USER'S GUIDE

Silicon Sculptor

Actel Silicon Sculptor User's Guide V1.07

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SILICON SCULPTOR LIMITED WARRANTY

Actel Corporation

The Silicon Sculptor is manufactured by BP Microsystems, Inc. for Actel Corporation under an OEM agreement. There are two versions of the Silicon Sculptor; a single site version, which will be referred to as the Silicon Sculptor, and a six site concurrent programming version which will be referred to as the Silicon Sculptor 6X. Actel Corporation warrants the single site Silicon Sculptor product against defects in material or workmanship for a period of three years, and the Silicon Sculptor 6X for a period of one year, as follows:

For a period of three years for the Silicon Sculptor and one year for the Silicon Sculptor 6X, from date of purchase, Actel Corporation, through BP Microsystems, Inc., will repair or replace any defective product at no charge. Whether the warranted product should be repaired or replaced is wholly within the discretion of Actel Corporation and BP Microsystems, Inc.

This warranty does not cover any damage due to accident, misuse, abuse or negligence nor does it cover normal wear items such as socket modules and filters.

You should retain your dated bill of sale as evidence of the date of purchase.

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This warranty gives you specific legal rights, and you may also have other rights that vary from state to state.

Silicon Sculptor
Quick Start Guide

This is a quick guide to getting your Silicon Sculptor system up and running.

1: Connect all system components (see Chapter 2—Setup & Installation).

2: Power up the Silicon Sculptor programmer(s). Allow self test to complete.

3: Power up your PC and monitor.

4: Put on an ESD wrist-strap and plug into grounded receptacle.

5: Start the Silicon Sculptor software by typing **SCULPT** at the DOS command prompt and pressing **Enter**.

6: Select the Device to be programmed (**Alt-S**, see Chapter 4—Command Reference).

7: Insert a device. Make sure the device is in the master programmer site if more than one unit is in operation.

8: Set Number of Devices (*Device/Operations* menu).

9: Program first device (**Alt-P**).

10: Continue to insert blank devices until done.

NEED HELP? Remember, you can get context-sensitive help at any time by pressing the **F1** function key.

For more detailed operating instructions, see Chapter 2—Setup & Installation, and Chapter 3—Tutorials.

For information on specific commands, see Chapter 4—Command Reference.

Silicon Sculptor—

Operator's Checklist

Operator: Date: Project:

Device Name: File Name: Number of Devices:

Must Do	Programming Steps	Done
3	Power up Programmer(s) (Allow self test to complete)	
3	Power up PC	
3	Verify Power On Self Test (POST)	
3	Launch SCULPT.EXE Software	
3	Insure proper socket modules are installed	
	Run Full System Test	
3	Select device to be programmed	
3	Load buffer with program file from disk	
	Verify Checksum	
	θEnable θDisable—Secure after programming	
	Other Options—	
	θEnable θDisable—	
	θEnable θDisable—	
	θEnable θDisable—	
	θEnable θDisable—	
	θEnable θDisable—	
	θEnable θDisable—	
	Program first device	
	Verify Actel Checksum	
3	Confirm first device has Passed	
3	Complete program run	
	Verify that PC's Pass/Fail count equals yours	
	Save Report to Directory—**C:\ .DOC**	
	Print and Attach Report	

Table of Contents

Chapter 1 — Introduction

Thank you for selecting the Silicon Sculptor Programming System. This User's Guide is designed to help you take full advantage of the Silicon Sculptor's unique capabilities. The bulk of this manual describes operation of the single site version of the Silicon Sculptor. However, the software is identical for the six site Silicon Sculptor 6X, and command descriptions apply for both. Refer to Appendix 2 for specific information about the Silicon Sculptor 6X.

How to Use This Guide

Be sure to read Chapter 2—Setup and Installation, which contains essential information on setting up your system.

If this is your first experience with an Actel programmer, you should definitely take advantage of the Tutorials in Chapter 3. They will take you step by step through the programming process. Along the way, you'll get acquainted with the full range of the Silicon Sculptor's capabilities.

If you are already familiar with our programmers, you may want to use the Quick Start Guide in the front of this manual, which covers the key points in getting the Silicon Sculptor up and running. We still encourage you to explore the tutorials for useful tips on getting the most from your Silicon Sculptor.

This manual also includes a reference guide to each command and feature of the programmer. A glossary of common terms and an extensive index are included at the end of the manual.

In this manual, menu commands are in italics, such as *Device/Options*. Keyboard strokes are in bold type, such as **F2** or **Enter**. File names are in all caps, such as SCULPT.EXE.

Special Features

Although designed for use as an engineering programmer, the Silicon Sculptor is a concurrent programmer, an innovative design in which multiple sites can operate independently.

The six site Silicon Sculptor 6X is intended for high volume production programming where devices are programmed concurrently.

The electronics are based on proven designs from BP Microsystems, so programming is speedy and reliable.

The system supports all of the Actel FPGA families. Currently, all devices in a given package can be supported with a single socket module regardless of family.

The unique architecture of your Silicon Sculptor allows it to be tightly integrated with the PC to provide the highest level of performance and ease of use.

Your PC is used to hold the data that will be programmed into devices. Specific programming algorithms and instructions are stored on the PC's disk and downloaded to the programmer when you select a chip.

Thus, the algorithm is actually executed by each socket's internal microprocessor. This guarantees accurate waveforms and precisely controlled critical time delays independent of the PC's speed. The speed of your PC will only affect the rate at which the algorithm and data is downloaded to the programmer and will not affect programming yield.

Readily Upgradable

Actel stands behind the Silicon Sculptor with service, support and ongoing software development.

We also update this manual on a regular basis, but it may describe an older version of the software than you have. If you discover new features in your software, you can learn about them by pressing F1 for online help or contacting our Technical Support Hotline for assistance.

How to Reach Us

Technical Support— North America Only	888-99-ACTEL (992-2835) or 800-262-1060
Technical Support— Direct	408-739-1010 (Voice) 408-739-1540 (Fax)
E-Mail—	tech@actel.com
Web Page—	www.actel.com

Chapter 2 —

Setup and Installation

Package Checklist

The Silicon Sculptor system is delivered in a single box. Please check carefully to insure the correct equipment has been received and is undamaged.

PACKAGE SUMMARY	
Box 1:	Silicon Sculptor
	Certificate of Conformance
	Registration Card
	Power Cable
	Communications Cable
	Diskettes containing SCULPT.EXE software
	System Manual

Hardware Installation

After the equipment has been unpacked, you are ready to connect the Silicon Sculptor to the PC. Your new programmer will be connected to a parallel printer port on your PC. It is preferable to dedicate a port to the programmer, but you may plug and unplug the cables or use a manual mechanical printer switch instead.

Use the 25 conductor cable provided with your programmer. Do not use a ribbon cable or an RS-232 cable that has fewer than 25 conductors. You can extend the cable up to 12 feet, but be certain to use only a 25-conductor shielded cable. A high percentage of the hardware-related problems reported to our technical support are actually ribbon cable failures. Ribbon cables work well installed inside a chassis, but often make poor connections when subjected to the flexing that occurs when used improperly.

A custom expansion cable is available that will allow you to connect multiple units together for concurrent programming. This cable is connected only between the expansion ports of the systems. If more than two units are to be connected, an identification switch must be changed and resistor pack removed on units 3 and above. Please see the tutorial "Setting Up The System" in chapter 3 for more information.

Plug the programmer AC power cord into a power socket. **Note:** the Silicon Sculptor power supply operates from 90 to 250 VAC for simplified worldwide use. Connect one end of the cable provided to the programmer's connector and tighten the screws. Connect the other end of the cable to your computer's parallel printer port.

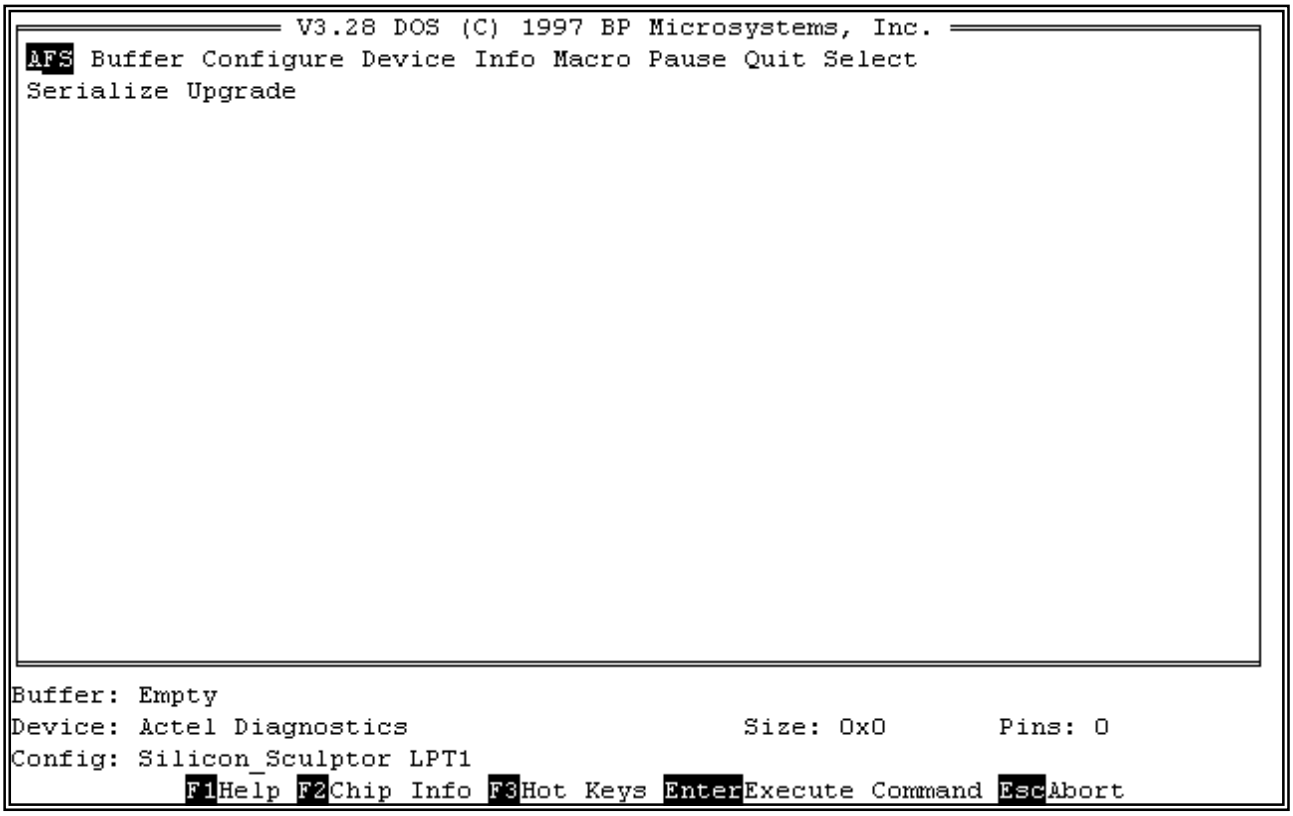
Do not attempt to use any print buffers or electronic switches on the same port as the programmer. Verify that you have connected to the correct parallel port on your computer. Connecting to a serial port or a third party card may damage the programmer. This type of damage is not covered by the warranty.

Turn on the computer and the programmer. Both the Power LED and Active LED on each programmer site will light up. While the Active LED is on, the Silicon Sculptor is performing a self-test. After several minutes, the Active LED will turn off and only the Power LED will remain on. If any of the Fail LEDs have turned on, the Silicon Sculptor has detected an error during its self-test. If this occurs, make a notation of which unit is displaying the Fail LED and call Actel's technical support line.

Software Installation

Do the following to install the software. If you are running in a Windows environment, you must first load a DOS shell. Please refer to your Windows users guide for instructions on loading a DOS shell.

- Select the drive and directory where you would like the Silicon Sculptor software to be installed.
- Insert the disk labelled **Disk 2** into drive a: and type **a:install**. You will then be prompted to insert **Disk 1**. This will extract the SCULPT.EXE software onto your selected directory.
- Verify that the programmer is powered on and all Pass LEDs are on.
- Type SCULPT at the command prompt. The software should display a screen similar to this:



The software version number will appear at the top of the screen and a message will appear briefly at the bottom saying "*Establishing communications, please wait*." If the Silicon Sculptor is found on one of the LPT ports, no error message will appear and you are ready to begin programming. Otherwise, you should make sure you are connected properly, the power to the programmer is turned on, then try again. If the programmer is not attached, the software will automatically go into a demonstration mode and allow you to use all the features that do not require a programmer to be present.

Running Self-Test

You are strongly advised to run a full system Self-Test-test on your programmer before performing any other operation. The Silicon Sculptor diagnostics will ensure that the power supplies are functioning properly, and will test the integrity of all pin drivers. The diagnostic self-test is activated by pressing **Alt-D**. Insure that there are no devices in any of the programmer sites prior to beginning the self-test. Any device left in a programmer site may be damaged during testing.

Once the self-test has been entered, two choices under the *Device* main menu selection will be visible. Highlight *Test* and press **Enter**. You will be given a choice between running all the units through self-test or selecting a particular unit to test. Choose *All* and press **Enter**. The self-test will cycle through all of the units on the Silicon Sculptor.

When a unit finishes self test, the green Pass LED will be on. If any Fail LEDs are illuminated after the completion of the self-test, note which unit(s) have failed and call Actel's technical support.

Chapter 3 — Tutorials

Using These Tutorials

This series of tutorials was designed to take a first-time user of the Silicon Sculptor, step by step, through the basics of efficient operation.

Our approach is a little different from other systems with which you may be familiar, so please take the time to go through these tutorials.

If you are already familiar with a given section, feel free to skip to the next.

The Silicon Sculptor has been designed to be as simple to operate as possible, and you can quickly learn to use its many features.

Need Help?

Don't forget, you can always get context-sensitive Help by pressing the **F1** function key.

The Basics

If you are completely new to device programmers, there are a few basics you should know before beginning the tutorials.

A device programmer is a tool used to configure a programmable integrated circuit for use in the design or manufacture of electronic equipment.

The device programmer is analogous to a floppy disk drive. A floppy drive allows a user to copy programs or data stored on a PC onto a blank floppy disk. The programmer copies data from the PC to a blank integrated circuit instead of a disk.

The user supplies a pattern that will be programmed into the blank device. The pattern is stored in a file on disk.

The Silicon Sculptor software supplies the programmer with all the information it needs to program the user's pattern into a specific device. The software is updated on a regular basis to cover new devices and to update existing algorithms. Learn more about the Silicon Sculptor's unique capabilities in Chapter 1—Introduction.

In these tutorials, menu commands are in italics, such as *Device/Options*. Keyboard strokes are in bold type, such as **F2** or **Enter**. File names are in all caps, such as SCULPT.EXE.

TUTORIAL 1— SETTING UP THE SYSTEM

In this tutorial, you will learn how to set up your Silicon Sculptor system and get it running properly.

1— Position the Components

Proper placement of the system components is an important factor in the ease and efficiency with which you can program devices.

You should position the programming modules and PC keyboard so that all can be reached easily from one working position. You should keep the programmer level if you intend to program fine-pitch devices

We also recommend setting up on a conductive mat that can be grounded. The operator should use an ESD wristband plugged into the Silicon Sculptor, located on the left side of the programmer, to prevent static discharge that can cause damage to the devices you are programming.

Be sure to allow extra space for staging blank and programmed devices, labeling and paperwork. We suggest designating an area to your left for blanks, an area to your right for programmed devices, and a location to the left rear for rejects. After time, you will develop a habit of moving in the same pattern, thereby increasing your efficiency.

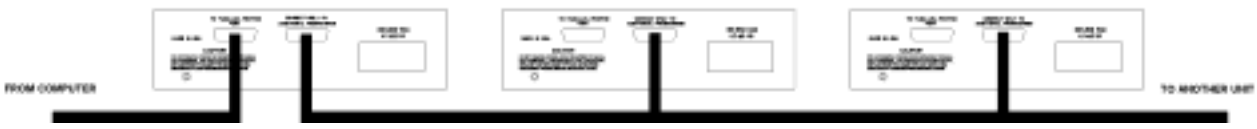
2— Install the Software

Refer to Chapter 2—Setup & Installation for instructions on installing the software.

3— Connect the Components

Once you have things in place and the software installed, you are ready to connect the components of the system.

If you have more than one programmer and only one PC, connect the programmers to each other using the custom expansion cable (optional). The expansion cable will allow multiple units to be connected together (2, 3, or 4 units) providing true concurrent operation. The cable should be connected as shown:



+ The system will self configure if only two units are connected together. If three or more units are connected, some modifications will need to be made internally to each programmer**. The chassis must be opened to accomplish this**. Please refer to "Troubleshooting – Configuring for Concurrent Operation" for instructions.

Plug the power cords from each programmer and the PC into a grounded power socket.

Connect the data cable to one of the parallel printer ports on the PC. Connecting to a serial port or a third-party card may damage the programmer.

It's most efficient to use one port for the programmer and a different one for your printer.

Connect your ESD wristband to the grounding outlet on the left side of the programmer. If you are working on a grounded mat, connect the mat to the programmer and the ESD band to the mat.

4— Power Up the System

Now you're ready to power up the system. Turn on your PC first but don't launch the Silicon Sculptor software yet. Next, turn on the programmer(s). It is important to power up the programmer(s) before launching the software on your PC. Try this now, and watch the following happen:

5— Programmer Self-Test

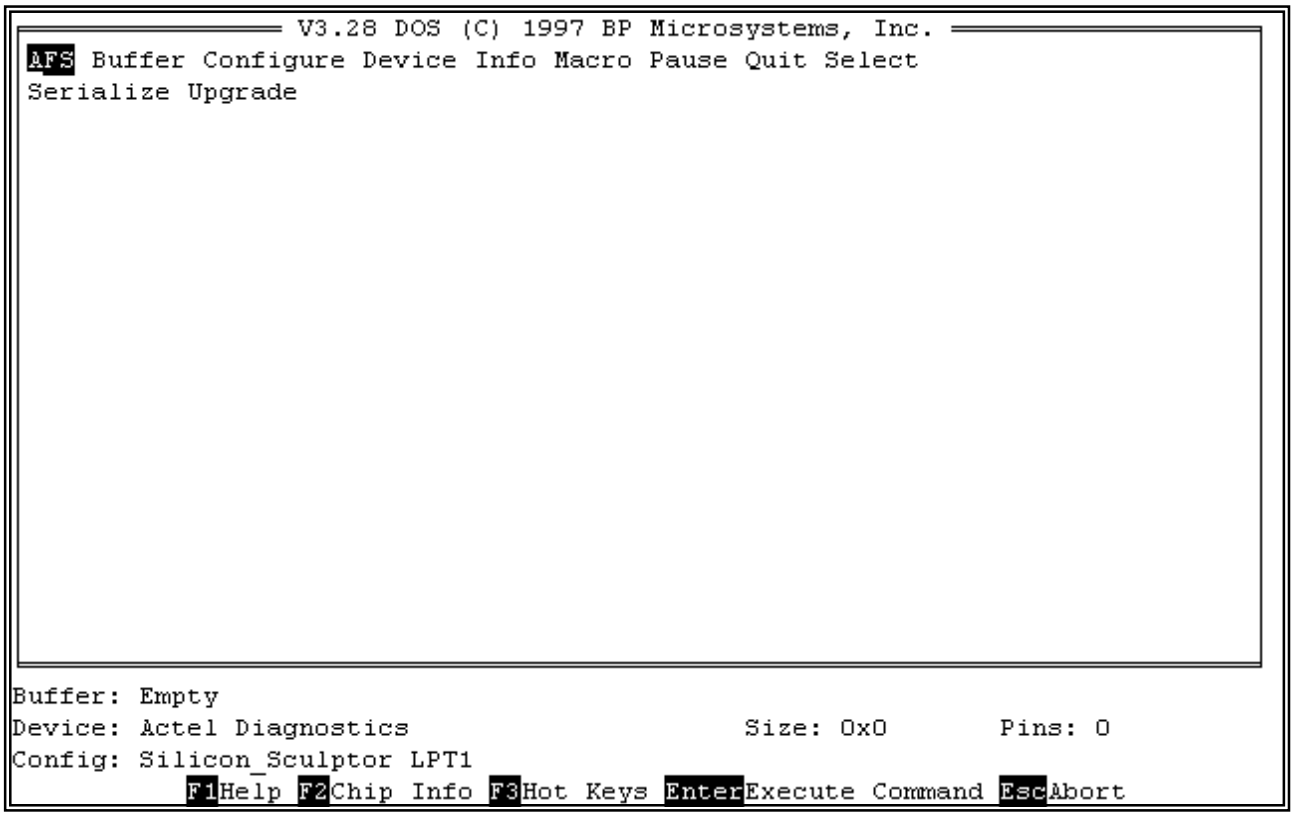
Each programmer will automatically perform a Power On Self Test (POST) every time you turn it on. Watch the LEDs to see the results.

Both the Power LED and Active LED on each programmer site will light up. The Active LED will stay on until the POST is completed. The Power LED will remain on. If any of the Fail LEDs have turned on, the Silicon Sculptor has detected an error during its self-test. If this occurs, make a notation of which lights are steady and any that are flashing, then call Actel's technical support line.

We recommend running a full system self-test on your Silicon Sculptor weekly (Please see Chapter 2 – Running Self-Test), but first you'll need to have the Silicon Sculptor software up and running.

6— Launch the Software

On your PC, enter **SCULPT** at the command prompt and press **Enter** to launch the SCULPT.EXE file. You should see a screen that looks like this:



Check the startup screen to verify that "Silicon_Sculptor" and port (LPT-1) appear on the "Config:" status line. If the word "DEMO" appears, check your connections to the programmer and make sure power is on. Restart the software if necessary.

7— Moving Around the System

When you see the above screen, you are in "Command Mode." From here, it's easy to navigate your way around the system, using the menu commands. You'll see the menu commands on the line near the top of the display, beginning with *Buffer* on the left.

The Silicon Sculptor system offers a wide variety of commands and options, which are covered in detail in Chapter 4—Command Reference. These tutorials will introduce you to those commands you will use the most.

When you're in Command Mode, you can access any of the main menus by typing the first letter of the menu name. Try this now with "**C**" for *Configure* or "**S**" for *Select.*

You may also press the **Left** and **Right** direction keys to change the selection, then press **Enter** to execute the selected command. Try this now, and select *Info*.

When you select *Info*, or many of the main menu items, you will see a sub-menu of further options. To move through these options, use the **Up** and **Down** arrow keys to highlight the desired selection, then press **Enter**. Try this now and select *"Info/Revisions"*. This option will display information on the latest revision of the software you are using.

You get back to the Command Mode by pressing **Esc**. In this case, since you are two levels down you will have to press **Esc** twice.

Many different "hot keys" are available in Command Mode. These key combinations are short cuts for more time-consuming menu selection techniques. Learning to use them can speed your operation of the system. All the hot keys are listed in detail in Chapter 4—Command Reference. You can see them on-screen at any time by pressing **F3**. The ones you will probably use most are covered in these Tutorials.

8— Full System Self-Test

Use one of these hot keys now to perform a full system self-test by pressing **Alt-D**. This will test every component in the system more extensively than the automatic POST. We recommend that you perform this test once a week, to make sure everything is operating properly.

9— Need Help?

The most important "hot key" when you're getting started is **F1**. You can press the **F1** key for extensive, online help at any time.

REVIEW—

In Tutorial 1, you have learned:

1. How to position the components of your system for maximum efficiency.
2. How to install the Silicon Sculptor software.
3. How to connect the components correctly.
4. How to power up the system.
5. Programmer Power On Self Test (POST).
6. How to launch the software.
7. How to move around the system using Menu Commands.
8. How to run a full-system self-test.
9. How to access online help using hot key **F1**.

TUTORIAL 2— CONFIGURING YOUR SYSTEM

In this Tutorial, you will learn how to customize the system to serve your particular needs, using options under the *Configure* menu. The system "wakes up" with default options which will probably serve your needs at first, but this Tutorial will show you how to change them if you ever need to do so.

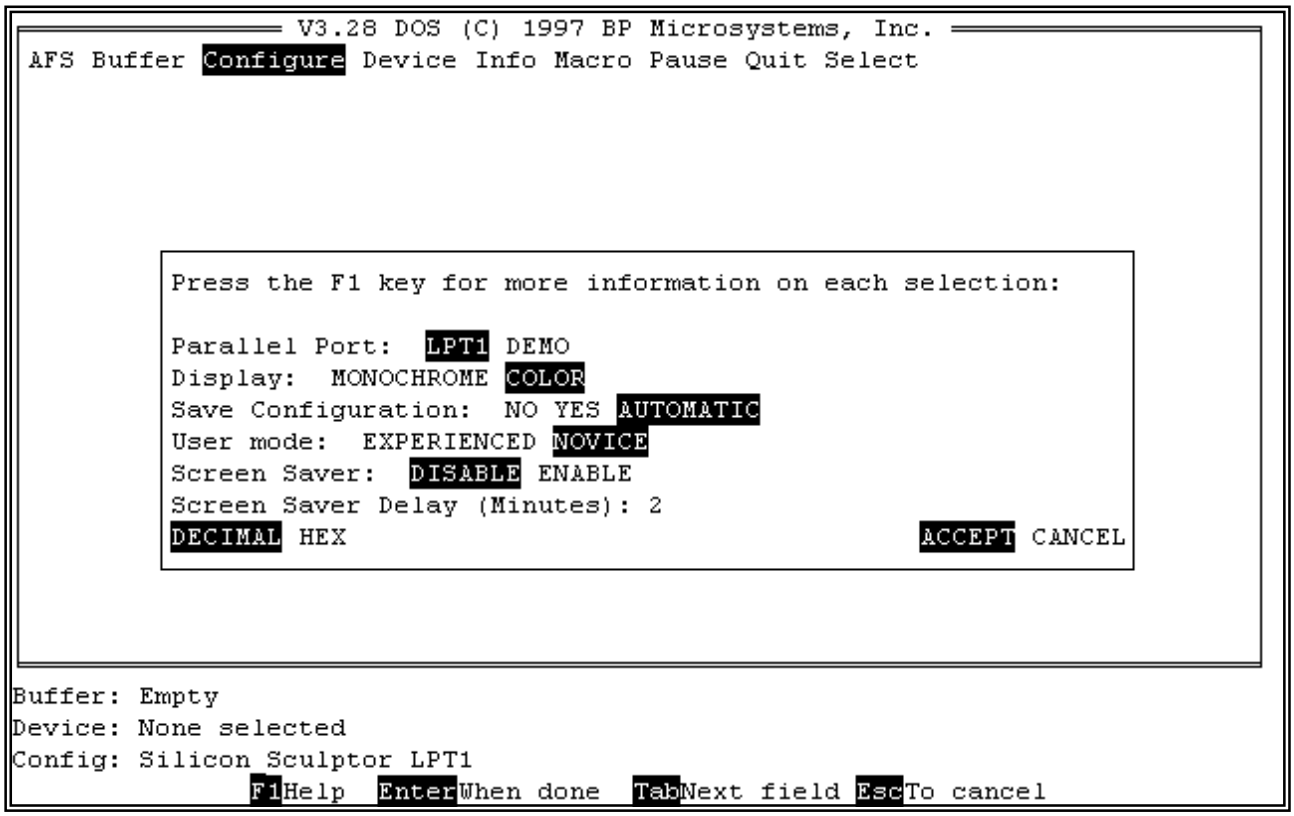
1— Reading the System Status

From now on, we will assume you've got the system connected properly, that you have powered up the programmers and let them complete their self-test successfully, and then launched the SCULPT.EXE file on your PC.

The four status lines at the bottom of the Command Screen display important information to help you double-check what you've told the system to do. These lines will show you:

- What data is in the buffer. (There should be none now, because you have not yet loaded a file).
- The device selected and its size information. (Again, there will be none until you select a device in Tutorial 3.)
- The programmer attached to your PC (this should indicate a Silicon Sculptor as well as the type and number of programmer sites) and the *Device/Option*s selections you have made.
- General status. This may tell you to press a key to continue, or to define what the function keys do.

From the Command mode, use the cursor keys to select *Configure*, and press **Enter**, or simply type **C**. You should see a screen that looks like the following:



2— Default Options Your Silicon Sculptor software "wakes up" with certain default options set. Let's see what these are, and how you can change them to customize the system for your particular needs. Later, we'll learn how to make your changes permanent.

•Parallel Port This field shows the parallel port to which the programmer should be attached. If the programmer is attached to a different port, the software will find it automatically. If no programmer is attached, the software will put itself into a demonstration mode.

•Display This field allows you to switch from color to black-and-white display. You may find this useful if you are using a gray scale or monochrome monitor.

•User Mode This field tells the software how much on-screen help you need. The default option is NOVICE. This setting provides you with numerous warning messages to guide you in learning your way around the system. It also gives you the chance to abort potentially hazardous operations, like programming a chip. By changing the setting to EXPERT, you can turn off these messages when you no longer need them. This will make programming go a little faster.

•Startup Messages You can set this field to DISABLED to turn off the startup messages, again speeding up your programming routine.

•Screen Saver This field will enable a screen saver, which will blank your screen after a specified amount of time.

•Screen Saver Delay Specifies the time of inactivity (in minutes) to wait before blanking the screen.

•Decimal or Hex This field determines the format you use to enter numbers into the system. If you're used to decimal (0-9) select that option. If you're used to hexadecimal, (0-9, A-F) select Hex. The advantage of Hex is that it allows you to use fewer characters to represent bigger numbers, e.g., FF instead of 255. This is a global command, which means that changing it here will change it throughout the program.

3— Saving your Configuration Whenever you want to change the Configuration of your system, you can make the Silicon Sculptor software "wake up" to your settings every time. To do this, use the *Save Configuration* field.

The three options in this field are YES, NO and AUTOMATIC.

•Yes YES saves your choices when you press **Enter**, and the next time you start the program they will be recalled. Your settings are saved in a .CFG file in the same directory as the SCULPT.EXE file. If you want to revert to the original default settings, just delete the .CFG file.

•No Selecting NO lets you make changes to the system for the current programming session. When you start the program again, it will revert to the previous settings.

•Automatic This option saves any changes you make automatically whenever you quit the program. When you start the program again, all your settings will be restored, including your chip selection, saving you time in getting back to work.

REVIEW— In Tutorial 2, you have learned:

1. How to read the current system status.
2. What the Configuration Default options are, and how to change them.
3. How to save your special Configuration settings.

TUTORIAL 3— LOADING THE BUFFER

1— Understanding File Formats

Once you've selected a device, the programmer knows the proper algorithm (i.e., the correct voltages, pin numbers and other mechanical data). The next step is to load a file into the programmer's buffer, and that's the subject of this Tutorial.

+ Actel FPGAs can be programmed with two file formats; AFM or DIO. Actel highly recommends that the AFM format be used whenever possible. The AFM format is much smaller and is easily transferred between systems.

Choose *Buffer/Load* from the main menu. To limit the list to a specific set of files, you can change the "*Directory:*" specification from ***.*** to ***.afm**, for instance (press **End Backspace A F M**). You can also change the disk drive and directory by editing the "*Directory:*" field. To choose one of the files listed, select the file by moving the cursor up or down and press **Enter** to copy your choice to the "*File to load:*" field and the software will automatically identify the file type and move its cursor accordingly.

Pressing **Enter** on "..\" or any other name ending in "\" is an alternative way to change the current directory and allows easy traversal through your directory tree.

One of the big advantages of the Silicon Sculptor software is its ability to recognize the type of file you have loaded, instead of requiring you to specify it. In the rare instance where the file type is mis-identified, you can change it in the *File Type* field.

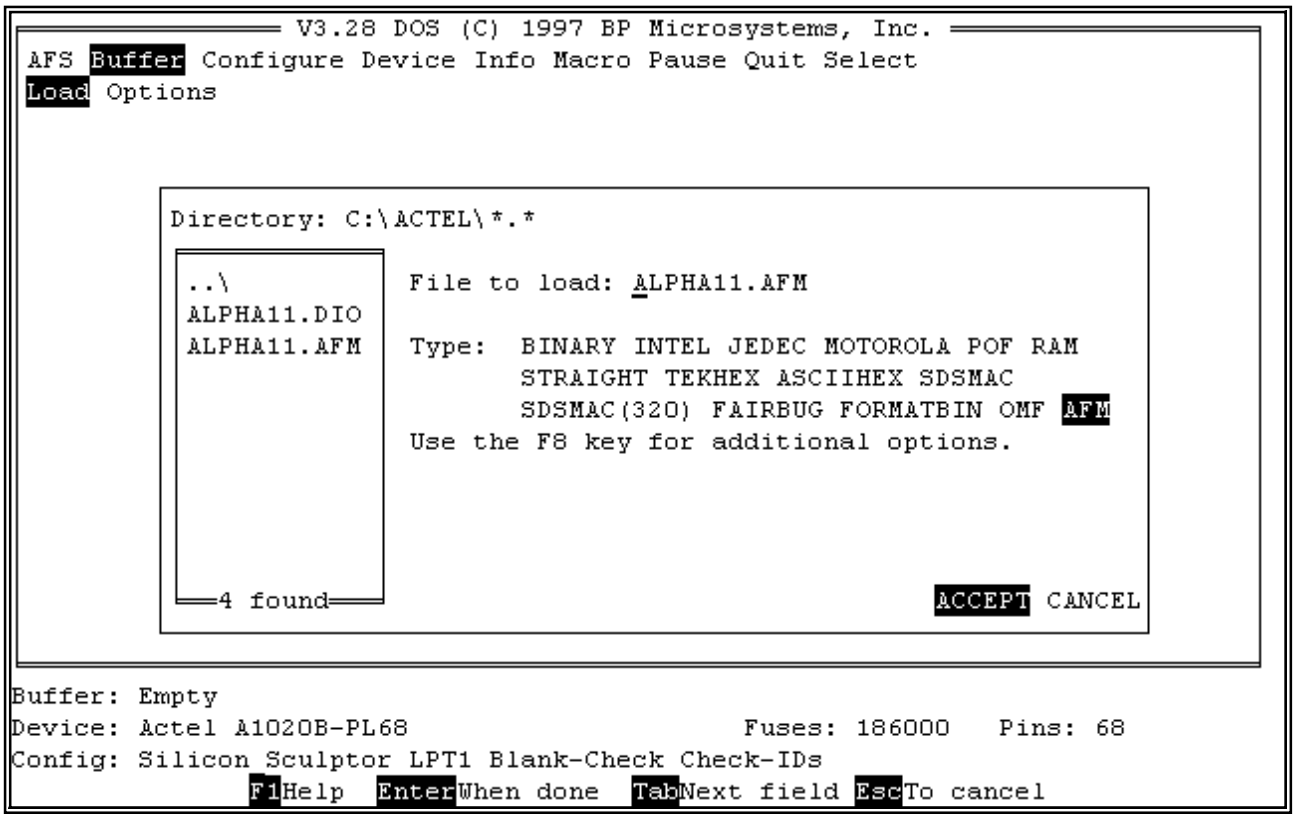
For most work, you only need to know the correct name for the file you are programming into your device.

2— Device/Options

In some cases, you will need to specify some additional Load Parameters to control how and where the file is loaded into the buffer. You can access these options by pressing **F8** from within the *Buffer/Load* dialog box. For the purposes of this tutorial, you will not need to use these options. When you do, you can find instructions in Chapter 4—Command Reference under *Buffer/Load*, *Device/Options* and *Device/Configur*e.

3— Loading the File

From the command mode, press **Alt-L** to bring up the *Buffer/Load* screen.



If you are going to use the same file repeatedly or if the file is too large to fit on one floppy disk (DIO files are too large for most devices), you can speed your operation by copying that file from the floppy disk into a directory on your hard drive. You can also set the *Buffer/Options* menu option to AUTOMATIC to find and load this same file every time you launch the Silicon Sculptor software.

Use the cursor keys to select the file and press **Enter**. The file name will appear to the right of *File to load:* and the file *Type:* will be automatically determined. Press **Enter** again and the file will be loaded into the programmer's buffer.

You can confirm that this has been done by looking at the status lines at the bottom of the screen. The *Buffer:* field should have changed from Empty to the name of your selected file.

REVIEW—

In Tutorial 3, you have learned:

1. The basics of data files used to program your device.
2. How to access further options using **F8**.
3. How to find and load the file into your programmer prior to programming.

TUTORIAL 4— PROGRAMMING A DEVICE

Now that you have a file loaded into the buffer, you are ready to begin programming a device.

1— Set Number of Devices to Program

The advantage of the Silicon Sculptor is its ability to program many devices very quickly. But before you get started, you must tell the software how many devices you want to program. Starting in the Command Mode, select the *Device/Operations* menu and press **Enter**.

In the *Device/Operations* dialog box, enter the number of devices you want to successfully program in the *Number of operations:* field.

2— Program One Chip First

With the Silicon Sculptor, you must program one device successfully first, to make sure the system is properly configured. Once the first device is properly programmed, the PC will broadcast the necessary information to every programmer site on every programmer so you can take full advantage of the Silicon Sculptor's speed.

To begin, start from the command mode and select *Device/Program* (or just press **P**).

This will alert the system that you are ready to begin programming. A message should appear onscreen saying "Press Start Button on Master."

Next, insert the device into the Programmer's Master programmer site. The system will identify this programmer site for you by turning on the red Start button light next to that programmer site.

We highly recommend using a vacuum pencil to pick up and insert a chip, in order to minimize the chance of damage from bending package leads or from static discharge.

+ Devices must *not* be inserted or removed when the ACTIVE LED is on.

+ The Silicon Sculptor has protection circuitry, so it is not necessary to remove the device to be programmed before the power is turned on or off.

It is very important to insert the device correctly so that its pin 1 matches up with pin 1 in the programmer site. Pin 1 is often identified by a notch or a mark on the device, and by a mark on the programmer site. Inserting the chip improperly may damage it, so make sure you have it properly aligned.

PGA, BGA Placement Place the PGA or BGA device as indicated by the particular socket module.

QFP Placement Align pin one with the mark on the programmer site.

PLCC & LCC Placement Place pin one on the side facing the operator.

Once the device is in the programmer site, lock it in place to achieve continuity.

Now press the Start button next to that programmer site. The yellow ACTIVE LED will come on and programming will begin. When programming of that device is completed, the yellow ACTIVE LED will go off and one of the other two status lights will come on.

4— Verifying that the device is correctly programmed

There are two ways to make sure the device is correctly programmed. You can watch the lights beside the programmer site. If the green PASS LED comes on, the device has been properly programmed. If the red FAIL LED starts flashing, something has gone wrong. You can get the same information by watching the PC screen, which will report the PASS/FAIL status of each device.

The worst mistake a device programmer can make is to allow a failed device to be counted as passed. The Silicon Sculptor has a special feature to help make sure this doesn't happen to you.

If the device has passed, the status LEDs will turn off and the Start button will turn on again when you remove the device from the programmer site. If the device has failed, the red FAIL LED will remain steadily illuminated even when the device is removed.

If you have to leave the programmer during a session, you can always determine the PASS/FAIL status of a device by looking at the LEDs. If a device is in the programmer site and the PASS LED is on, the device has been successfully programmed. If the device has already been removed and the FAIL LED is still on, that device has failed. If the device has been removed and only the Start button LED is on, that device was good and the programmer site is ready to program a new device.

5— Completing your production run

Once the first device is programmed properly, the PC will broadcast all the necessary information to each programmer site in your system and you are ready to begin your programming run. From then on, each programmer site is doing the actual work, and the PC is only polling the programmer to determine when the device is finished and whether it passed or failed. This is one of the big advantages of the Silicon Sculptor, because the programming information has a shorter route to travel to the device being programmed.

6— Reading the results of your production run

When the specified number of devices have been programmed, the software will send a report to the PC screen. This will tell you the device, the name of the file you programmed into it, how many operations the system performed, how many devices passed and how many failed. This is useful in helping you make sure you have programmed the correct number of devices successfully.

The report will also show you the beginning and ending time of your programming session, the number of units per hour, and the percentage of successful operations.

7— Saving and printing report results

The report from each run can be saved to the hard disk, and can be printed out. Instructions for doing this can be found in Chapter 5—Command Reference, under the *Info/Log* command.

REVIEW— In Tutorial 4, you have learned:

1. How to set the number of devices to program.
3. How to program the first device.
4. How to verify that a device is programmed correctly.
5. How to complete your production run.
6. How to read the results of your production run.
7. And how to save or print the report of those results.

Chapter 4 — Command Reference

TABLE OF CONTENTS

Interface Commands

This section describes the commands provided by the interface software. Commands are located in menus at the top of the screen. To execute a command, type the first letter of a menu entry or use cursor keys to select the desired command and press Enter. In this section, command names are written as *name* or *menu/name*, where menu is the menu name, if used, and name is the entry that invokes the command.

Keyboard Usage

The following keys may be used at any time:

F1	Help
Esc	Interrupt a command

•The program starts at the command level. These keys operate any time you are at the command level:

→, ←, **Space**	Move Selection
↓, **Enter**	Execute the command that is selected
A-Z	Select and execute command
Esc	Move up one line in the command menu
F2	Chip Information
F3	Hot-Key Help

• Hot-Keys also operate at the command level:

Alt-C	Configure
Alt-D	Diagnostic Hardware Test
Alt-H	Help Menu (F3)
Alt-I	Chip Information (F2)
Alt-L	Buffer/Load
Alt-O	Device/Options
Alt-P	Device/Program
Alt-Q	Quit

Alt-S	Select
Alt-X	Quit
Alt-0...9 or Alt-F1...F9	Play Macro file #.pgm (*e.g.*, Alt-1 plays macro file 1.pgm)

•Dialog boxes gather information before executing commands. The dialog box control keys are:

↑, **Esc**	Cancel dialog box and return to command level
Enter	Exit the dialog box and execute command
Tab	Move to next field in dialog box
Shift-Tab	Move to previous field in dialog box
Home	Move to first selection on a line
End	Move to last selection on a line

•When editing text:

Backspace	Delete character to left
← , →	Move cursor
Home	Move to left end of line
End	Move to right end of line
Ctrl-U	Clear line
Ins	Turn ON/OFF insert mode

•When selecting a file (Under *Buffer/Load* or chip) under *Select* from a list, editing the selector string (directory or part number) changes the list. Highlight the item you want and press **Enter**. To make selections:

↑, ↓**, PgUp, PgDn**	Move selector highlight
Enter	Make selection

COMMANDS

Buffer/Clear

Description Clears all fuse data buffers.

\+ Note: this command is only available when the "*User Mode*" is set to EXPERIENCED under the *Configure* command.

Application Use this command to clear the data buffers.

Operation Press **Enter** to clear the buffers. Press **Esc** to cancel the command.

\+ The buffers are automatically cleared during a *Buffer/Load* command if the "*Clear buffer before loading:*" option is set to YES under the F8 additional options in the *Buffer/Load* dialog box.

See Also *Buffer/Load Device/Options*

Buffer/Load

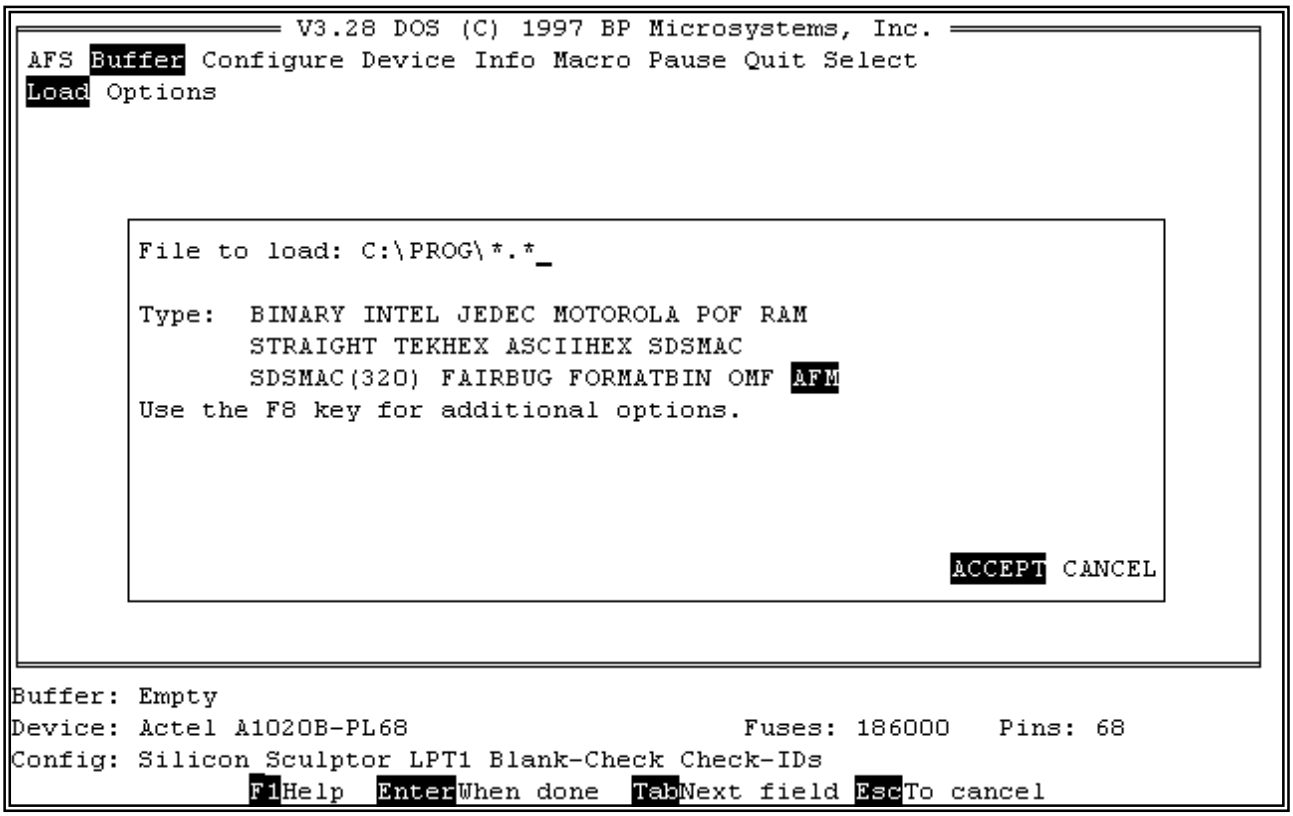
Description Load a data file from disk into the buffer

Hot-Key **Alt-L**

Application Load the buffer before programming.

Loading files from floppy disks

+ When using a hard disk, displaying the current directory on-screen takes a small amount of time. However, the display time may become rather slow when using a floppy disk. To speed up the display, use the *Buffer/Options* command and set the "*Show file names:*" option to DISABLE. The *Buffer/Load* dialog will then appear similar to the following:



When the file name display is turned off, you have to type the exact file name and press **Enter** to load the file.

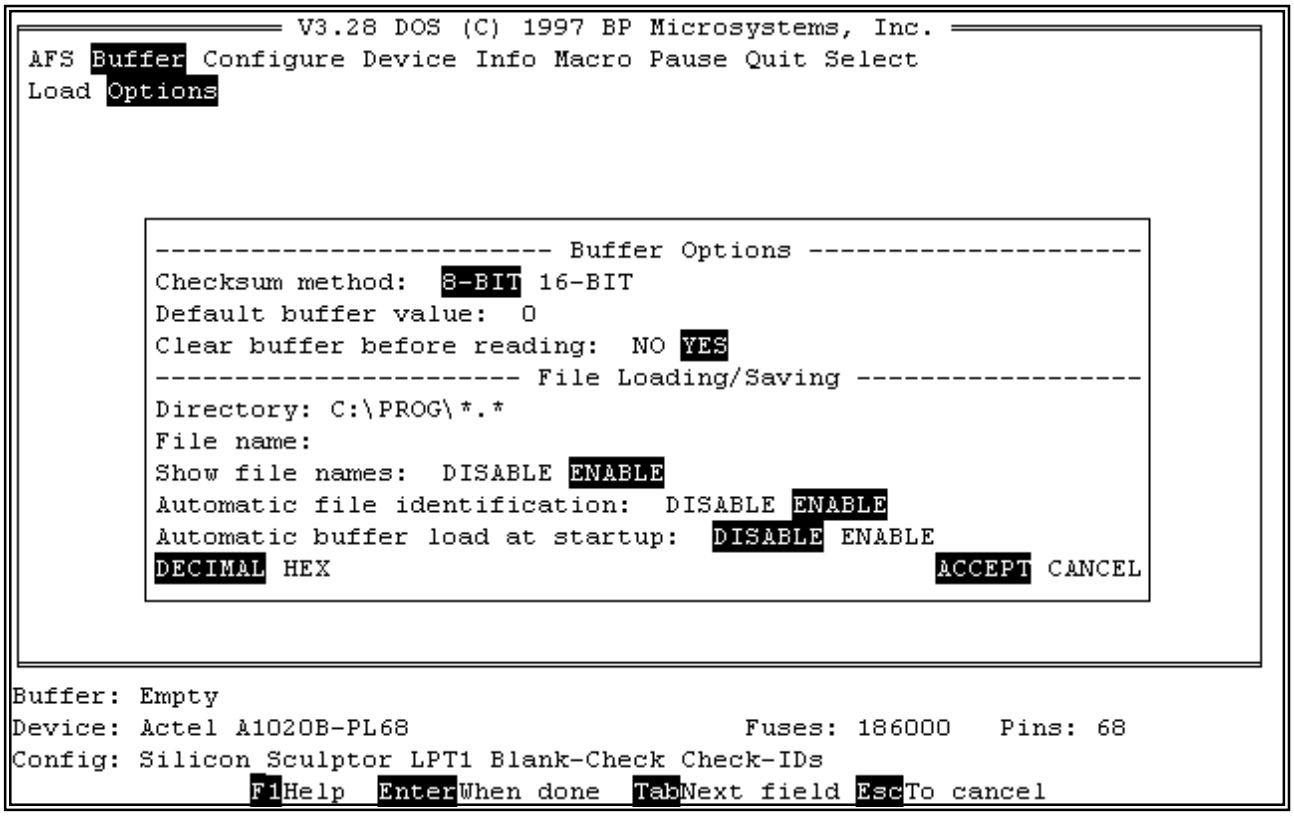
See Also *Buffer/Options*

Buffer/Options

Description Set the options that control the loading of the buffers.

Application Select generic buffer options such as: (1) checksum method or(2) default value. Also, set several options pertaining to the *Buffer/Load* command, which include: (1) changing the default directory; (2) changing the default filename; (3) disabling the listing of files in a selector box; (4) disabling automatic file type identification; and (5) enabling the loading of the filename when the software starts up.

Operation A dialog box will appear showing the current settings for the buffer options.



>> Use the **Tab** key to select the field you want to change.

>> Press the **F1** key on any field to get context-sensitive help.

>> Change selections using the **Left** and **Right** direction keys.

>> Press **Enter** when finished.

Buffer Checksum method;: This dictates how the checksum is computed. Adding 8 bits at a time is the default, but you can specify 16 bits at a time instead. This affects the checksum displayed at the bottom of the screen and also affects the *checksum* command (**F9**) when editing hex or binary files.

Default buffer value: This is the value that the buffer is initialized to when it is cleared. The buffer is cleared when a new file is loaded, if the "*Clear buffer before loading:*" option is set to YES in the *Buffer/Load* dialog box; or when a chip is read, if the "*Clear buffer before reading:*" option is set to YES in the *Device/Options* or the *Buffer/Options* dialog box. 0 is the default value of this field when you receive the software. It makes calculating the checksum very fast because we can assume that the starting checksum is 0 and simply add to it when data is changed in the buffer. This allows us to calculate the checksum without having to know the range of data in the buffer.

Directory: This is the currently selected directory last used by the *Buffer/Load* command.

File name: This is the file name used by the *Buffer/Load* command and will be saved when the configuration is saved according to the *Configure* command.

Show file names: This dictates whether or not a list of files and directories is shown in a selector box when you use the *Buffer/Load* command. The purpose of this option is to speed up file retrieval on PCs with slow disk access when you already know the exact file name you wish to use.

Automatic file identification: The software is shipped with this option ENABLED to help the user select the proper file type when loading a file with the *Buffer/Load* command.

Automatic buffer load at startup: When ENABLED, this option will load the file specified by the "*Directory:*" and "*File name:*" above, when the software is first started. This is a simple alternative to creating a macro with the *Macro/Record* command, which does the same thing.

See Also *Buffer/Load, Device/Options, Macro/Record*

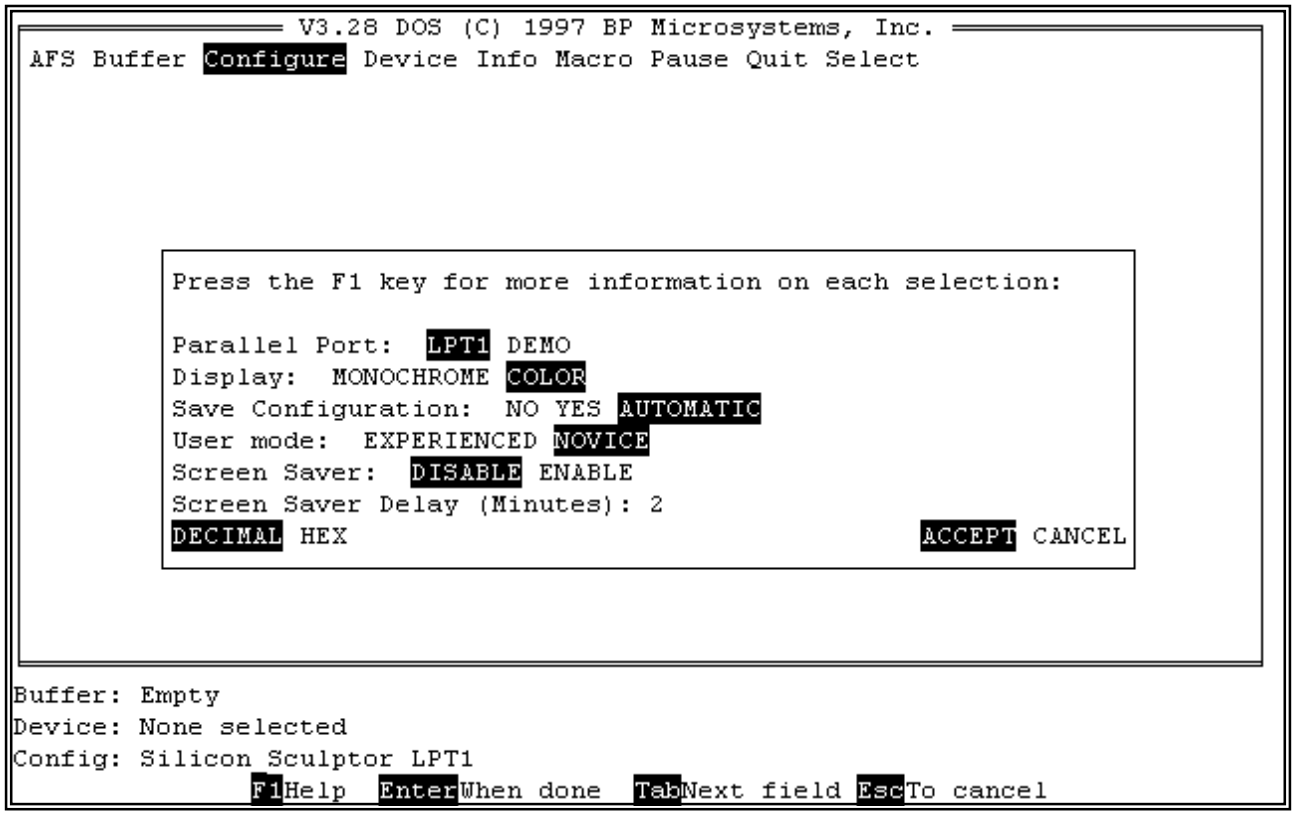
Configure

Description Select the configuration options that control operation of the programmer.

Hot-Key **Alt-C**

Application Select other operating modes, such as: (1) whether you have a color or monochrome display; (2) which parallel port you want the software to look at first when it starts up; (3) when to save the configuration options that have been set under this *Configure* command and under the *Buffer/Options*, *Device/Options*, and *Device/Operations* commands; (4) experienced or novice mode of operation; and (5) whether the startup messages appear.

Operation A dialog box will appear showing the current settings for the startup configuration options.



>> Use the **Tab** key to select the field you want to change.

>> Press the **F1** key on any field to get context sensitive help.

>> Press **Enter** when finished.

+ To make a permanent change, you must select YES or AUTOMATIC in the "*Save/Configuration:*" field.

Parallel Port: This specifies which port to attempt to communicate with a Silicon Sculptor programmer when the software starts up. If a programmer is not found on the specified port, then the software scans other available ports and tries to find a programmer somewhere. If no programmer is found, then it puts itself into a demonstration mode that allows access to all the software features that do not require the presence of a programmer.

Display: When using a color video adapter (CGA, EGA, or VGA), you can choose a black and white display, if desired. If you have a monochrome monitor it is not necessary to change this field. If you are using a laptop, it may be easier to read the screen if you choose a black and white display.

Clear Screen after Commands: ENABLE will clear the screen after each command, DISABLE allows multiple commands to be executed with a history of their result being printed to the screen.

Screen Saver: If enabled, the screen saver will blank out the screen during times of inactivity. The screen saver will be blanked after the specified amount of time has passed with no keystrokes (see *Screen Saver Delay*).

Screen Saver Delay (Minutes): Sets the number of minutes that the screen saver delays before blanking the screen. The valid range is from 2 to 15 minutes.

Save Configuration: YES writes the present configuration back to disk when you press Enter. The next time you start the program, the same configuration will be recalled. It creates a .CFG file in the same directory as the SCULPT.EXE that started the program. Therefore, if you delete this file, the software will revert to its original default configuration.

NO allows you to make changes for this programming session only and will not save the present configuration back to disk.

AUTOMATIC saves the configuration to disk every time you exit the program. The program automatically sets all options and reselects the chip when the software is restarted.

The configuration file will be written to the current directory, allowing you to save multiple configurations in different directories. You can override this feature and always use a single configuration file by setting an environment variable to specify in which directory to store that "SCULPT.CFG" file. Place a line in your autoexec.bat file similar to this one to use a single configuration:

```
set bpcfg = c:\sculpt
```

User mode: Selecting EXPERIENCED instead of NOVICE mode gives you the *Buffer/Clear* command.

Startup messages: The informative messages that appear when the software is started up may be DISABLED with this option.

Decimal or Hex: This selection determines whether numeric fields are entered and displayed in decimal (using 0-9) or hex (using 0-9, A-F). This affects the display of the information appearing on the status line at the bottom of the screen.

+ This is a global command, in that changing this setting within any of the dialog boxes will alter the information displayed in all of the subsequent dialog boxes.

Device/Actel_ChkSum

Description Calculates, displays, and verifies the Actel design checksum for single-site operation.

Application Verify the design checksum of the program file to the checksum value programmed into the device. Also displays the 16 bit checksum and the 20 bit user defined design ID.

Operation

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, the Silicon Sculptor software displays "PASSED." If the two numbers are not the same, the program displays "FAILED," with additional comments to briefly explain why it failed. The checksum and design ID read from the FPGA will be displayed.

+ If you have already programmed the Probe fuse on an ACT 1 or 40MX device, you may not be able to read the Checksum from the device in some cases.

This command displays values read from the FPGA and only works with a single programmer. This command should not be used in concurrent mode with multiple programmers (or multiple programming sites) since it will not give the correct results. Use the Verify_ChkSum command instead for multiple programmers.

Device/Verify_ChkSum

Description Compares the 16 bit checksum programmed into the device to the design checksum in the programming file.

Application Verify the design checksum of the program file to the checksum value programmed into the device. This is a pass/fail test and works in single-site and concurrent operation.

Operation

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, the Silicon Sculptor software displays “PASSED.” If the two numbers are not the same, the program displays “FAILED”.

Since the Checksum is the last data programmed into the FPGA, this command is useful to make sure that a device has been correctly programmed to a given design. This test will screen out incorrectly programmed devices including blank devices, partially programmed devices, and devices programmed to a different design.

+ If you have already programmed the Probe fuse on an ACT 1 or 40MX device, you may not be able to verify the Checksum from the device in some cases.

If you wish to display the 16 bit design checksum, and the 20 bit user ID, use the Actel_Chksum command. However, the Actel_Chksum command will only work for single-site operation.

Device/Blank

Description Verifies that a device is blank (all fuses unprogrammed, or open).

Application Prior to programming, verify that a device has not been previously programmed. This operation is automatically done prior to programming any device.

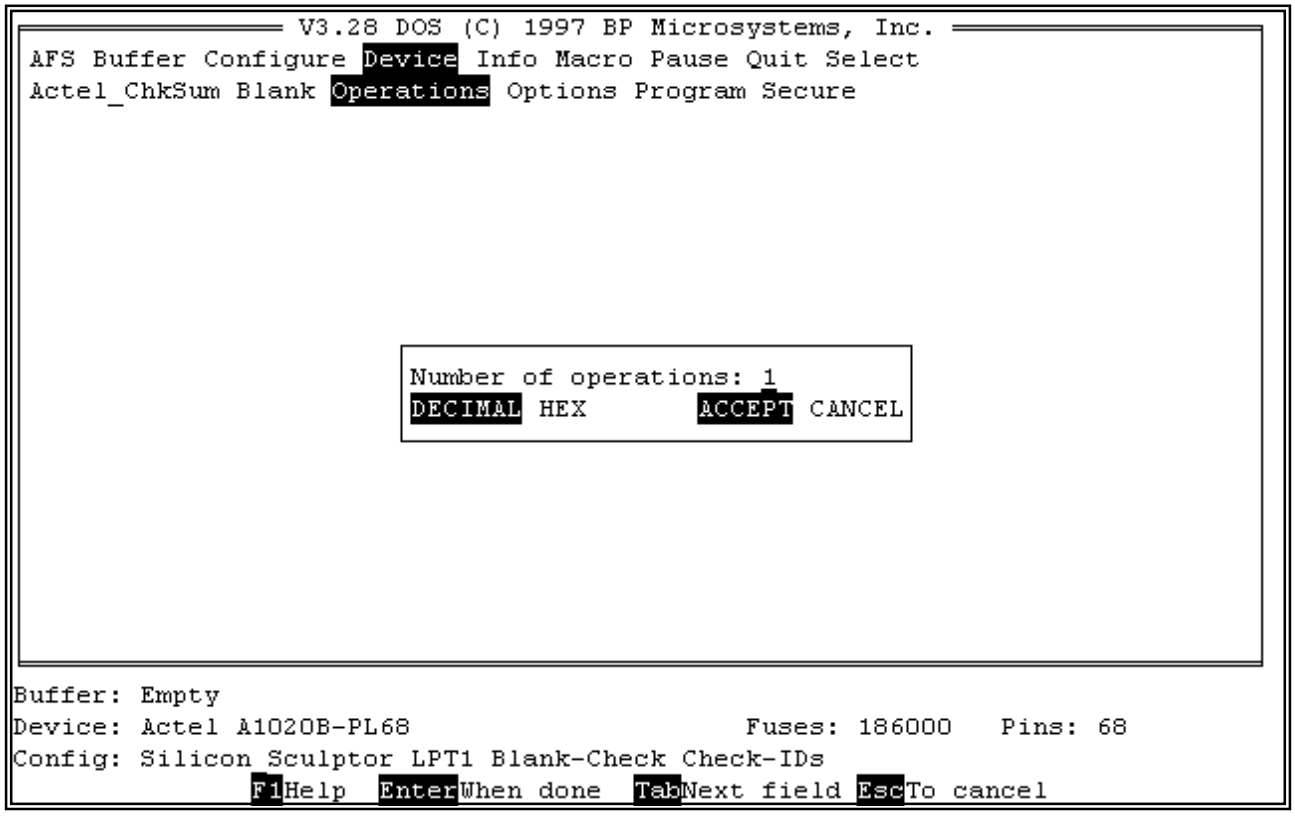
Operation FPGAs are checked by verifying that all of the fuses are unprogrammed. Any new FPGA should pass this test.

Device/Operations

Description Defines the number of device operations performed.

Application Prior to using the programmer in a high-volume production setting, select how many devices will be operated on.

Operation A dialog box will appear showing the number of operations (defaults to 1).



>> Press the **F1** key on any field to get context-sensitive help.

>> Press **Enter** when finished.

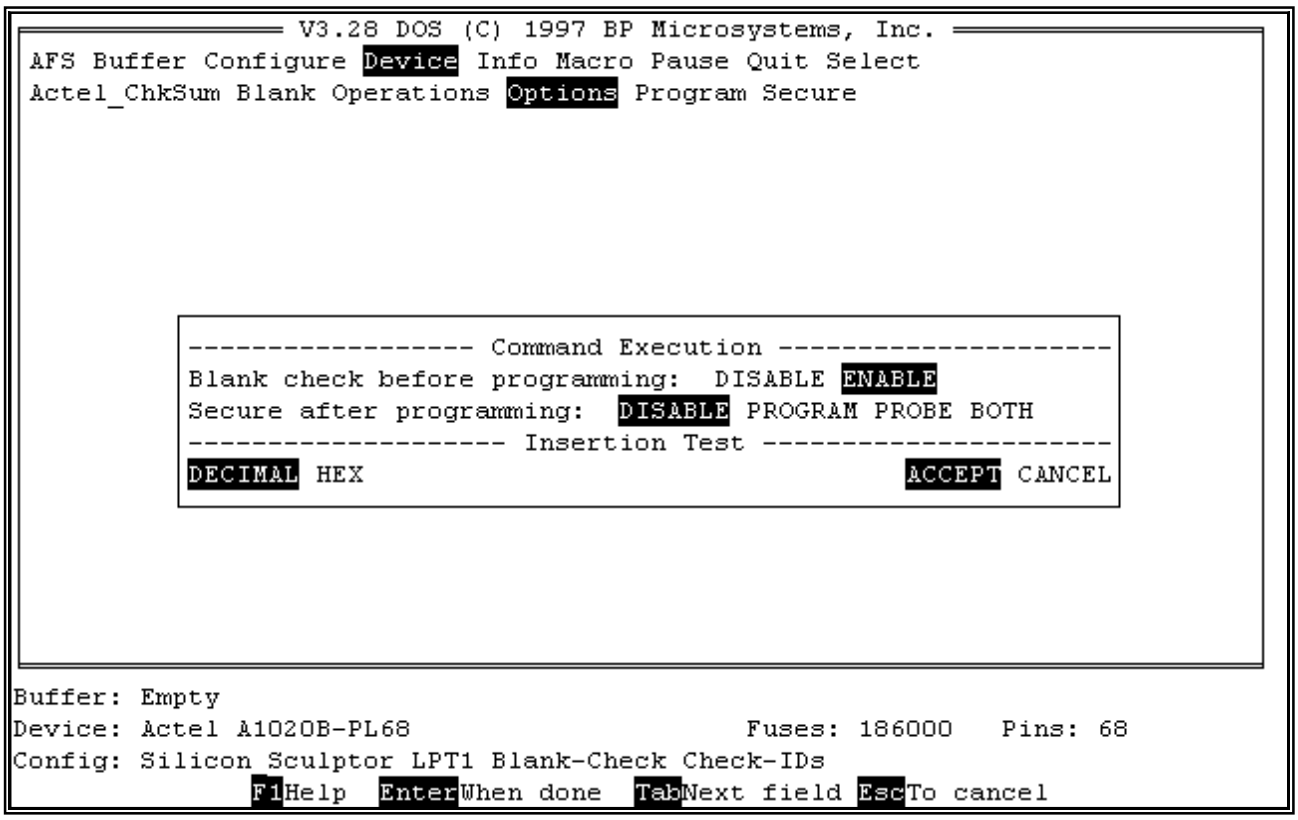
Number of operations: Specify the number of operations for this run. This number is typically the number of chips you wish to program. For concurrent, or multi-site programming, the number of operations must be greater or equal to the number of programming sites.

Device/Options

Description Allows you to specify different programming, reading, and testing options to reflect your target system requirements. This should be done prior to performing a *Device/Program* command.

Hot-Key **Alt-O**

Operation for FPGAs Below is an example of the Device/Options available when you have selected an FPGA:



>> Use the **Tab** key to select the field you want to change.

>> Press the **F1** key on any field to get context-sensitive help.

>> Change selections using the **Left** and **Right** direction keys.

>> Press **Enter** when finished.

Device/Program

Description Program a device from data in the buffer.

Hot-key **Alt-P**

Application To program your design into the device. Also verifies that the correct device type is inserted into the socket and verifies the device is blank (unprogrammed) before programming begins.

Operation for FPGAs Programming failures are a normal and expected result of antifuse-based FPGA design. The guaranteed quality and reliability of 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. Commercial devices typically exhibit a 1-2% failure rate.

If a device fails to program, call Actel Technical Support at 1-800-262-1060 (North America only) or 408-739-1010 with information concerning any problems observed. For normal device failure rates, devices can be returned for replacement by requesting an RMA number. For device failure rates greater than those specified above, a failure analysis can performed.

See Also *Buffer/Load, Device/Options, Device/Operations, Troubleshooting*

Device/Secure

Description Program the security fuse(s).

Application To prevent probing of the device.

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

ACT 1 or 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, ActionProbe, and Silicon Explorer diagnostic tools. Programming the Program fuse prevents further programming of the device, including programming the Probe fuse. The following table summarizes the effects of programming the Security fuses on the PRA, PRB, SDI, and DCLK pins.

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.

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

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 bidirectional pin.

3 If the Probe fuse is programmed, the Probe Circuit is permanently disabled, which disables the Silicon Explorer diagnostic tool.

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 or 40MX Security Fuse Configurations

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

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.

Mode[1]	Security	PRA, PRB	SDI, DCLK
low	-	user-defined I/O	user-defined I/O
high	no	Actionprobe outputs[3]	Actionprobe inputs[4]
high	yes[2]	Actionprobe disabled	Actionprobe disabled

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 ActionProbe and the Silicon 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 non-ACT 1 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 non-ACT 1 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.

Info/Chip

Description Display some characteristic information on the currently selected chip.

Hot-keys **F2 or Alt-I**

Application To provide you with an on-line database of summary programming information on specific chips. This is a useful way to learn which package types are available for a chip and which programmers support a chip.

\+ Special notes regarding the programming or operation of the chip are also found under this command. This command may also be invoked by one of the above hot-keys while on the highlighted chip in the *Select* command. After the information appears for the highlighted chip, you may then use the **Up** and **Down** direction keys to move through the list of chips and continue to get the information for each chip in the list.

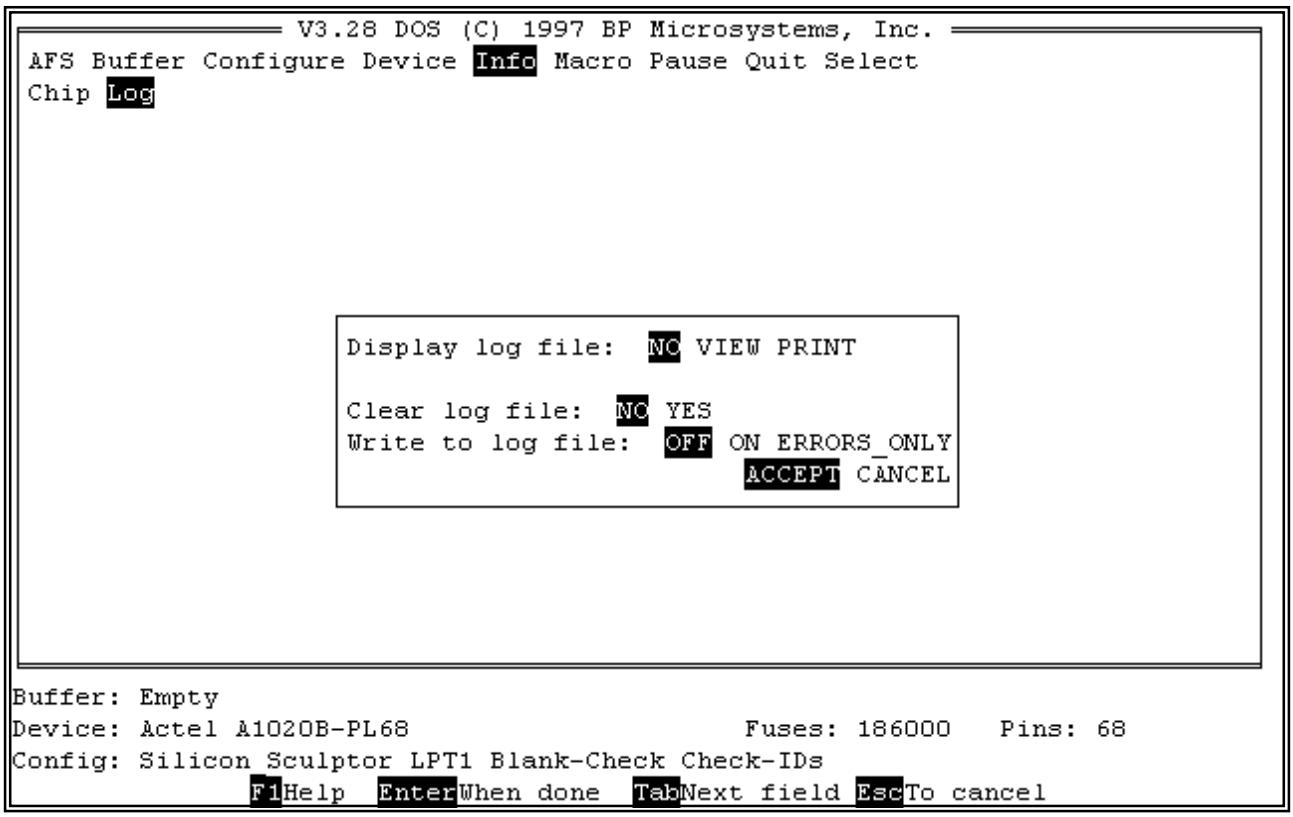
See Also *Select*

Info/Log

Description Send information displayed in main window to a log file.

Application You may create a log of all the activity during a particular programming session. This log file may be viewed at any time, printed, or saved to another file name.

Operation Below is an example of a dialog box:



>> Use the **Tab** key to select the field you want to change.

>> Press the **F1** key on any field to get context-sensitive help.

>> Change selections using the Left and Right direction keys.

>> Press **Enter** when finished.

Display log file: NO allows you to choose one of the other options. VIEW will disable all other options and display the contents of the current log file in the main window, allowing you to press any key to see the next full screen. PRINT disables the "*Clear log file:*" and "*Write to log file*:" fields and enables the "*Send log file output to:*" field (see below). It will let you print to the default printer or to a file name specified by you.

Send log file output to: This option appears only when PRINT is selected in the above "*Display log file*:" field. It allows you to print to the default printer port or specify your own printer port or file name. Simply hit Enter if you want to send it to the **LPT** port shown, or **Esc** to cancel.

Clear log file: This option allows you to clear the current contents of the log file. It is important to do this periodically; otherwise, the size of the file will get so large that it will use up a substantial amount of disk space.

Write to log file: ON simply opens the current log file and appends all subsequent writes to the main window to the opened log file. The file will grow until this option is set back to OFF. The file is not cleared until you do it with the above "*Clear log file:*" option. Thus, you can record some (ON), stop (OFF), record some more (ON), stop (OFF), ...etc., until you have all the information you are interested in saving. At this point you will probably want to print the log file and then clear it for future use.

+ This log file is written in the current directory and is named SCULPT.LOG.

Macro/Debug

Description Play a sequence of commands stored in a macro file and pause after each line read from the file.

Application This command is intended for advanced users of macro commands. It is useful when you have generated your macro files by some other means than the *Macro/Record* command. For example, you used an editor or wrote your own program to generate the macro files, and now you are encountering problems with the *Macro/Play*.

Operation A selector box appears showing all the macro files (.PGM) in the directory specified.

>> Choose the desired directory by editing the "*Directory:*" string (*e.g.*, C:\MACROS*.PGM).

>> Highlight the desired file name using the cursor up and down keys.

>> Press **Enter** twice to execute the file.

The command sequence stored in the macro file is played back with a pause after each line read from the file and after a dialog box has been filled.

See Also *Macro/Play, Macro/Record*

Macro/Finish

Description Terminate a sequence of commands you are recording into a macro file.

\+ **Note**: this command appears only while you are recording a macro file.

Application This command ends a macro file.

Operation Executing the command will terminate the macro file. The last command executed prior to this command will be the last command in the macro file. When the macro file is executed, the programmer will be left in command mode once the macro file ends.

See Also *Macro/Record*

Macro/Play

Description Play a sequence of commands stored in a macro file.

Hot-keys **Alt-0...9** or **Alt-F1...F9**

Application This command saves time when doing a series of operations for a specific chip. You may record a macro file for each chip you commonly program.

Operation A selector box appears showing all the macro files (.PGM) in the directory specified.

>> Choose the desired directory by editing the "*Directory:*" string (*e.g.*, **C:\MACROS*.PGM**)

>> Highlight the desired file name using the cursor up and down keys.

>> Press **Enter** twice to execute the file.

The command sequence stored in the macro file is played back. Macro files are easily written to perform common operations, such as configuring the programmer, selecting a chip, loading a file, and programming the chip.

+ If you used one of the digits from **0-9** or a function key (**F1-F9**) as your macro file name, you may now use the **Alt** key and that same key to automatically play the macro file. This saves you time by not requiring that you execute the *Macro/Play* command every time you wish to play your macro.

+ If you have problems with playback, the macro file may not have been recorded with the *Macro/Record* command. You may want to use the *Macro/Debug* command to determine where the error lies.

See Also *Macro/Debug; Macro/Record*

Macro/Prompt

Description Displays a message to a macro file user.

+ **Note**: this command appears only while you are recording a macro file.

Application It is used to impart information to a macro file user. You may want to create macros that tell the user of the macro what to do next, such as insert a particular chip or place a specific disk in the appropriate drive.

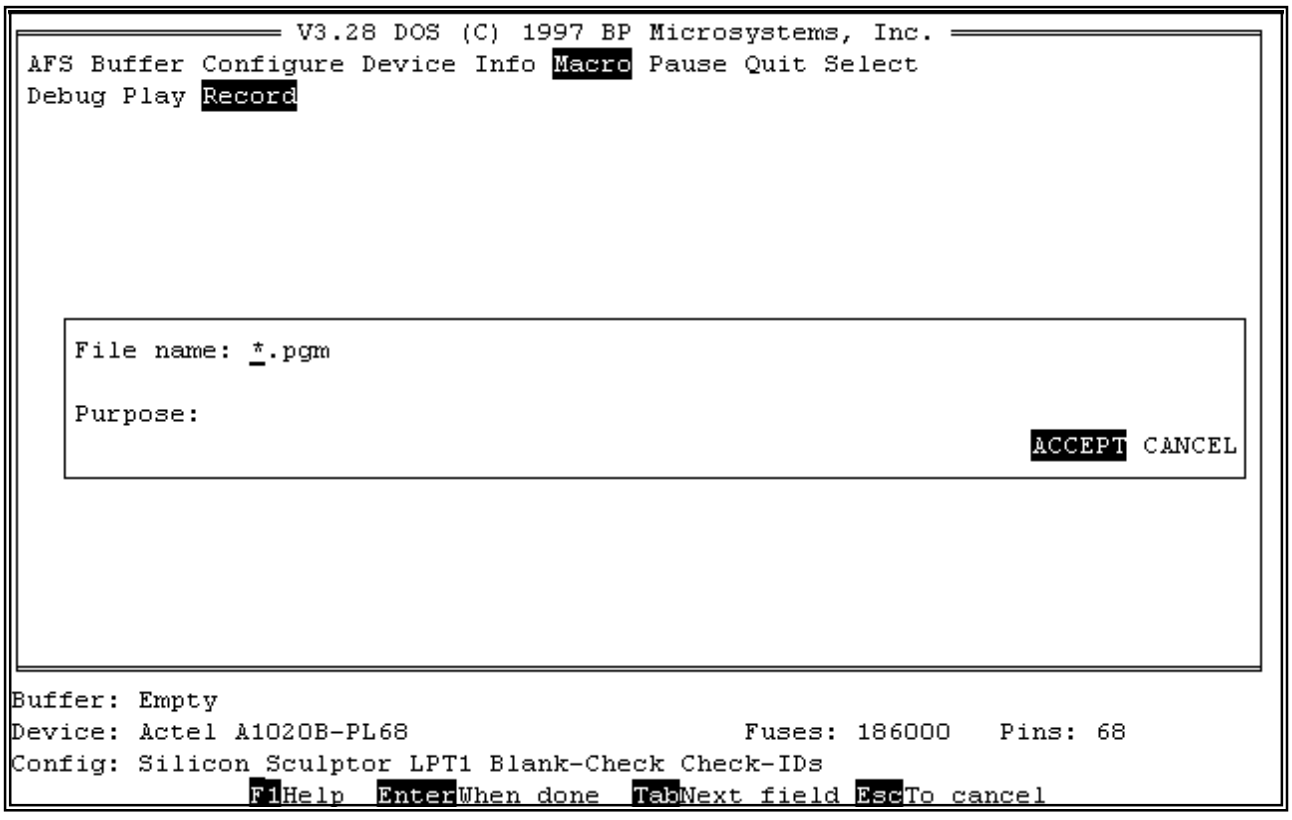
Operation Enter up to four lines of text in the dialog box. When the macro file runs, the text will appear for the reader to observe. The user must press a key to continue the macro file execution.

Macro/Record

Description Store a sequence of commands in a macro file.

Application Store commonly used command sequences in macro files to speed up operation and reduce operator errors. Macro files can be played back from the *Macro/Play* command, from the DOS command line, from a batch file, from a make file, or from another macro file.

Operation A dialog box appears showing all the macro files (.PGM) in the directory specified:



>> Select the desired drive, directory, and file name to create. If you use one of the keys **0...9** or **F1...F9** as the file name, you may execute the macro by using the **Alt** key and the corresponding key. Otherwise, you must use the *Macro/Play* command to execute a previously recorded macro.

>> You may include a comment for your own reference in the file generated by moving the cursor to the "*Purpose:*" field and entering a comment. The comment appears in the second line of the file, when viewed with a text editor.

>> Pressing **Enter** executes the command, and the software records every command you execute thereafter.

>> When finished, terminate recording by using the *Macro/Finish* command or *Quit*. If you want the macro file to leave the user at the DOS prompt after the file plays, use the *Quit* command. *Macro/Finish* lets the user perform other functions, such as chip programming.

\+ You can include user-prompts by executing the *Macro/Prompt* command while recording.

See Also *Macro/Play; Macro/Finish; Macro/Prompt*

Pause

Description Execute a DOS shell.

Application Execute DOS commands, then return to the programmer in its present configuration.

Operation The DOS command interpreter is started as a subshell. Normal DOS commands can be entered. When you want to return to the programmer, type the *EXIT* command at the DOS prompt.

+ If no DOS shell is created, you may not have enough available memory to generate a DOS shell. You will have to use the *Quit* command instead, and then return back to the programmer by executing the SCULPT.EXE file again. You may be able to free more base memory by adding EMS memory or by changing your CONFIG.SYS and AUTOEXEC.BAT files.

Quit

Description Exit the program and return to DOS.

Hot-key **Alt-X**

Operation You are returned immediately to DOS. Any buffer changes will be lost; however, if you have "*Save Configuration:*" set to AUTOMATIC in the *Configure* command, then all the options you have set during this session will be saved and restored the next time you start the software.

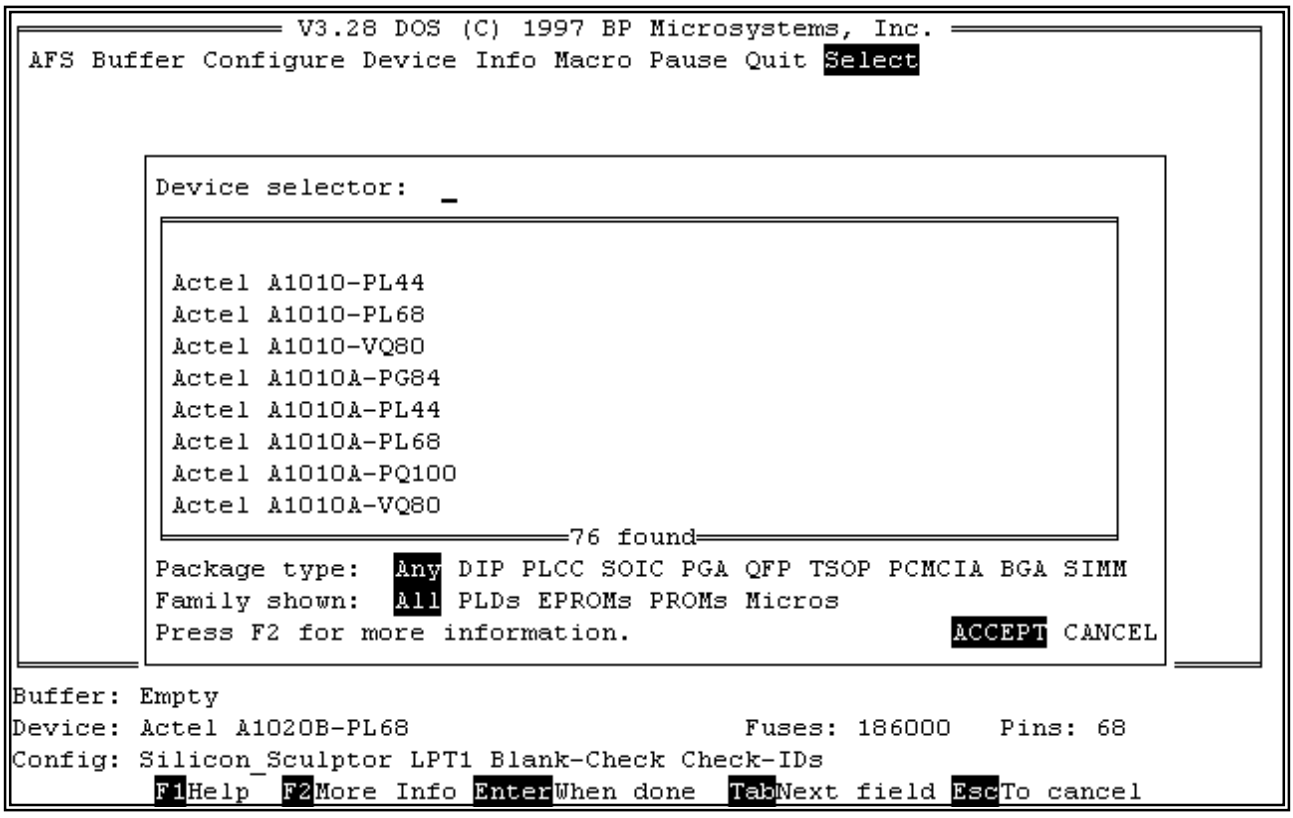
Select

Description Specify the Actel FPGA part number to select the proper programming algorithm.

Hot-key **Alt-S**

Application Selecting a device will configure the programmer for the correct programming algorithm. The algorithm includes voltage, timing, and pinout requirements. You must use this command before programming or performing any other device operations.

Operation A dialog box appears containing a list of devices. Initially, the device list contains every part the programmer currently supports. As you type letters and numbers, the device list narrows to include only those names containing the characters you type, in the order you type them. Pressing **Enter** will select the part that is highlighted. The algorithm status line at the bottom of the screen will be updated to show the part number, number of pins, and organization.



Package type: You may want to use the Tab key to move to this field and select a specific package type to see what devices are supported in that particular package.

Note: this is not required before programming a chip with a different package type; it is provided only for your information. It is easiest just to leave it in the "Any" position, unless you are exclusively using one package type. The Silicon Sculptor will automatically interrogate the socket module you have attached to determine the proper programming pinout.

See Also *Device/Program, Info/Chip*

Chapter 5 — Tips

System Configuration For SCULPT.EXE

Minimum Configuration For SCULPT.EXE

A 286 or better CPU.

At least 4MB of memory for DOS (8MB recommended). 16MB for Windows 3.1, 95, or 98.

+ We do NOT require a memory manager to be present.

If a memory manager is present, it must conform to either the VCPI or DPMI specifications. Most modern memory managers (including Windows) conform to both specifications.

Configuring Memory Managers To Run With The DOS Extender

HIMEM.SYS and EMM386.EXE

(DOS 4.X Only)

EMM386.EXE must be removed from the CONFIG.SYS file or the system must be upgraded to a newer version of DOS.

Alternately, HIMEM.SYS and EMM386.EXE can be replaced with either QEMM or 386MAX. 386MAX is recommended above QEMM.

+ We require either the VCPI or DPMI interface in order to shift the processor into protect mode. Almost all memory managers shipped today meet the VCPI standard. Unfortunately, the memory manager shipped with DOS 4.X does not meet either of these industry standards. Upgrading to a newer version of DOS will solve the problem.

HIMEM.SYS and EMM386.EXE

(DOS 5.X Only)

Make certain that the NOEMS option **does not** exist on the EMM386 line. If it does, change the line:

DEVICE=C:\DOS\EMM386.EXE NOEMS [...]

To

DEVICE=C:\DOS\EMM386.EXE **FRAME=NONE** [...]

+ We require either the VCPI or DPMI interface to shift the processor into protect mode. EMM386 for DOS 5.X only supports the VCPI interface. The NOEMS option disables the VCPI interface along with the EMS interface. EMM386 for DOS 6.X does not suffer from this limitation and can use the NOEMS option without any problems.

HIMEM.SYS and EMM386.EXE

(DOS 6.X Only)

There are no known additional requirements for this configuration.

HIMEM.SYS and EMM386.EXE

(MS Windows 3.1)

This is essentially the same memory manager that shipped with DOS 5.X. It should therefore be configured the same way.

Make certain that the NOEMS option **does not** exist on the EMM386 line. If it does, change the line:

DEVICE=C:\DOS\EMM386.EXE NOEMS [...]

To

DEVICE=C:\DOS\EMM386.EXE **FRAME=NONE** [...]

+ We require either the VCPI or DPMI interface to shift the processor into protect mode. The version of EMM386 that ships with Windows 3.1 only supports the VCPI interface. The NOEMS option disables the VCPI interface along with the EMS interface. EMM386 for DOS 6.X does not suffer from this limitation and can use the NOEMS option without any problems.

QEMM (Version 6.X)

Verify that the NOEMS option **does not** exist on the QEMM line in the CONFIG.SYS file. If it does, change the line:

DEVICE=C:\QEMM.SYS NOEMS [...]

To

DEVICE=C:\QEMM.SYS **FRAME=NONE** [...]

+ We require either the VCPI or DPMI interface to shift the processor into protect mode. QEMM only supports the VCPI interface. The NOEMS option disables the VCPI interface along with the EMS interface.

386MAX (Version 7.X)

386MAX supports both the VCPI interface as well as the DPMI interface. There are no known problems running with this memory manager.

General Information

The Silicon Sculptor will operate from 90V AC TO 260V AC, at 50 or 60 Hz. It does not need to be switched for 120/240 operation.

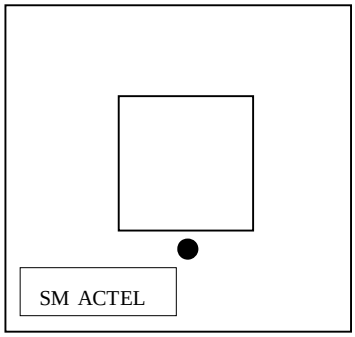
The Silicon Sculptor incorporates a special protection circuit that disables all pin drivers during power up and power down. This protects any device that may be in the programmer site when the unit is turned off, so you don't have to worry about leaving devices in the programmer site.

Socket Module Pin 1 Orientation

Each socket module for the Silicon Sculptor has been designed to be as versatile as possible by supporting all devices of a given package type from each device family. Some of the modules are capable of supporting different pin counts of a particular package type.

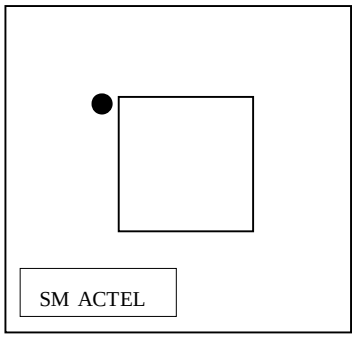
Each module displays the module name as well as a mark indicating the location of pin one on that module. The following illustrations show exactly what should be looked for to determine the location of pin one on each module.

PLCC



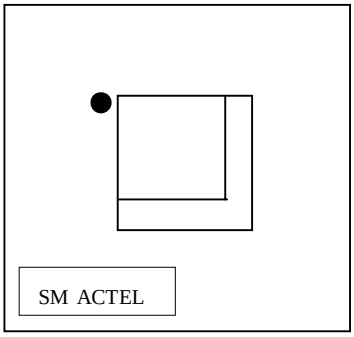
The PLCC modules show pin one on the side closest to the user.

QFP



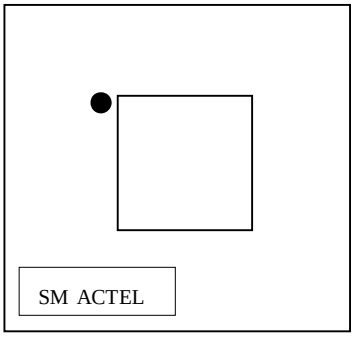
The QFP modules have the pin one indicator in the upper left-hand corner. Please use caution, as there may be exceptions to this convention.

PGA



The PGA modules are configured with pin one being in the upper left-hand corner. Some of the PGA modules are designed to accommodate different PGA package sizes. Smaller devices should be top left justified as shown in the diagram.

BGA



BGA modules also reference pin one in the upper left-hand corner. Each module will only support one package size.

Chapter 6 — Troubleshooting

TABLE OF CONTENTS

In This Chapter

The information in this chapter may help you solve or identify a problem with your programmer. If you have a problem that you cannot solve, please call us. We are dedicated to making Silicon Sculptor programmers as trouble-free as possible.

How to Reach Us

Technical Support— North America Only: 888-99-ACTEL (992-2835) or 800-262-1060

Technical Support— Direct: 408-739-1010 (Voice), 408-739-1540 (Fax)

E-Mail— tech@actel.com

Web Page— www.actel.com

Software

The control software for your programmer is updated on a frequent basis to add features and provide you with support for new chips.

Our policy is to resolve user issues as quickly as possible, often within a day or two, and to release update software immediately on the Web. Therefore, if you have encountered a software issue, there is a good chance that it has already been fixed and placed on the Web.

+ We recommend that you obtain the latest software revision before calling our support line with a software problem. Many of our technical support calls result in the user obtaining the latest version of the software.

Calling the Technical Support Line

You can obtain technical support from Actel by calling 1-800-262-1060 (North America only) or 408-739-1010. You can also reach us by fax at 408-739-1540 or send email to tech@actel.com. We request that you have the following information ready when you contact us:

- Your software version number (from the top of the screen)
- The exact error message and error number you received
- The exact algorithm that was selected (bottom of screen)
- The exact part number on the chip you were trying to program
- The command you executed
- The results of running the **Alt-D** self-test command on your programmer

It is also useful to have a print-screen of the error, or to print out a log of the error (see *Info/Log* command). You may be asked to upload your file and/or send in your devices so we can analyze the error at the factory.

+ If you need to return your programmer to Actel for any reason, you must call and get a Return Material Authorization (RMA) number before shipping; mark the RMA number clearly on the shipping container. Be sure to include a description of the problem experienced, a return address, contact person and a phone number.

Testing the Hardware

The programmer can test its own hardware quite extensively. The self-test routine can detect problems in the pin-drivers, power supply, microprocessor, data cable, printer port, and several other circuits. The hardware test cannot detect problems resulting from a dirty socket (see below). To execute the test:

- Remove any chips from the programmer sites
- Press **Alt-D** hot-key
- Choose to test a single unit or all units
- Watch the screen for any error messages

+ If you receive an error during the test, please call Technical Support for assistance.

Power-on Self-Test (POST)

When power is applied to the programmer, it performs a power-on self-test (POST). This test checks RAM, ROM, CPU, analog circuits, and basic system integrity.

Note: Do not attempt any programming operations until the POST is complete.

If the POST fails, the red ERROR LED will be on. Failure codes are:

3 short flashes	Cannot Self-Calibrate
2 short flashes	ROM checksum error
1 short, 1 long flash	RAM error

ERROR MESSAGES

Error 3: Cannot reset hardware

The software cannot establish communications with the programmer. Here are some suggestions:

- Be sure the programmer has proper power and that the power LED is on.
- Make sure the cable from the programmer to the computer is properly connected to a parallel printer port. If you are using a ribbon cable, this is probably the problem (ribbon cable connectors are designed for use inside a chassis where the cable is not flexed). You should use a shielded 25 conductor cable (not an RS-232 cable).
- Your LPT port could be the culprit. If you have multiple parallel ports, you may have the ports configured incorrectly; that is, two at the same address. Some laptops have the ability to disable the port. If you have one, make sure the LPT port is enabled.
- Another program may be interfering with the port such as a print cache. When running under Windows, you increase the potential of another program trying to access the same parallel port and changing the expected status at the port.
- If you have a hardware lock key between the programmer and the port, then try removing it.
- Last but not least, the programmer may be damaged. Try another computer and/or parallel port and see if it works there. See *Calling the technical support Hotline* in this chapter.

Error 4: Excessive current detected. The protection circuit has shut off the power.

The command was aborted to protect the programmer and hopefully not damage the chip. The device was taking too much current from the programmer. Possible causes are:

- The device may be inserted backwards and the continuity test has been turned off or did not successfully detect the device.

- The wrong algorithm could be selected and improper voltages were applied to the chip in the programmer site.
- If using a programming adapter, there could be a short.
- You may want to remove the chip and run the hardware test (**Alt-D**) to make sure all the pin drivers are functioning correctly. If the hardware passes the test, be sure you have the correct algorithm (device entry) selected for your device. If the error still occurs and you are sure the device is inserted correctly, then you should suspect a faulty device.

Error 5: Hardware time-out.

This error message is generated when the software was waiting on a response from the programmer while executing a command and the programmer did not respond within the expected amount of time. This error may result from several causes. You may be experiencing communication errors (see "*Error 3: Cannot reset hardware*" above). There may be a bug in the software for this particular algorithm (see *Error 10: Error in programming algorithm*" below. See also *Power-on Self Test* above.

Error 6: Wrong model number.

See "*Error 3: Cannot reset hardware*" above for possible causes.

Error 8: LPTx: is not a functioning port.

The parallel port LPTx (where x=1, 2, or 3) that is selected with the *Configure* command does not exist in your computer, is not functional, or has a bad cable connected to it.

Error 9: Programmer execution error.

The programmer failed an internal consistency check. See "*Error 3: Cannot reset hardware*" and "*Error 5: Hardware time-out*" above for possible causes.

Error 10: Error in programming algorithm. Please call technical support.

The software has detected an internal error. You should contact Actel to report the error. You may need to obtain a software update. See *Calling the technical support Hotline* in this chapter.

Error 11: There is no data in the buffer. You must load a file.

A command tried to read data from the buffer to program or verify a chip, but nothing has been loaded into the buffer yet or the buffer was recently cleared.

Error 14: There is no chip in the programmer site.

Be certain that your chip is inserted correctly. If the chip was inserted correctly, remove it and run the hardware self-test to be sure your programmer is functioning correctly (**Alt-D**). A defective chip may cause this error.

Error 15: The chip is not inserted in the programmer site correctly.

The continuity test determined that the chip in the programmer site does not have continuity on all the proper pins. You should examine these pins carefully. Possible causes are:

- A bent pin.
- The chip is not in the proper position in the programmer site.
- The chip has a different number of pins than the chip selected.
- The algorithm selected has a '*', indicating it requires an adapter, but you did not use the adapter, or vice-versa.
- The socket is dirty and not making a connection.
- The wrong socket module or adapter is being used for this device.

Error 16: The chip is inserted backwards.

The chip has passed the continuity tests, but appears to have the GND and Vcc pins improperly placed in the socket. If the PLCC, or QFP is not accidentally rotated, then the device is probably defective. Try a known good device.

Error 17: Out of base memory. You should have at least 200K free.

Your computer's configuration does not have enough RAM available to run the software. You should have 640K RAM installed with at least 200K available for program execution. Memory resident programs, such as network drivers, may reduce the RAM available to the programmer, so you may need to remove these programs from your CONFIG.SYS and AUTOEXEC.BAT files. If you are using DOS 5.00, you can specify that DOS be loaded into high memory, saving base memory for Silicon Sculptor software. See your DOS manual for details. The *mem* or *chkdsk* command will show you how much conventional memory is available.

Error 18: Temporary file error.

Our software's virtual memory manager is trying to store data that is currently not needed in RAM to the disk. The program was unable to create a temporary file or the disk is full. You should make sure you have plenty of disk space (the larger the data files, the larger the requirement for temporary disk space) and set the DOS environment variable TMP to point to the directory you wish to use for swap space. The program does take advantage of EMS memory if you have an expanded memory manager installed. This is much faster than using the disk for temporary swap space. If you want to specify that your hard disk (C:) can be used for temporary file storage, then execute the following command in your AUTOEXEC.BAT file:

```
SET TMP=C:\
```

Error 21: Cannot program.

Not able to program the device in the programmer site. See *Errors While Programming* in this chapter.

Error 23: Invalid electronic signature in chip (device ID).

The chip may be damaged.

Error 24: Invalid electronic signature in chip (algorithm ID).

The chip may be damaged.

Error 25: Invalid electronic signature in chip (manufacturer ID).

Actel FPGAs have electronic identifiers that specify the manufacturer, the device code, and the proper programming parameters. The most common cause of this error is selecting one type of device in the Selection menu and inserting a different device in the socket.

Error 26: Device is not blank.

The *Device/Blank* command was executed or the "*Blank check before programming:*" option was enabled in the *Device/Options* dialog box and the device in the programmer site is determined to have programmed data. Possible causes are:

- The device was previously programmed and cannot be erased.
- The wrong algorithm was used.

Error 27: Device is not secured.

An attempt to secure a device was made, but it failed. See *Errors While Programming* in this chapter.

Error 31: Database file is invalid. The .EXE file is corrupted.

The .EXE file you are executing has been corrupted. You should get a new copy from Actel. See *Calling the technical support Hotline* in this chapter.

Error 32: Sorry, algorithm not found. Please call technical support.

The .EXE file you are executing has been corrupted. You should get a new copy from Actel. See *Calling the technical support Hotline* in this chapter.

Error 33: You must reselect the chip you want to program.

The device was selected before establishing communications with the programmers, perhaps prior to turning on the programmer or before switching to a different programmer. Simply reselect the chip and you will be in business again.

Error 36: You must properly install the correct socket module.

On the Silicon Sculptor, the software interrogates the socket module before each operation to determine the correct mapping for the algorithm selected. You will get this error if:

- There is no socket module installed.

- The socket module installed does not support the device you have selected (*e.g.*, you have selected a 100 pin device and you have a 208 pin PQFP socket module attached).
- The socket module installed is not supported by the version of the software you are using. Use the latest version.
- The pinout has not yet been defined for this package type. It may be an oversight on our part. If so, please call technical support and inform us of this problem.

Error 39: Device already secured.

The device cannot be legitimately programmed because it has been secured.

Error 41: Error reading file.

The *Buffer/Load* command was executed inside a macro file and the buffer could not be loaded. This error message is not displayed on the screen, but is returned to DOS when the software is being run via a batch file.

Error 43: Error in macro file.

A macro file was being played back and an error was detected in the syntax of the file. Possible causes are:

- The macro file is corrupted.
- The macro file was recorded with an earlier version (<V2.00) of the software.
- The macro file was generated by a user's application or text editor and does not conform to the proper macro file format.

Error 44: Internal error. Please call technical support.

The software detected an internal inconsistency. This may be caused by the computer not performing correctly.

Error 45: Hardware requires calibration. Please call technical support.

The self-test (**Alt-D**) has detected that the hardware is improperly calibrated. The unit must be returned for repair. See *Calling the technical support Hotline* in this chapter.

Error 46: AFS software required to execute this function.

This is a function that is available to users that have purchased the Advanced Feature Software only. In order to use the chosen function you must buy the AFS upgrade. See *Calling the technical support Hotline* in this chapter.

Error 47: Self test failed. This unit may need service. Please call technical support.

The self-test (**Alt-D**) has detected a hardware problem. The unit may need to be returned for repair. Note the exact error message and see *Calling the technical support Hotline* in this chapter.

Error 50: Device sum does not match sum specified in AFS/Options.

The sum calculated on the device does not match the sum entered in the *AFS/Options Checksum Verify* command. Check this option to see if a mistake was made when entering the sum value. Also check the buffer checksum to see if it matches the value entered for *Checksum Verify* or if any data in the buffer has changed.

Error 52: DynCall Stack Underflow.

The internal dynamic linker underflowed its reference table. If this error reoccurs, then call the Actel Technical Support Line.

Error 53: DynCall Stack Overflow.

The internal dynamic linker overflowed its reference table. If this error reoccurs, then call the Actel Technical Support Line.

Error 60: The demo period for this programmer has expired.

This programmer is a demo from Actel and the demo period has expired. Call the Actel Sales Department for an upgrade code to extend the Demo period.

Error 61: Concurrent programmer did not initialize properly.

The Silicon Sculptor Concurrent programmer did not initialize correctly. Cycle the power on the programmer and try your operation again. If you continue to get this error message, send the programmer in for repairs.

Error 65: Concurrent Unit has the wrong socket module.

The specified programming site does not have the same socket module as the master site. The site must contain the same socket module as the master programmer in order to program devices on that site. The site has been temporarily disabled. Starting a new device operation with the correct socket module on the site will re-enable the site.

Error 66: Concurrent unit has the wrong technology adapter.

The specified programming site has the wrong technology adapter (TA). Cycle the power on the programmer. If the error persists, call Actel Technical Support.

Error 67: Concurrent unit has the wrong BIOS.

The specified programming site has the wrong BIOS. Cycle the power on the programmer. If the error persists, call Actel Technical Support.

Error 68: Concurrent unit has the wrong number of pin drivers.

The specified programming site has the wrong number of pin drivers. Cycle the power on the programmer. If the error persists, call Actel Technical Support.

Error 69: Concurrent unit is not available.

The specified programming site is not responding to commands. Verify that the programmer number is correct. Cycle the power on the programmer and try again. If the error persists, call Actel Technical Support.

Error 70: The buffer data cannot be used to program this device.

You loaded a file type that is not a valid option for the currently selected device. Re-select the device and load the buffer again. If the error persists, call Actel Technical Support.

WARNING MESSAGES

Warning: Device is not blank

You will get this warning when using the *Device/Program* command with the "*Blank check before programming*" operation enabled in the *Device/Options* dialog box. You are given the option to "*Abort, Retry, or Ignore*".

Warning: Device has been secured

You will get this message only on devices that have the ability to read the security bit prior to performing any other operation. You are given the option to "*Abort, Retry, or Ignore*".

FIELD REPAIRS

The Silicon Sculptor Concurrent Programmer has a fault tolerant design. If one of the sites quits functioning you can continue using the other sites until the down site can be repaired.

This section explains how to identify a failed unit and disconnect it from the system, so you can continue programming with all other functioning programmer sites. The replacement of circuit boards (PCBs) at a failed site is also covered in these instructions.

Please call Technical Support anytime for assistance at 1-800-262-1060 (North America only) or 408-739-1010.

Self-diagnostics Test

Remove any chips from the programmer sites before running the diagnostics test. Select *Actel Diagnostics* from the *Select* menu and press <enter> on *Device/Test*, or use the hot-key combination **ALT-D**, to invoke the self-diagnostics test. If you already know which site is failing you can run the diagnostics on just that site. If the entire system is not working, select *All Sites*. The software will indicate which site is bad.

Swapping Socket Modules

If a problem occurs with one particular site, you can determine if the problem is with the socket module or the internal circuits by swapping socket modules with another site. If the socket module works on another site and the one you replaced it with fails, the problem is probably with the internal circuitry. If the socket module is bad, call Technical Support so that a Return Material Authorization (RMA) can be issued for the replacement or repair of that module.

Configuring for Concurrent Operation

If you wish to connect three or more units together, please follow the steps below (this is for units 2, 3 and 4 only – no modifications are needed for unit 1).

+ Note: You will need the custom expansion cable for concurrent operation (more than two units only).

1. Turn off power. **DISCONNECT THE POWER CORD AND PARALLEL CABLE!**

2. Remove any socket module from the programmer.

3. Turn programmer over so that the bottom chassis is on top. This will make it easier to separate the top and bottom chassis.

4. Remove screws from the chassis and lift the bottom chassis up and over the back, taking care not to disturb the power supply connections.

5. Locate DIP switch SW1 on the motherboard. It will be positioned close to the power connectors and ribbon cable.

6. The DIP switch represents the ID of the unit as a binary value. A switch in the "on" position represents a "0" while "off" represents a "1". Switch 1 is the least significant bit of the ID.

7. Switches 1-5 control the ID of the unit. **DO NOT MODIFY ANY OF THE REMAINING SWITCHES OR THE SYSTEM WILL NOT FUNCTION PROPERLY!** Move the switches to the positions shown for each unit.

Unit #2 Setting:

Switch:	1	2	3	4	5	6	7	8
Setting:	Off	On	On	On	On	Off	On	On

Unit #3 Setting:

Switch:	1	2	3	4	5	6	7	8
Setting:	On	Off	On	On	On	Off	On	On

Unit #4 Setting:

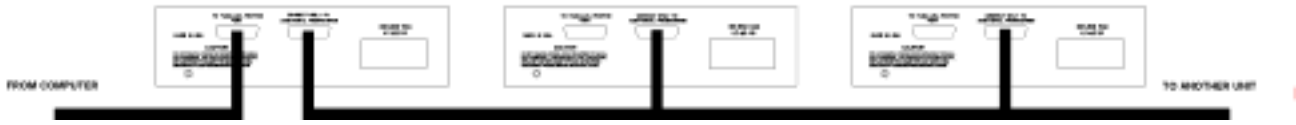
Switch:	1	2	3	4	5	6	7	8
Setting:	Off	Off	On	On	On	Off	On	On

8. Read the label on the motherboard.

- If you have the CPCB10 motherboard, perpendicular to SW1 is a register pack labeled RP1401. This is a 10 pin SIP (Single in-line package) device. Carefully remove this from the unit.
- If you have the CPCB11 motherboard, proceed on to the next step.

9. Replace the chassis bottom and install the chassis screws.

10. Reconnect the cables as shown.



11. Run the Actel Diagnostics test to ensure all units are communicating properly.

Appendix 1—
Silicon Sculptor Specifications

SOFTWARE—

File Type:	AFM, DIO
Device Commands:	Blank, check sum, options, program, secure
Features:	Revision history, session logging, on-line help, device and algorithm information

HARDWARE—

Diagnostics:	Pin continuity test, RAM, ROM, CPU, pin drivers, power supply, communications, cable, calibration, timing, ADC, DAC
Memory:	4 MB DRAM (8 MB recommended) if running DOS. 16 MB for Windows 3.1, 95, or 98.
Pin Controllers:	80286 CPU. One per programming site.
Programming Sockets:	One (a maximum of four Silicon Sculptor's can be connected together in concurrent operation with the custom expansion cable part number SS-EXPANDER). Six programming sites for Silicon Sculptor 6X (a maximum of two 6X programmers can be connected for a total of twelve programming sockets).
User Interface:	3 LEDs (pass, fail, active) and one start switch per socket

PIN DRIVERS—

Quantity:	84 per programming site. Pin drivers and waveform generators are fully independent and concurrent on each programming site.
Voltage:	0 to 25.00V in 25mV steps
Current:	0-1A, 15uA resolution
Slew rate:	0.001 to 2500 V/µs
Timing:	1µs - 1s ± 1µs, ±0.01%
Clocks:	1 MHz to 16 MHz, any pin
Protection:	Overcurrent shutdown, power failure shutdown

GENERAL—

Power: 90-260 VAC, 47-63 Hz, 1.2 KVA, IEC inlet connector for worldwide use

Mass: 7 lbs. (3 kg.) for single site version. 33 lbs. for 6X version.

Dimensions: 11 in. x 12.25 in. x 3.25 in. (28 cm. x 31 cm. x 8.25 cm.) for the single site version. 32 in. x 16 in. x 4 in. for Silicon Sculptor 6X.

Maintenance: Replace worn socket as required

STANDARD ACCESSORIES—

Software disk

User's Guide

Power cable

Communications cable

OPTIONAL ACCESSORIES—

Four unit expansion cable (male connectors – DB25, 25 conductor shielded round cable)

OTHER FEATURES—

Operator Mode: The software may be configured to allow only loading jobs to help eliminate the possibility of an inadvertent mistake

File Loading: Automatic file type identification; no download time because program is PC controlled; supports AFM, DIO and other file formats

Device Selection: Intelligent device selector allows you to type as little or as much of the part number as you like, then choose from a list of devices matching your description

Algorithm Updates: Algorithm changes and algorithm updates are available free of charge.

Programming Yield: Assured by independent universal pin drivers on each socket, short distance from pin drivers to device, and accuracy of waveforms

Protection: Overcurrent shutdown, power failure shutdown, ESD protection, reverse insertion, banana jack for ESD wrist straps

Features and specifications subject to change.

Appendix 2— Silicon Sculptor 6X Operation

The Silicon Sculptor 6X is similar to six single site Silicon Sculptor programmers packaged in a single chassis. All electronics perform in the same manner, and both programmers operate with the same software. All software commands are the same for both programmers.

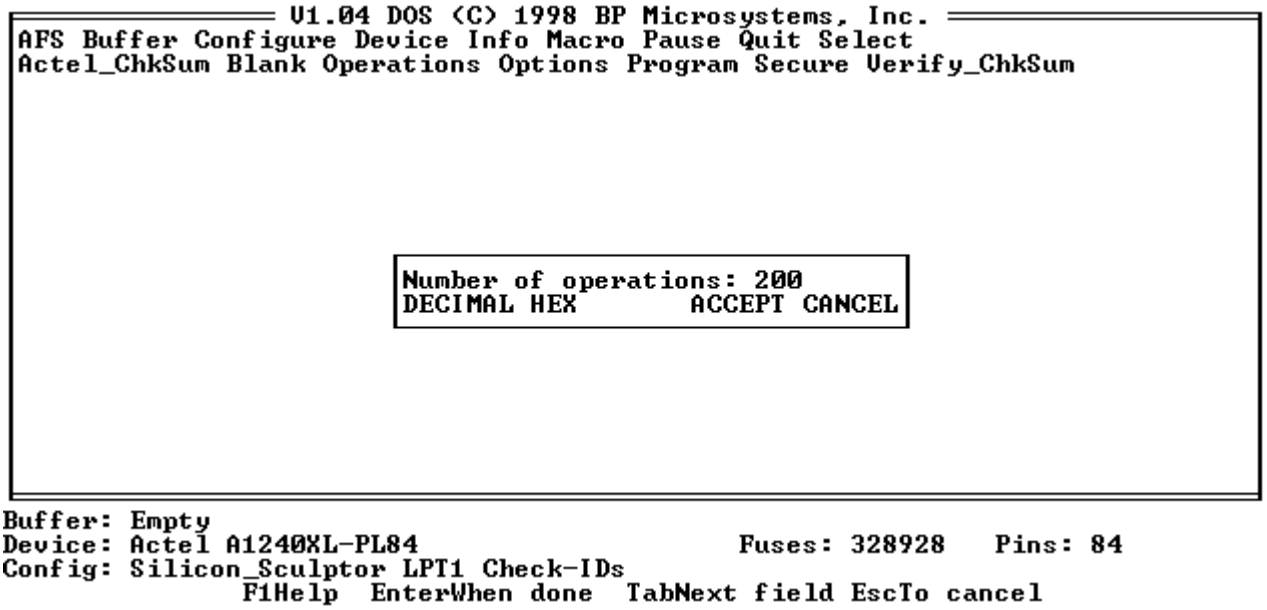
The Silicon Sculptor 6X is designed for high volume production programming. It is normally used in concurrent mode, where multiple devices are programmed simultaneously.

The Silicon Sculptor 6X can be used in a single site engineering mode, similar to the Silicon Sculptor, by setting the "Number of operations" in the *Device/Operations* menu to "1". This mode of operation allows keyboard control of the programmer (no need to press the Start button) and enables use of the "Actel_ChkSum" command (see Chapter 4 – Command Reference).

Concurrent Programming on the Silicon Sculptor 6X

1— Set Number of Devices to Program

The advantage of the Silicon Sculptor 6X is its ability to program many devices very quickly. However, before you get started, you must tell the software the number of devices you want to program. Starting in the Command Mode, select the *Device/Operations* menu and press **Enter**.



In the *Device/Operations* dialog box, enter the number of devices you want to successfully program in the *Number of operations:* field. The graphic above indicates you have requested 200 devices.

2— Program One Chip First

With the Silicon Sculptor 6X, you must program one device successfully first to make sure the system is properly configured. Once the first device is properly programmed, the PC will broadcast the necessary information to every programmer site on every programmer so you can take full advantage of the Silicon Sculptor 6X's speed.

To begin, start from the Command Mode and select *Device/Program* (or just press **P**).

This will alert the system that you are ready to begin programming. A message should appear onscreen saying "Press Start Button on Master."

Next, insert the device into the Programmer's Master programmer site (socket # 1). The system will identify this programmer site for you by turning on the red Start button light next to that programmer site.

We highly recommend using a vacuum pencil to pick up and insert a device, in order to minimize the chance of bending package leads or damage from static discharge.

Devices must *not* be inserted or removed when the ACTIVE LED is on.

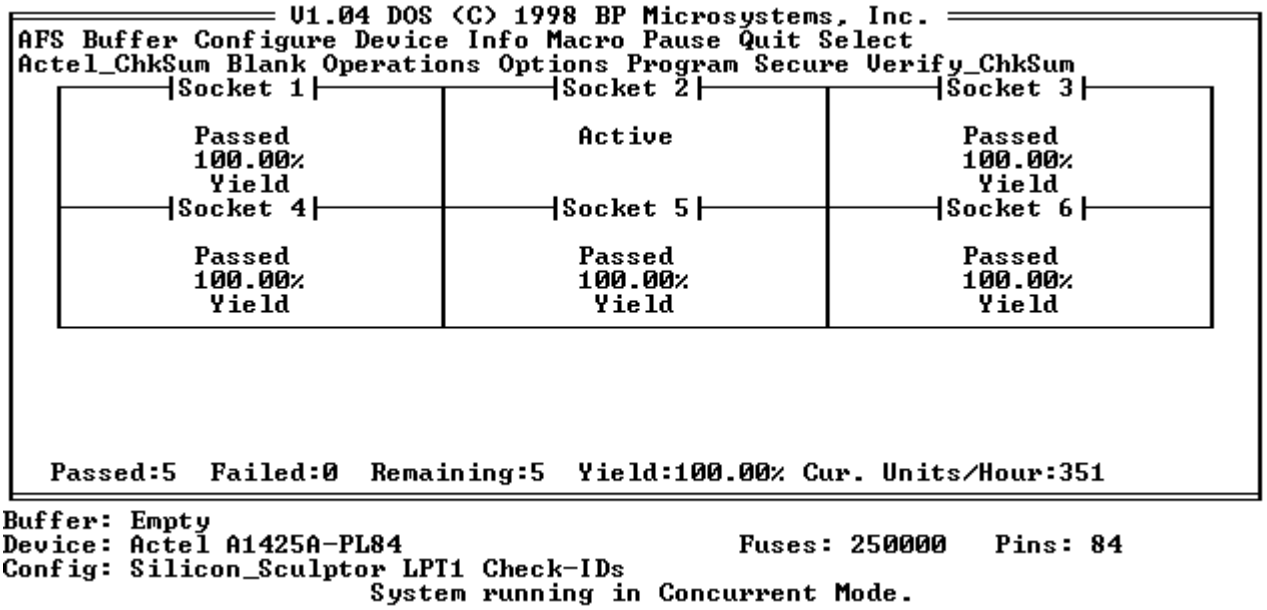
The Silicon Sculptor 6X has protection circuitry, so it is not necessary to remove the device to be programmed before the power is turned on or off.

Once the device is in the programmer site, lock it in place to achieve continuity. Observe proper pin one orientation as indicated by the dot on the programming socket adapter.

Now press the Start button next to that programmer site. The yellow ACTIVE LED will come on and programming will begin. When programming of that device is completed, the yellow ACTIVE LED will go off and one of the other two status lights will come on.

3— Completing your production run

Once the first device is programmed properly, the PC will broadcast all the necessary information to each of the six programming sites in your system and you are ready to begin your programming run. From then on, each programmer site is doing the actual work, and the PC is only polling the programmer to determine when the device is finished and whether it passed or failed. This is one of the big advantages of the Silicon Sculptor 6X, because the programming information has a shorter route to travel to the device being programmed.



You are now ready to program the remaining 5 devices. Insert another device in the next programmer site, press the lighted Start button for that site, and the system will begin to program that device. Without waiting for it to finish, you can insert the next device into the next programmer site. By the time the last programmer site is filled, the first device should be completed, and you can remove it and insert a new blank device in its place.

As each socket finishes, additional blank devices can be inserted. Once the total number of devices entered for the number of operations have been successfully programmed; the PC will beep to indicate your production run is completed.

4— Reading the results of your production run

When the specified number of devices have been programmed, the software will send a report to the PC screen. This will tell you the device, the name of the file you programmed into it, how many operations the system performed, how many devices passed and how many failed. This is useful in helping you make sure you have programmed the correct number of devices successfully.

The report will also show you the beginning and ending time of your programming session, the number of units per hour, and the percentage of successful operations.

5— Saving and printing report results

The report from each run can be saved to the hard disk, and can be printed out. Instructions for doing this can be found in Chapter 4— Command Reference, under the *Info/Log* command.

Daisy Chaining two Silicon Sculptor 6X programmers.

Two (maximum) Silicon Sculptor 6X programmers can be connected to a single PC providing a total of 12 programming sites.

You can "daisy chain" the two programmers using an optional expansion cable. A standard "serial" cable will work. The cable must have male DB25 connectors on each end, have 25 conductors (wired pin-to-pin), be shielded, and not exceed 6 ft (or 2 M) in length. If you wish to purchase the proper cable from Actel, contact your Actel sales representative.

The first programmer is connected to the PC in the normal manner using the standard parallel cable provided. The second programmer is connected to the first programmer using the expansion cable. The cable plugs into the expansion female connectors on the two programmers.

The programmers will auto-configure for 12 site concurrent programming. It is not necessary to set any internal DIP switches. The Silicon Sculptor software will recognize the second programmer and display the yield status of the 12 programming sites.

GLOSSARY

Adapter: Used to convert the programming socket on your programmer to the socket required by the chip you want to program (PLCC or other). Also, it may contain active or passive circuitry that redirects or modified the signals connected to the chip to allow the programmer to program a chip with specific requirements.

BGA: (Ball Grid Array) A surface mount device with solder balls and a high pin count, similar to a PGA.

Batch file: A file used by MSDOS to perform a sequence of DOS commands. Batch files use the extension .BAT.

Blank check: A test performed by the device programmer to ascertain whether a device has been programmed or it is in a virgin state.

Checksum: A number that results by adding up every element of a pattern. Typically either a four or eight digit hex number, it is a quick way to identify a pattern, since it is very unlikely two patterns will have the same checksum.

Concurrent programmer: A multiple-socket programmer that starts programming each device as soon as it is inserted in a socket, without all sockets having to be filled.

Dialog box: The method used by the device programmer's user-interface software to allow the user to select options and specify information. The user can specify any options and fill in any blanks in the box then press ENTER to force the software to process the information.

Die: The silicon chip that is located within an IC package. It is a small rectangular flat piece of silicon that has been fabricated with many transistors to perform a specific function. It is glued into a plastic or ceramic package and connected to the external metal interconnect pins of the IC with very small bonding wires.

FPGA: (Field Programmable Gate Array) A very complex PLD. The FPGA usually has an architecture that comprises a large number of simple logic blocks, a number of input/output pads, and a method to make random connections between the elements.

Gang Programmer: A multiple-socket programmer that requires each device to be placed in a socket before any can be programmed. See *Concurrent Programmer*.

Hex file: A human-readable ASCII file that represents any binary data. Each byte in the binary pattern is represented by two hex characters (0-9, A-F), so that any of the 256 possible bytes, which include both control or unprintable characters, may be printed. The hex file may also contain address or checksum information. The pattern represented by the hex file may be represented by a binary file or any of the hex file formats—any file format may contain any pattern. The names of the hex file formats (Intel, Motorola, Tektronix, etc.) indicate who standardized its format and does not indicate anything about the pattern or the device the pattern is intended for.

Macro file: A file that records a specific sequence of commands and can be easily played back to perform those commands again. Commonly, a macro will be recorded by an engineer to select a device, set the options required to program it, load a specific file, and program the device. Once recorded properly, an operator can program devices without learning the details of the programmer software.

Make file: A file commonly used by software engineers in conjunction with a make utility program to automate the building of software projects. If the software project required a device to be programmed following a compile and link operation, the make file can start the device programmer and specify a macro file to perform the programming operation.

Memory device: A device that contains an array of numbers. The device has a set of inputs, called addresses, which specify which location in the array is being accessed. A set of input/output pins produce the stored number (pattern) when the device is read, and accept a new a new value when the device is written or programmed. Additionally, there are one or more input pins that select the operating move (read, write, standby, etc.). Memory devices may be classified by whether they are volatile or non-volatile, and whether they may be erased. The memory's organization refers to its word width and the number of words in the device.

Non-volatile: The characteristic of a device that does not lose its contents when its power is removed. Non-volatile memory is useful in microcomputer circuits because it can provide instructions for a CPU as soon as the power is applied, before secondary devices, such as disk, can be accessed. Non-volatile memory includes ROM, EPROM and EEPROM.

OTP: (one-time programmable) The characteristic of an FPGA that can be programmed once but cannot be erased.

Package: The plastic or ceramic that protects an IC die and connects it to the target circuit. See also LCC, PLCC, and QFP.

Parallel printer port: A standard port on virtually every PC designed for connection to a printer. This port has eight data lines and several control lines. Parallel ports may be either unidirectional or bidirectional. If your computer has a unidirectional port, the programmer will use the status lines to read data back from the programmer. The port allows high-speed communication (many times faster than a serial port). There may be up to three parallel ports in most PCs, designated LPT1, LPT2, and LPT3.

PGA: (Pin Grid Array) A square, through-hold IC package that has pins located on a square grip with 0.100 inch pitch. It may have up to several hundred pins. Used primarily for military and prototype designs.

PLCC: (Plastic leaded Chip Carrier) A square plastic package that has J-shaped leads on four sides. This can be surface mounted or placed in a socket for through-hole use. Available in 44 to 84 pins.

PQFP: (Plastic Quad Flat Pack) See QFP.

QFP: (Quad Flat Pack) A square IC package that has surface-mount leads coming from four sides. It is used for high-density applications, usually over 100 pins. Lead pitch may be 0.025 inches or smaller.

RAM: (Random Access Memory) A volatile memory device.

ROM: (Read-Only Memory) A non-volatile memory device that cannot be programmed by the user. It is programmed at the factory through the use of a mask pattern in the final fabrication steps of the die.

Serial memory: An EPROM or EEPROM that is accessed by shifting in addresses and shifting out data one bit at a time. Interfaces are available using one, two or three wires for clock, data in, and data out.

Socket module: On a Silicon Sculptor programmer, the interchangeable metal chassis that contains a programming socket.

TQFP: (Thin Quad Flat Pack) Similar to QFP but with a lower profile and physically smaller in length and width.

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