writes text out to the screen.

The "h" and "l" commands are used to set particular signals to logic 1 (h) or logic 0 (l).

The "print" command prints the current state of "inputs" and "outputs" vectors.

The "repeat" command prints the output vector to the screen after every clock cycle.

Example Output File

The following output file (outfile) was created as a result of the command file used in this example.

```
Enabling Counter
The Counter is Cleared
inputs    = 10101010
outputs   = 00000000
Clocking
outputs   = 00000001
Clocking
outputs   = 00000010
Clocking
outputs   = 00000011
Clocking
outputs   = 00000010
Clocking
outputs   = 00000011
```

7

Silicon Explorer Diagnostic Tool

This chapter contains information and procedures to setup and access the Silicon Explorer diagnostic tool for in-circuit testing of programmed Actel devices. This includes setup information and a description of the Explore window and the optional Analyze window used to access the Silicon Explorer diagnostic tool. The Silicon Explorer is only available for the PC platform. Contact your local sales representative for information about purchasing Silicon Explorer.

In-Circuit Testing with Silicon Explorer

The Silicon Explorer diagnostic tool, purchased separately from the APSW software, is used to probe internal nodes of an Actel device and consists of the Probe Pilot adapter, the Explore window accessed through the APSW software, and the optional Analyze window. It is useful for debugging your device while it is operating in a system. The Silicon Explorer is different from the Actel Debugger tool in that the device being tested receives all input stimulus from the user's system.

The Silicon Explorer interfaces with a programmed device through a standard COM port on a PC. Using the Explore window, the Silicon Explorer can be used to dynamically monitor signal behavior on a device using two dedicated pins on the device. The Analyze window is an 18-channel logic analyzer that displays timing analysis of both the probe outputs and up to 16 additional signals on the user's system. Each tool may be used separately.

Actel also offers the Silicon Explorer Lite, which does not include the Analyze window and relies on an external scope or logic analyzer for viewing signals.

Probe Pilot

The Probe Pilot connects to a standard serial port on a PC using either an 8250 or 16550 UART and establishes communication using the 9-Pin D-Sub connector. The Probe Pilot is shown in Figure 7-1.

Figure 7-1. Silicon Explorer

Note: Devices being tested with the Silicon Explorer receive all input stimulus from the user's system.

Connecting The Probe Pilot to the Target

The Probe Pilot is shipped with a replaceable target cable assembly (TCA-8020A) that interfaces the Probe Pilot to your target system. Align the short red wire on the TCA-8020 with the red dot on the case and make certain that the 2mm header is fully inserted. The contacts on the TCA-8020 accept standard 0.025" round or square test accessories.

Powering the Probe Pilot

The Probe Pilot is powered by the target running at 3.0VDC to 5.5VDC. When power is applied, the yellow "heart beat" LED on the Probe Pilot begins to blink.

The Silicon Explorer is designed to withstand the conditions normally found in a lab environment. However, long term exposure to out-of-

range conditions can cause failure. In particular, long term connection to reverse- or over-voltage power conditions can cause thermal failure.

Current Consumption

The Probe Pilot is a CMOS device and exhibits very low current consumption at idle and rises rapidly to several hundred milliamps during acquisition. If your power supply is unable to supply the necessary current, the Probe Pilot or your target may reset. Table 7-1 is a guide to typical current consumption based on an acquisition rate at 5V. Current will be proportionately higher at 3V.

Table 7-1. Typical Current Consumption

Acquisition Rate	Current@5V	Probe
IDLE	125ma	Probe Pilot Lite
10MHz	350ma	Probe Pilot
20MHz	450ma	Probe Pilot
50MHz	550ma	Probe Pilot
100MHz	750ma	Probe Pilot

Using an External Power Supply

If your target system cannot power the Probe Pilot, use the following procedure to connect an external supply:

1. **Connect the Probe Pilot ground and the power supply ground to the target.**
2. **Connect the 5V lead of the supply to the 5V lead of the Probe Pilot.**

A low cost regulated 5V 1 amp power supply is available from:

Digi-Key (800) 344-4539
Digi-Key# T310
Cui #DTR050100-P-1

Connecting the Probe Pilot to the FPGA

The Probe Pilot has a 22-pin (18 channels, a clock, VCC, GND, and clock GND) and a 16-pin connector for FPGA debug, using the Actel Action Probe circuitry. The Probe Pilot Lite only has the 16-pin connector.

Connecting Signals to the Target for Logic Analysis

The information in this section applies to using the Analyze window and is not available if you purchased Silicon Explorer Lite. Connect any of the Probe Pilot's 18 channel leads to the desired target signals using standard test accessories. To sample synchronously, connect the CLKIN lead to the target's clock which must be a continuous signal. If the clock is greater than 20MHz, connect the CLK-GND (twisted pair) to a ground point near the CLK lead.

Connecting the Probe Leads

You can connect the probe leads by attaching one of two supplied cable assemblies.

One cable assembly terminates in individual 0.025 receptacles that can connect to 0.025 headers or micro-clips according to the labels on the wires. The other assembly interfaces directly to the target board when a 16-pin header is installed on the target according to the pin-out shown in Figure 7-2.

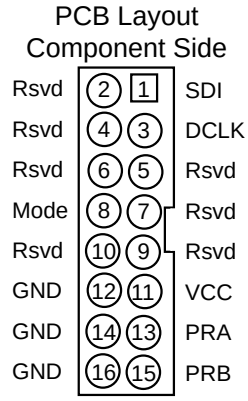

Figure 7-2. Pinouts

The Probe A and B pins on the probe connector may be selected as the source for logic analyzer channels 1 and 2 respectively, by clicking on the # field in the Analyze window and selecting PRA or PRB as the source. Selecting the probe pins as the source disables the CH1 and/or CH2 inputs from the target cable assembly.

Explore Window

The Explore window is accessed through the APSW programming software. Figure 7-3 shows the Explore window that is displayed when the Action Probe software is invoked.

Figure 7-3. Explore Window

The left side of the Explore window displays the module layout for the design being debugged. As you move the cursor around this side of the window, the instance name for each module is displayed in the bottom left corner of the Explore window.

The right side of the Explore window is the Internal Nets list box that displays the net names for all internal nets found in the design being debugged. This window can be configured to display the net names in a flattened or hierarchical format. By default, the nets are displayed hierarchically.

Using Silicon Explorer with the Explore Window

Silicon Explorer diagnostics can be executed through the Explore window in APSW. You must connect the Silicon Explorer to your PC and an Actel device on the user's circuit board and invoke the Action Probe software to access the Silicon Explorer diagnostic tool. This section contains procedures to use the Silicon Explorer diagnostic tool.

To access the Silicon Explorer diagnostic tool:

1. **Connect the Silicon Explorer.** Connect one end of the Silicon Explorer to a COM port on your PC and the other end to the Actel device on the circuit board.
2. **Invoke APSW.** Double click the "Windows Programming" icon located in the Designer Series program group. The APSW window is displayed (see Figure 4-1 on page 30). You may see the following message displayed in the APSW main window:

```
Loading Activator 2 firmware...
SCSI controller not found
Warning: Could not connect with Activator 2
```

   Ignore this warning. The Probe Pilot is connected to the COM port and it does not need a SCSI controller or an Activator 2.
3. **Open the design to debug.** Click the Open button or choose the Open command from the File menu. The Open dialog box is displayed. Type in the design name or browse to the directory that contains the <design_name>.adb (or .afm) file and select it. Click OK.
4. **Invoke the Action Probe software.** Click the Action Probe button or choose the Action Probe command from the Tools menu. The Explore window is displayed (Figure 7-3). A message is displayed in the APSW main window stating "Debugger Initialization Complete."
5. **Select the COM Port.** Select the COM Port you connected the Silicon Explorer to by choosing the appropriate COM port from the Explorer Port Menu located under the Probe menu. Assigning the COM port enables the Probe A and Probe B buttons.

6. **Choose the signal to observe.** Click the signal name of the net you want to probe in the Internal Nets list box.

7. **Choose the Probe to assign to the signal.** Click the Probe A button or choose the Probe A command from the Probe menu to select Probe A. Click the Probe B button or choose the Probe B command from the Probe menu to select Probe B.

The status bar at the bottom of the Explore window shows the current net that is assigned to Probe A and Probe B. The Probe A and Probe B LED indicators on the Probe Pilot become active when a successful probe has been established. When the LED is on, the Probe A or Probe B pins are at a logic high; when the LED is off, the pins are at a logic low.

Specify Nets or Pins to be Displayed

Use the following procedure to set the method of net or pin display in the Explore window.

1. **Open the List Boxes Configuration dialog box.** Choose the Configure List Box command from the Options menu. The List Boxes Configuration dialog box is displayed (Figure 7-4).

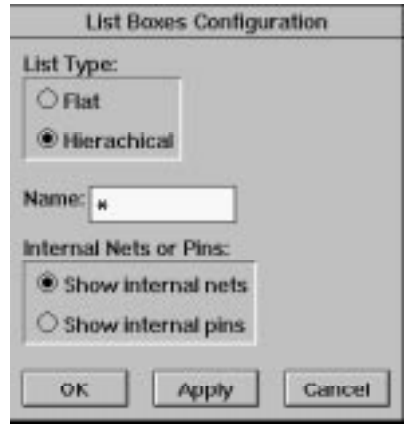

Figure 7-4. Explore List Box Configuration Dialog Box

2. **Choose the List Type.** Under List Type, choose Flat for a flattened net list or Hierarchical for a hierarchical listing of net names.

3. **In the Name box Enter the name of signal(s) you want to display.** The Name box can take the wildcard character "*" to list all net names containing a particular string. The default lists all net names in the design.
4. **Choose the type of signal to display.** Choose the Show internal nets or Show internal pins option in the Internal Nets or Pins box. The same signals are available for probing regardless of the configuration you choose. The choice of "nets" or "pins" is given for the user's convenience.
5. **Apply the changes.** After the choices are made, click the Apply button to apply the changes without closing the dialog box or the OK button to apply the changes and close the dialog box.

Analyze Window

The Analyze window is not available if you purchased Silicon Explorer Lite. On installation, the Analyze window is set to the Demo mode. You may select COM 1 through 4 by selecting the port from the acquisition menu. The Analyze software continuously polls the Probe Pilot for activity. Setting the port to the Demo mode prevents the application from opening any COM ports on your system.

The COM port information is saved in the analyze.ini file found in your Windows directory.

The Analyze software defaults to 115,200 baud — at this speed data transfer will be less than 20 seconds for the entire buffer. On some slow systems (486-33MHz or less) particularly those with 8250 UARTs,

better performance could occur at 57,600 baud due to the need to retry blocks at high speed.

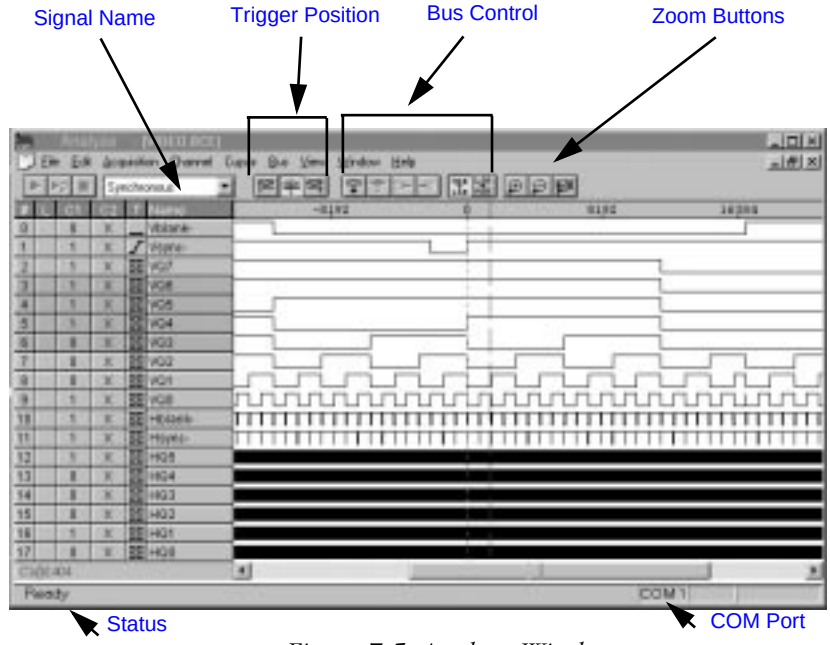

Figure 7-5. Analyze Window

Note: Many notebook computers share the external COM port with a built-in infrared (IR) port. You may have to enter your CMOS setup menu to enable the COM port.

Using Silicon Explorer with the Analyze Window

Invoke the Analyze icon from the Designer Series Program Group and check the status in the lower right corner of the display. If the COM port is properly selected and power has been applied, then the status will read IDLE. The analyzer captures 64K samples which are then uploaded to the host over the serial port. This should be the same COM port used for Probe Pilot and the Analyze window.

Acquisition parameters may be set from either the tool bar or the pull-down menus. The parameters are shown in Table 7-2.

Table 7-2. Acquisition Parameters

Acquisition Speed	10Khz to 100MHz asynchronous or synchronous to 66MHz
Trigger Position	4K Pre Trigger 60K Post Trigger 32K Pre Trigger 32K Post Trigger 60K Pre Trigger 4K Post Trigger
Trigger Pattern	Left click on individual signals in the T column to specify don't care, low, high, rising, falling or either edge. The trigger pattern is the logical AND of the 18 patterns.

Once the acquisition parameters are set, click the Run button (red triangle) in the upper left to begin acquisition. At this point the analyzer will begin capturing data and after the initial 64K samples are acquired, sampling will continue until either the trigger pattern is recognized or the stop button (black square) is pressed (see Figure 7-5).

During this period, the status window displays PRE for the pre-trigger state (although you may not see it if the trigger pattern is matched quickly).

Next, the POST state will be entered and data after the trigger pattern (or stop button) will be sampled until the post trigger requirement is fulfilled. Then the data are uploaded to the host (READ State with progress indicator). The entire upload process takes less than 20 seconds, although you may zoom in and view data immediately as the buffer is uploaded as a background task.

At this point the data may be viewed. Panning and zooming are available from either the scroll bars, tool bar, or keyboard control. In

addition, dragging a box in the display area displays a zoom window. Table 7-3 lists keyboard equivalents.

Table 7-3. Keyboard Equivalents

Key	Function
Up Arrow	Zoom In 2X
Down Arrow	Zoom Out 2X
Left Arrow	Scroll Earlier (Data moves Right)
Right Arrow	Scroll Later (Data moves Left)
Page Up	Jump One Screen Earlier
Page Down	Jump One Screen Later
Home	Jump to Trigger

Cursors are placed by left-clicking or right-clicking in the display area. The time is displayed below the channel labels while the value is displayed in the C1 and C2 columns. The L or “Live” Column indicates the current state of the 18 channels when the analyzer is in IDLE.

The Analyze application offers many convenient features for viewing, saving and printing data. More detailed information is available from the on-line help system.

Diagnostic Self Test

The Silicon Explorer includes a test header for the Probe Pilot to perform functional tests of the I/O drivers. If you suspect that your Probe Pilot has a failed I/O driver, then you can perform the following test.

To test a Probe Pilot:

1. **Connect the supplied ribbon cable from the Probe Pilot or Probe Pilot Lite to the test header and apply power to the terminals on the test header.** Red is positive and Black is negative.
2. **Disconnect the target cable assembly and snap the 2mm header into the end of the Probe Pilot, observing polarity.** This step is not applicable on to the Probe Pilot Lite.
3. **Invoke the Analyze window.** Double click the "Analyze" icon located in the Designer Series program group. The Analyze window is displayed (see Figure 7-5 on page 65).
4. **Test the Probe Pilot port.** Make sure the status is IDLE, then choose the Self Test command from the Help menu.

To test a Probe Pilot Lite:

1. **Connect the supplied ribbon cable from the Probe Pilot or Probe Pilot Lite to the test header and apply power to the terminals on the test header.** Red is positive and Black is negative.
2. **Invoke APSW.** Double click the "Windows Programming" icon located in the Designer Series program group. The APSW window is displayed.
3. **Open a design.** You must open a design to access the Action Probe software. Click the Open button or choose the Open command from the File menu. The Open dialog box is displayed. Type in the design name or browse to the directory that contains a <design_name>.adb (or .afm) file and select it. Click OK

4. **Invoke the Action Probe software.** Click the Action Probe button or choose the Action Probe command from the Tools menu. The Explore window is displayed (Figure 7-3). A message is displayed in the APSW main window stating “Debugger Initialization Complete.”

5. **Test the Probe Pilot port.** Make sure the status is IDLE, then choose the Self Test command from the Help menu.

A

Troubleshooting

This appendix describes some common problems you may encounter with the Activator, Adaptec 1505 SCSI card, or APSW or APS2 software and their solutions. If you are still unable to resolve your problems after reading this Appendix contact Actel's Customer Applications Center.

Driver Does Not Load under Windows

Problem: The software driver does not load during boot-up.

Solution: Check for the following:

- The 1505 card is installed properly.
- The IRQ and I/O address settings match between the 1505 card and the software driver.
- The software driver is the correct one.
- There are no hardware conflicts.

Refer to Chapter 2, "Hardware Installation on a PC" on page 7 for information.

Activator

This section describes problems you may encounter with an Activator and their solutions.

Green Power Light is Blinking

Problem: The green power light is blinking after the power is turned on.

Solution: A self test has failed. Contact Actel for a replacement Activator.

Activator Communication Link Down

Problem: The following error message appears:

```
ERROR: Activator communication link down. Exiting...
```

Solution: There is a problem with the connection between the Activator and the PC, or the Activator has lost power. Check the connections (the Activator power light should be illuminated), and try re-invoking APSW.

Firmware Load Failed

Problem: No contact with the programmer is found and the following error message appears:

```
Firmware load failed. WARNING: Could not connect with Activa-
tor.
```

Solution: Check that you have turned on the Activator, that the SCSI cable is correctly installed, and the SCSI cable connection to the workstation is secure. The locking arms on the SCSI board can be misaligned. Also, verify that the device driver(s) are installed correctly. Refer to Chapter 2, “Hardware Installation on a PC” on page 7 or Chapter 3, “Hardware Installation on a Workstation” on page 21 for information about configuring drivers.

Wrong Adapter Module

Problem: The incorrect Adapter Module is inserted in the Activator and the following error message appears:

```
FAILED—Wrong adapter module
```

Solution: Remove the Adapter Module and replace it with the correct one. The design may have also been configured with a different package or device type.

Old Revision

If the Adapter Module does not support the selected device, even if the correct package is selected, the following message is displayed:

```
Old revision adapter module
```

AFM File

This section describes problems that you may encounter when opening an AFM file and their solutions.

AFM File Generation

Problem: Generating the AFM file is taking a long time.

Solution: Depending on device type, device utilization, and machine speed, this process could take a few minutes. If 15 minutes have passed without completion, the hard disk may be out of memory. Exit APSW and check available disk space. If there is less than 1 megabyte, free up some disk space and try generating the .afm file again.

AFM Generation Failure

Problem: AFM file generation failed.

Solution: The software could not find a valid FUS file. The file may not be present or it may have been created with a release prior to ALS 1.22. You must regenerate the FUS file using Designer.

Fuse

This section describes problems that you may encounter during programming and their solutions.

Failed Fuse

Problem: The following error message appears:

```
FAILED—fuse XXX integrity test 6, 7, or 8
```

Solution: This message often indicates that the device is bad. If you observe a programming failure rate in excess of 5%, contact the Actel Customer Application Center at 1-800-262-1060.

Failed Programming Fuse

Problem: The following error message appears:

```
FAILED—programming fuse XXXX
```

Solution: This message often indicates that the device is bad. If you observe a programming failure rate in excess of 5%, contact the Actel Customer Application Center at 1-800-262-1060.

When an antifuse is programmed, multiple voltage pulses are applied to the V_{PP} pin. While the pulses are applied, I_{PP} current is checked. If the antifuse is open (unprogrammed), there will be no I_{PP} current. The Activator can tell if the antifuse has been programmed once it detects I_{PP} current. Pulses are applied until I_{PP} current is detected, or the maximum number of pulses is exceeded. If the antifuse does not program after the maximum number of pulses are applied, a "FAILED Programming Fuse" message is displayed on the screen and the failed antifuse number is shown.

BAD fuse failures are often caused by a poor connection of the V_{PP} pin to the socket pin. This is especially true if the part fails programming on the first antifuse. Remove the part and check for bent pins. If the pins are not bent and the other parts continue to fail with the "FAILED Programming Fuse" error, then the V_{PP} pin of the socket could be damaged. Contact Actel's Customer Applications Group.

SCSI Controller

Problem: SCSI Controller not found.

Solution: The SCSI controller board has not been installed in the PC, or there is an I/O address conflict. Also, verify that the device driver(s) are installed correctly. Refer to the Hardware Installation chapter specific to your computer for information about configuring drivers. If you are working on a workstation, verify that no other APSW processes are running. Only one APSW process may run at a time.

Fuse Failures

This section describes failure messages that appear when a fuse fails to program.

Check 6 Failure

Once the antifuse has been programmed, the Activator addresses the same antifuse again and checks for I_{PP} current at a lower V_{PP} voltage. This is to make sure that the anitfuse was correctly addressed the first time and that the I_{PP} current did not come from another source. If no current is detected with this new test, the chip fails programming and APSW/APS2 issues the "Integrity test 6" failure for the antifuse. Once again, the antifuse number that failed is displayed.

Check 7 and 8 Failures

This test is only performed on ACT 1 and 40MX devices. After the Activator completes the "CHECK 6" test, it then does two additional tests to make sure that an additional antifuse was not programmed mistakenly. The first test checks antifuses on the same column as the programmed antifuse, and the second test checks the same row. The tests are done by addressing these other antifuses, applying a voltage to V_{PP} and making sure no I_{PP} current is detected. If the tests fail (I_{PP} current is detected), a "FUSE INTEGRITY FAILURE" failure is displayed.

Error Messages

This section describes general programming error messages that might be displayed.

Integrity Test

Incorrectly programmed fuses, like the Check 7 and 8 failures above, are reported in the following format:

```
Integrity test <test type>. <test number>
```

This message indicates that the device is a programming reject. Actel will replace devices that fail programming.

Fuse Current Sense Test

This test is not performed on ACT 1 or 40MX devices. This test is done to ensure that a logic module output is not inadvertently programmed to GND or VCC. The error message's format is the following:

```
Fuse <fuse number>, current sense test <test number>
```

Not Blank

If the device has been programmed and programming is attempted, the following message is displayed:

```
Not blank
```

Silicon Explorer

This section describes error messages that might be displayed during debugging using the Silicon Explorer diagnostic tool, and the reason the message is displayed.

POLL Message

Problem: I've connected Probe Pilot and the Analyze window display reads "POLL."

Solution: Look on the top of the Probe Pilot for the flashing yellow LED. If it isn't flashing, make sure you have properly connected an adequate power supply.

Problem: It's flashing but still POLL.

Solution: There are a number of things that can prevent communication from being established. The following lists the most common:

1. Wrong COM port. Try all four COM ports even though you're sure that your mouse is on COM 1.
2. No power to the analyzer.
3. Desktop Systems External connector not connected to the COM port internally.
4. Laptop Systems external COM connector disabled. Use your PC's CMOS setup program to enable the COM port.

5. Com port IRQ reassigned for DOS program, control panel not updated.
6. Multiple mouse drivers in system.ini.
7. Third-party serial port “enhancers” not conforming to windows API.

IDLE

Problem: I’ve got the IDLE message but when I click on Run, the Analyze window flashes an error message and returns to IDLE.

Solution: If the target power is incapable of supplying the necessary current, then the Analyze window resets and returns to IDLE. Many current-limiting supplies will trip when set too close to the operating current.

Read-Back Error

Problem: The Analyze window acquires data and then indicates errors on read-back.

Solution: The Analyze window bursts data back in blocks at high speeds, with built-in retry for a bad block (both Checksum and byte count are used). Some third-party serial programs block all interrupts forcing the analyzer into a retry loop. Some laptops power down the UART and drop a few characters. Try disabling “Power Saving” in the CMOS setup menu.

Windows Runs Slow

Problem: When the Analyze window is open, my other Windows programs run slow.

Solution: If the Analyze window is open but it is not connected or powered up, then the system is constantly timing out looking for a response. Either close the Analyze window or change the COM port to DEMO.

B

AVI File Description

The AVI file is a log file generated while an Actel FPGA is programmed. The file contains information about the number of V_{PP} pulses applied to each fuse to program the fuse and the programming current sensed through each fuse. If a programming failure occurs, the AVI file contains information about the programming failure mode.

A new AVI file is generated each time the programming sequence begins. If you want to save an AVI file, you must re-name it before restarting the programming sequence. The following excerpt shows an example AVI file:

```
************************************************************
; FILEID AVI \example.avi
; PROGRAM Activator (tm) 2 Programming System 3.1.1
; VAR DDFDIE c:\ACTEL/data/a1200/1280/G1280.ddf
; VAR DDFPACKAGE c:\ACTEL/data/a1200/1280/qfp172.ddf
; VAR FUS \designs\mod25\mod25.fus
; VAR AFM \designs\mod25\mod25.afm: Compressed
; VAR SIG
; ACT-FUSE: Fuse 1
; SILICON-SIGN 4:   5F80000      FFE   600000        0   FD335C
; ICC-STANDBY:       22            -          -           -
; IPP-STANDBY:0
; ESBIN: 3
; START-TIME Mon Mar 18 17:59:12 1996
;          4          3            2           1
1:      146   11    -       -     -       -     -       -
2:      146   7     -       -     -       -     -       -
3:      146   10    -       -     -       -     -       -
4:      146   8     -       -     -       -     -       -
5:      146   8     -       -     -       -     -       -
6:      146   9     -       -     -       -     -       -
7:      146   11    -       -     -       -     -       -
8:      146   7     -       -     -       -     -       -
9:      146   4     -       -     -       -     -       -
10:     146   8     -       -     -       -     -       -
11:     146   10    -       -     -       -     -       -
12:     146   20    -       -     -       -     -       -
13:     146   10    -       -     -       -     -       -
14:     146   5     -       -     -       -     -       -
15:     146   15    -       -     -       -     -       -
16:     146   18    -       -     -       -     -       -
17:     146   9     -       -     -       -     -       -
18:     146   11    -       -     -       -     -       -
************************************************************
```

The first thirteen lines of the file shown above contain header information. This information is obtained from both the programming file (.afm or .fus) and the unit being programmed. Each line of the AVI file header is preceded by a semi-colon. The header contains the following information:

- The complete Silicon Signature (read from the device) prior to programming.
- The I_{CC} standby value of the device before it is programmed. In the example, the I_{CC} standby of 22 corresponds to a standby of 2.2mA.
- The device "esbin" number, which corresponds to the V_{PP} used during programming.

The remainder of the AVI file contains information about the programming sequence. As each fuse is programmed, a new line is added to the AVI file. The first column of numbers in the AVI file is the fuse number. A typical RH1280 design requires approximately 15700 fuses to be programmed. The AVI file would contain over 15700 lines, including header information.

There are 8 additional columns in the AVI file. The 8 columns are listed in groups of 2, with each group corresponding to a socket on the Activator 2 (sockets are numbered 1-4). If the Activator 2s is used, the single socket is always recognized as socket 4.

The first column in a group of 2 contains the final programming current sensed by the Activator through each fuse as it is programmed. The programming current is listed in tenths of milliamps, and no decimal point appears in the number. For example, a programming current listed as 146 corresponds to current of 14.6mA . It is not unusual for different fuse types to have different programming currents.

The second column in a group of 2 contains the number of V_{PP} pulses that were required to program a specific fuse. The maximum number of programming pulses reported in the AVI file is 64464 pulses. There is an inherent variation in the number of pulses required to program a fuse depending on the fuse type. A wide distribution of V_{PP} pulse counts can be expected.

After the array fuse programming information, test results from the "end of programming" tests executed by the Activator are stored. If any of these tests fail, the failing test is indicated in the AVI file.

C

Product Support

Actel backs its products with various support services including Customer Service, a Customer Applications Center, a fax back service, a Web and FTP site, electronic mail, and worldwide sales offices. This appendix contains information about using these services and contacting Actel for service and support.

Actel U.S. Toll-Free Line

Use the Actel toll-free line to contact Actel for sales information, technical support, requests for literature about Actel and Actel products, Customer Service, investor information, and using the Action Facts service.

The Actel Toll-Free Line is (888) 99-ACTEL.

Customer Service

Contact Customer Service for non-technical product support, such as product pricing, product upgrades, update information, order status, and authorization.

From Northeast and North Central U.S.A., call (408) 522-4480.
From Southeast and Southwest U.S.A., call (408) 522-4480.
From South Central U.S.A., call (408) 522-4474.
From Northwest U.S.A., call (408) 522-4434.
From Canada, call (408) 522-4480.
From Europe, call (408) 522-4474 or +44 (0) 1256 305600.
From Japan, call (408) 522-4252.
From the rest of the world, call (408) 522-4252.
Fax, from anywhere in the world (408) 522-8044.

Customer Applications Center

The Customer Applications Center is staffed by applications engineers who can answer your hardware, software, and design questions.

All calls are answered by our Technical Message Center. The center retrieves information, such as your name, company name, phone number and your question, and then issues a case number. The Center then forwards the information to a queue where the first available application engineer receives the data and returns your call. The phone hours are from 7:30 a.m. to 5 p.m., Pacific Standard Time, Monday through Friday.

The Customer Applications Center number is (800) 262-1060.

European customers can call +44 (0) 1256 305600.

Guru Automated Technical Support

Guru is a Web based automated technical support system accessible through the Actel home page (http://www.actel.com). Guru provides answers to technical questions about Actel products. Many answers include diagrams, illustrations and links to other resources on the Actel Web site. Guru is available 24 hours a day, seven days a week.

Action Facts

Action Facts is a 24-hour fax-back service that allows you to have technical literature faxed directly to you. The literature includes current applications notes, device diagrams, radiation testing reports, CAE-related documents, training release schedules, and much more.

To receive your free copy of the catalog or any of our literature, contact us at (800) 262-1062 or (408) 739-1588.

Web Site

Actel has a World Wide Web home page where you can browse a variety of technical and non-technical information. Use a Net browser (Netscape recommended) to access Actel's home page.

The URL is http://www.actel.com. You are welcome to share the resources we have provided on the net.

Be sure to visit the "Actel User Area" on our Web site, which contains information regarding: products, technical services, current manuals, and release notes.

FTP Site

Actel has an anonymous FTP site located at ftp://ftp.actel.com. You can directly obtain library updates, software patches, design files, and data sheets.

Electronic Mail

You can communicate your technical questions to our e-mail address and receive answers back by e-mail, fax, or phone. Also, if you have design problems, you can e-mail your design files to receive assistance. The e-mail account is monitored several times per day.

The technical support e-mail address is tech@actel.com.

Worldwide Sales Offices

Actel Corporation
955 East Arques Avenue
Sunnyvale, California 94086
USA
Toll Free: 888.99.ACTEL
Tel: 408.739.1010
Fax: 408.739.1540

California (North)
Tel: 408.328.2200
Fax: 408.328.2358

California (South)
Tel: 714.727.0470
Fax: 714.727.0476

Georgia
Tel: 770.844.4495
Fax: 770.844.1395

Illinois
Tel: 847.259.1501
Fax: 847.259.1572

Massachusetts
Tel: 508.635.0010
Fax: 508.635.9510

Texas
Tel: 972.235.8944
Fax: 972.235.9659

Actel Europe, Ltd.
Daneshill House, Lutyens Close
Basingstoke,
Hampshire RG24 8AG
United Kingdom
Tel: +44 (0)1256.305600
Fax: +44 (0)1256.355420

England
Tel: +44 (0)1256.305600
Fax: +44 (0)1256.355420

France
Tel: +33 (0)1.40.83.11.00
Fax: +33 (0)1.40.94.11.04

Germany
Tel: +49 (0)8165.9584.0
Fax: +49 (0)8165.9584.10

Italy
Tel: +39 (0)2.38.09.32.59
Fax: +39 (0)2.38.09.32.60

Actel Asia-Pacific
EXOS Ebisu Building 4F
1-24-14 Ebisu Shibuya-ku
Tokyo 150 Japan
Tel: +81 (0)3.3445.7671
Fax: +81 (0)3.3445.7668

Japan
Tel: +81 (0)3.3445.7671
Fax: +81 (0)3.3445.7668

Korea
Tel: +82 (0)2.555.7425
Fax: +82 (0)2.555.5779

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