APEX-ICE™ USB-based Emulator
Hardware and Software
Installation Guide

Edition Revision 6, December 2002

**ANALOG
DEVICES**

Notice

Analog Devices, Inc. reserves the right to make changes to or to discontinue any product or service identified in this publication without notice.

Analog Devices assumes no liability for Analog Devices applications assistance, customer product design, customer software performance, or infringement of patents or services described herein. In addition, Analog Devices shall not be held liable for special, collateral, incidental or consequential damages in connection with or arising out of the furnishing, performance, or use of this product.

Analog Devices products are not intended for use in life-support applications, devices, or systems. Use of an Analog Devices product in such applications without the written consent of the appropriate Analog Devices officer is prohibited.

Users are restricted from copying, modifying, distributing, reverse engineering and reverse assembling or reverse compiling the Analog Devices Apex-ICE USB-based emulator operational software (one copy may be made for back-up purposes only).

No part of this document may be reproduced in any form without permission.

Trademark and Service Mark Notice

The Analog Devices logo, SHARC, the SHARC logo, TigerSHARC, the TigerSHARC logo, and EZ-ICE are registered trademarks. VisualDSP++, the VisualDSP++ logo, Blackfin, the Blackfin logo, CROSSCORE, the CROSSCORE logo, EZ-KIT Lite, Apex-ICE, ICEPAC, and The DSP Collaborative are trademarks of Analog Devices, Inc.

Microsoft and Windows are registered trademarks, and Windows NT is a trademark of Microsoft Corporation.

All other brand and product names are trademarks or service marks of their respective owners.

Limited Warranty

The Apex-ICE USB-based emulator hardware is warranted against defects in materials and workmanship for a period of one year from the date of purchase from Analog Devices or from an authorized dealer.

Regulatory Compliance

The Apex-ICE USB-based emulator is designed to be used solely in a laboratory environment. The emulator is not intended to be used in any end products or as a portion of an end product. The APEX-ICE USB-based emulator may cause interference to other electronic devices operating at close proximity. The APEX-ICE USB-based emulator should not be used in or near any medical equipment or RF devices.

The APEX-ICE USB-based emulator has been certified to comply with the essential requirements of the European EMC directive 89/336/EEC (inclusive 93/68/EEC) and therefore carries the "**CE**" mark.

The APEX-ICE USB-based emulator had been appended to the Technical Construction File referenced '**DSPTOOLS1**' dated December 21, 1997 and was awarded CE Certification by an appointed European Competent Body as listed below.

Technical Certificate No: Z600ANA1.010

Issued by:

Technology International (Europe) Limited
60 Shrivenham Hundred Business Park
Shrivenham, Swindon, SN6 8TY, UK

The Apex-ICE USB-based emulator contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store used Apex-ICE USB-based emulator in the protective-shipping package.

Table of Contents

List of Tables

List of Figures

1 Introduction

Thank you for purchasing Analog Devices Apex-ICE™ USB-based JTAG emulator. The APEX-ICE is used in conjunction with the VisualDSP++™ development environment to create, test and debug advanced DSP application software on all of Analog devices fixed and floating-point JTAG based DSPs.

The APEX-ICE system provides state-of-the-art support for JTAG-compliant Analog Devices DSPs. Key features of the APEX-ICE include:

- USB Plug-n-Play
- Windows® 98, Windows® 2000, or Windows XP operation
- Rugged high-speed 3V/5V emulation for Analog Devices DSPs
- Multiprocessor support

1.1 For More Information About Analog Devices Products

Analog Devices can be accessed on the Internet at http://www.analog.com. You can directly access the DSP Web pages at http://www.analog.com/dsp. This page provides access to DSP specific technical information and documentation, product overviews, and product announcements. For specific information about DSP tools, go to http://www.analog.com/dsp/tools.

You may also obtain additional information about Analog Devices and its products in any of the following ways:

- FAX questions or requests for information to (781)-461-3010.

- Access the Computer Products Division File Transfer Protocol (FTP) site at ftp://ftp.analogdevices.com/ or ftp://137.71.25.69 or ftp://ftp.analog.com.

1.2 For Technical or Customer Support

You can reach our Customer Support group in the following ways:

- E-mail DSP Tools questions to: dsptools.support@analog.com
- DSP Tools Tech Support Form:
  http://www.analog.com/industry/dsp/tools/form_techsupport.html

- E-mail general DSP questions to:
  dsp.support@analog.com
  dsp.europe@analog.com (European customer support)

- Call: (800)-ANALOGD
- Contact your local Analog Devices sales office or an authorized Analog Devices distributor.

1.3   Purpose of This Manual

The *Apex-ICE USB-Based Hardware and Software Installation Guide* provides directions for installing the hardware and software for the APEX-ICE on your PC. This manual also provides a description of the use and configuration of the components on the APEX-ICE USB-based emulator.

1.4   Intended Audience

This manual is an installation guide for the Apex-ICE USB-based emulator. This manual is intended to help the customer quickly install the APEX-ICE so that they can begin using VisualDSP++.

1.5   Manual Contents

This manual contains the following information:

- Chapter 1 — Introduction
  Provides manual information and Analog Devices contact information.

- Chapter 2— Getting Started
  Provides software and hardware installation procedures, PC system requirements, and basic board information.

- Chapter 3 — Support
  Provides Technical Support Contact information.

- Chapter 4 — References
  Provides information on different resources available in developing an ADI DSP application.

1.6   On-line Help

Your software installation kit includes online Help as part of the Windows® interface. These Help files provide information about VisualDSP++ and the APEX-ICE.

To view the VisualDSP++'s Help, click on the **Help** menu item or go to the Windows task bar and select Start\Programs\VisualDSP\VisualDSP++ Help.

For more documentation, please go to http://www.analog.com/dsp/tech_doc.

2 Getting Started

2.1 Overview

This chapter provides the information you need to begin using the Apex-ICE system. Install your software and hardware in the order presented in section 2.4 for correct operation. This chapter has the following sections:

- Contents of your APEX-ICE Package (Section 2.2)
  Provides a list of the components that are shipped with this Apex-ICE USB-based Emulator.

- PC Configuration (Section 2.3)
  Describes the minimal requirement for the PC to work with the Apex-ICE USB-based Emulator.

- Installation Tasks (Section 2.4)
  Describes the step-by-step procedure for setting up the hardware and software.

2.2 Contents of your APEX-ICE Package

Your Apex-ICE USB-based emulator package contains the following items:

- APEX-ICE shielded board and cable
- CD containing emulation driver software
- Registration card – please fill out and return

The Apex-ICE USB-based emulator contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store used Apex-ICE in the protective-shipping package.

2.3 PC Configuration

For correct operation of the APEX-ICE USB-based emulator, your computer must have the minimal configuration shown in Table 2-1.

Table 2-1: Minimum PC Configuration

Windows® 98, Windows® 2000, or Windows XP
Intel (or compatible) 166 MHz processor
VGA monitor and color video card
2-button mouse
50 MB free on hard drive
32 MB RAM
One full-speed USB port
CD-ROM drive

2.4   Installation Tasks

The following tasks are provided for the safe and effective use of the APEX-ICE USB-based emulator. Follow these instructions in the order presented to ensure correct operation of your software and hardware.

1.   Install the APEX-ICE hardware
2.   Install the APEX-ICE driver
3.   Verify driver installation.

2.4.1   Set Up the APEX-ICE Hardware

This section provides all of the information required to install the APEX-ICE.

The Apex-ICE USB-based emulator contains ESD (electrostatic discharge) sensitive devices. Electrostatic charges readily accumulate on the human body and equipment and can discharge without detection. Permanent damage may occur on devices subjected to high-energy discharges. Proper ESD precautions are recommended to avoid performance degradation or loss of functionality. Store used Apex-ICE in the protective-shipping package.

2.4.1.1 Unpacking the Emulator

Remove the APEX-ICE from the package. Care should be taken when handling these boards to avoid discharge of static electricity that may damage some components.

2.4.1.2 Connecting the Apex-ICE

1.   Attach the probe to an unpowered target using the 14-pin header.

➢ **Note: Never connect an unpowered Apex-ICE to a powered target board.**

2.   Plug the power supply to a wall outlet.
3.   Connect the other end of the power supply to the 5V connector on the Apex-ICE.
4.   Connect the Apex-ICE USB connector to a full-speed port on your PC.

➢ **Note: The Apex-ICE can be connected to a powered PC.**

5. Apply power to the target DSP board.
6. Invoke theVisualDSP++ software.

The Apex-ICE status LED will flash when the Apex-ICE emulator is ready for a connection from either ApexControl or VisualDSP++.

➢ **Note: The status LED will flash approximately 20 seconds after power is applied and the USB cable is connected to the PC.**

2.4.1.3 Configuring the Apex-ICE

➢ **Note: This section is optional. This procedure reduces noise-related issues.**

The Apex-ICE contains connectors that two jumpers may be inserted to reduce the noise associated with JTAG signals. The two jumpers can reduce problems that may ocurr because of ringing and reflections on the JTAG signals on the target board.

➢ **Note: These jumpers are not installed when the Apex-ICE is shipped from the factory.**

Jumpers JP1 and JP2, shown in Figure 2-1, add a parallel terminator on the TDO and CLKIN signals. When the jumpers are installed, a parallel terminator of 120Ω and 91Ω, respectively, is connected to the TDO and CLKIN signals.

To configure the Apex-ICE:

1. Remove the four screws on the bottom of the plastic enclosure and remove the four screws on the top of the enclosure.

Figure 2-1 Jumpers

Figure 2-2 shows how to connect the terminators to the JTAG signals.

> ➢ **Note: Before these jumpers are installed, the target must be able to drive a 51Ω load. The DSP cannot drive this load directly. You must insert a driver between the JTAG signals at the DSP and the JTAG signals at the header.**
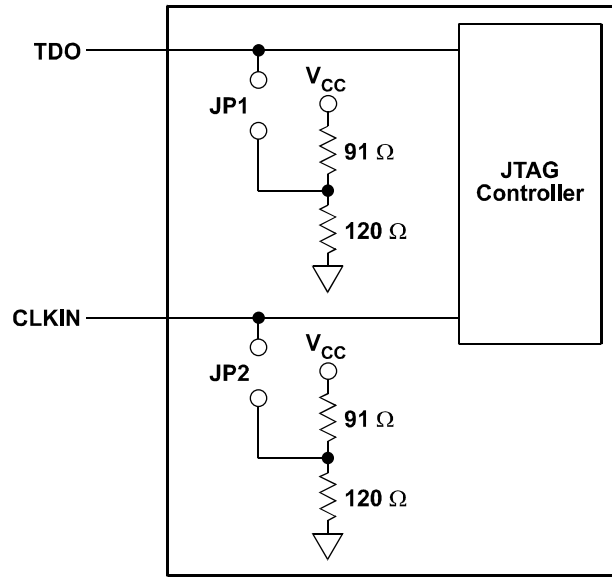
2. Insert the jumpers.

Figure 2-2 Terminators Connected to the JTAG Signals

2.5 Connection to your Target System

The Apex-ICE connects to the target processor through the JTAG interface. The target board must be built with an appropriate JTAG connector. Note the position of the key pin, which is used as a guide to connect the emulator to the target. Two extender connectors are included with the Apex-ICE emulator. These extenders are used to connect the Apex-ICE emulator to a target, which was designed for use with the ADI ICEPAC™. These extenders allow connection to the JTAG pins on the ICEPAC header. For more information on designing a JTAG interface, refer to EE-68, available on the Analog Devices DSP Web site.

2.6 Installing the Apex-ICE USB Driver

2.6.1 Windows 98 Installation

The Apex-ICE requires one full-speed USB port. Configuration of the board is performed automatically at boot up or at insertion due to plug-n-play hardware support. Before using your Apex-ICE for the first time, you must install the Windows 98 driver first. The following installation and verification procedures assume that you have connected the Apex-ICE as described in Section 2.4.1.2

To install the Windows 98 driver:

1. Insert the **Emulator Drivers CD-ROM** into the CD-ROM drive.

➢ **Note: If the VisualDSP++ Emulator Tools Installation splash screen displays, click Exit.**

The connection of the device to the USB port activates the **Window 98 Add New Hardware Wizard** as shown in Figure 2-3.

Figure 2-3. Add New Hardware Wizard

2. Click **Next**.
3. Select **Search for the best driver for your device** as shown in Figure 2-4.
4. Click **Next**.

Figure 2-4. Add New Hardware Wizard

5. Insert the CD-ROM labeled "Emulator Drivers CD" into the CD-ROM drive and click **Next**.

Windows 98 will automatically detect and install the Apex-ICE driver from the disk as shown in Figure 2-5.

Figure 2-5. Add New Hardware Wizard

6. Click **Next**.

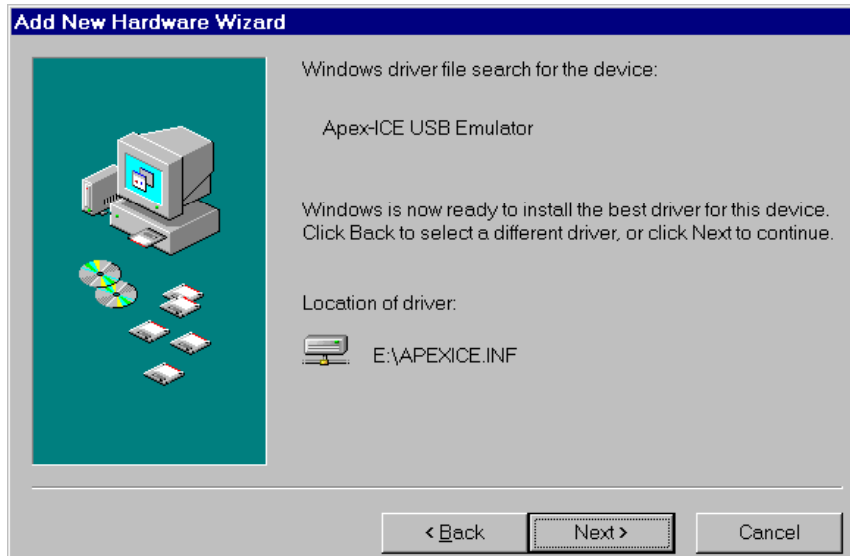The Add New Hardware Wizard will locate the ApexICE.inf file on the CD-ROM as shown in Figure 2-6.

Figure 2-6 Add New Hardware Wizard

7. Click **Next**.

The driver installation is now completed as shown in Figure 2-7.

Figure 2-7 Add New Hardware Wizard

8. Click **Finish** to exit the wizard.

To verify proper installation of the Apex-ICE through the Windows 98 Device Manager:

1. Click the **Start** button.
2. Select **Settings** and then **Control Panel**.
3. Double-click the **System** icon. The **System Properties** dialog box appears.
4. Click **Device Manager**. The **Device Manager** dialog box appears.
5. Double-click **DSP Emulators**. A window similar to that shown in Figure 2-8 appears.
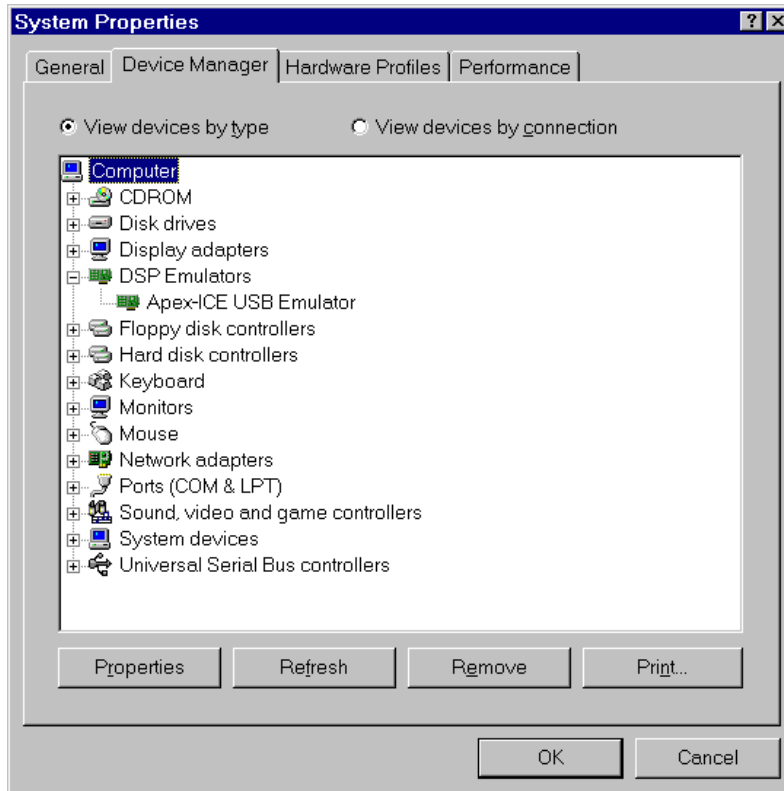
Figure 2-8 Device Manager

6. Double-click on **Apex-ICE USB Emulator**.

The **Apex-ICE USB Emulator Properties** dialog box appears as shown in Figure 2-9, showing the status of the Apex-ICE. The device status should indicate that the device is working properly.

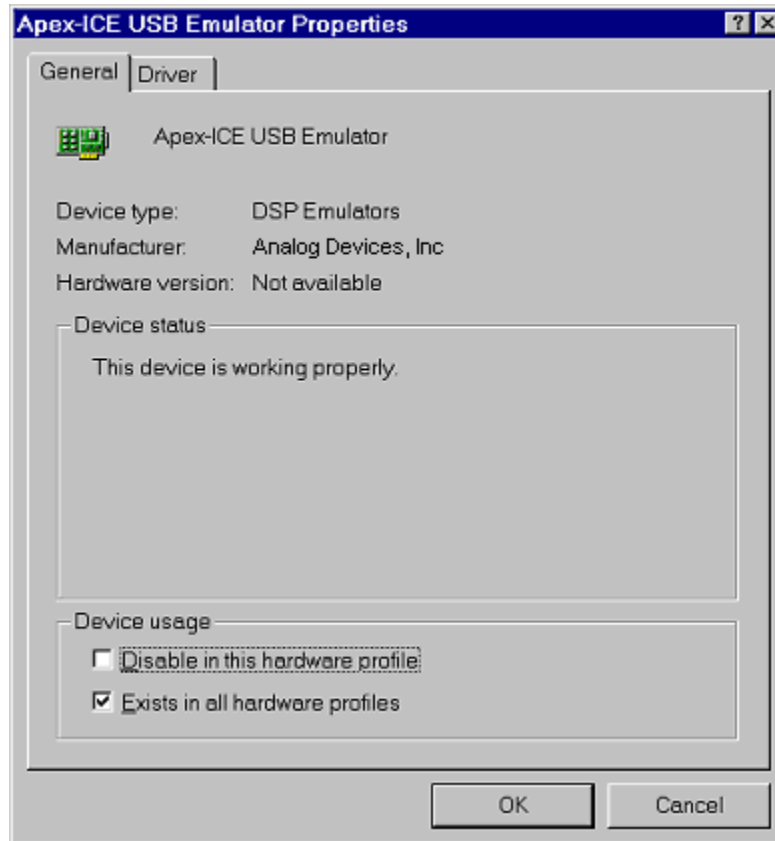➢ **Note: The Apex-ICE's Status LED should be blinking.**

Figure 2-9 Apex-ICE Properties Page

7. Click **OK**, and close all dialog boxes.
8. Remove the CD-ROM and store it in a safe place.
9. Proceed to Section 2.7 to install the Apex-ICE ApexControl software.

2.6.2 Windows 2000 Installation

The Apex-ICE requires one full-speed USB port. Configuration of the board is performed automatically at boot up due to plug-n-play hardware support. Before using your Apex-ICE for the first time, you must first install the Windows 2000 driver. The following installation and verification procedures assume you have connected the Apex-ICE as described in Section 2.4.1.2.

To install the Windows 2000 driver:

1. Insert the **Emulator Drivers CD-ROM** into the CD-ROM drive.

➢ **Note: If the VisualDSP++ Emulator Tools Installation splash screen displays, click Exit.**

The connection of the device to the USB port will activate the **Windows 2000 Found New Hardware Wizard** as shown in Figure 2-10.
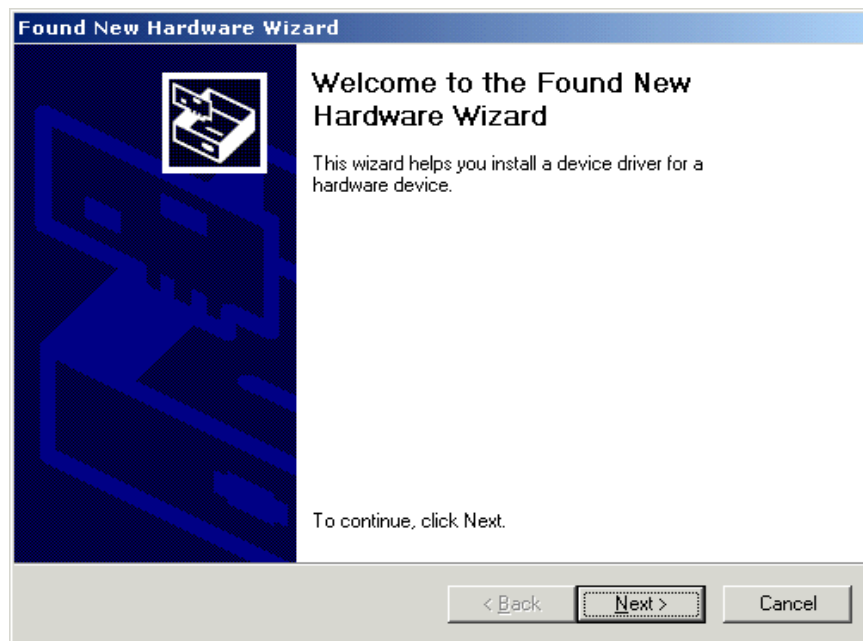
Figure 2-10 Found New Hardware Wizard

2. Click **Next**.

The **Install Hardware Device Drivers** page of the **Found New Hardware Wizard** dialog box appears.
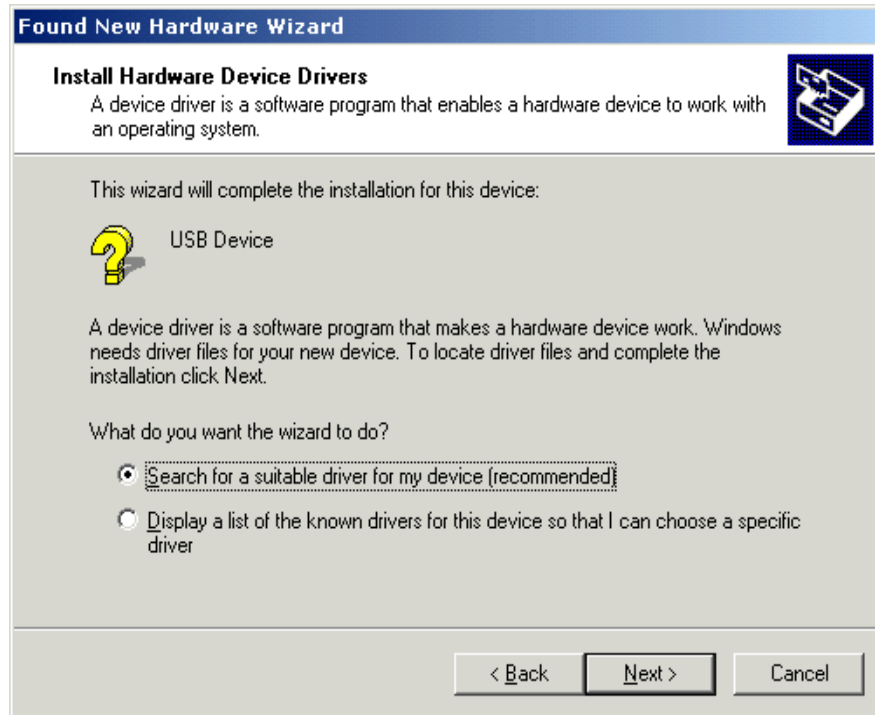
Figure 2-11 Found New Hardware Wizard

3. Select **Search for a suitable driver for my device**, and click **Next**.

The Locate Driver Files page appears as shown in Figure 2-12.
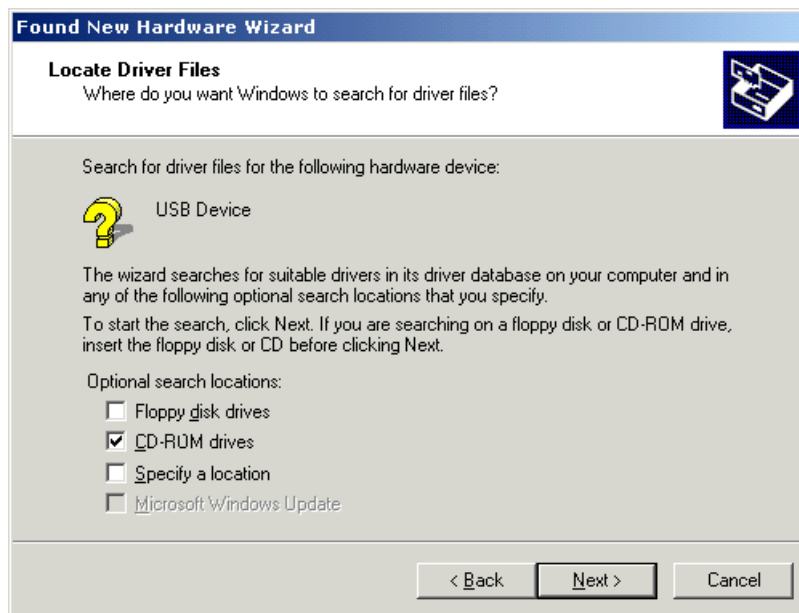

Figure 2-12 Found New Hardware Wizard

4. Ensure that **CD-ROM drives** is selected (checked) and click **Next**.

The Add New Hardware Wizard locates and installs the correct driver on the disk, completing the driver installation. You will see a window similar to that in Figure 2-13.
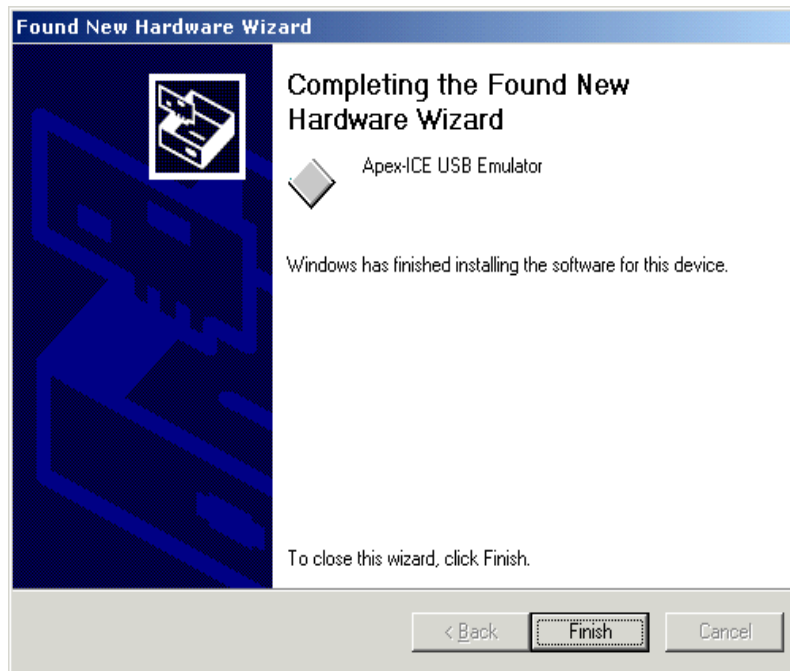

Figure 2-13 Found New Hardware Wizard

5. Click **Finish**.

To verify proper installation of the Apex-ICE through the Windows 2000 Device Manager:

1. Click the **Start** button.
2. Select **Settings** and then **Control Panel**.
3. Double-click the **System** icon. The **System Properties** dialog box appears.
4. Click the **Hardware** tab.
5. Click the **Device Manager** button. The **Device Manager** dialog box appears as shown in Figure 2-14.
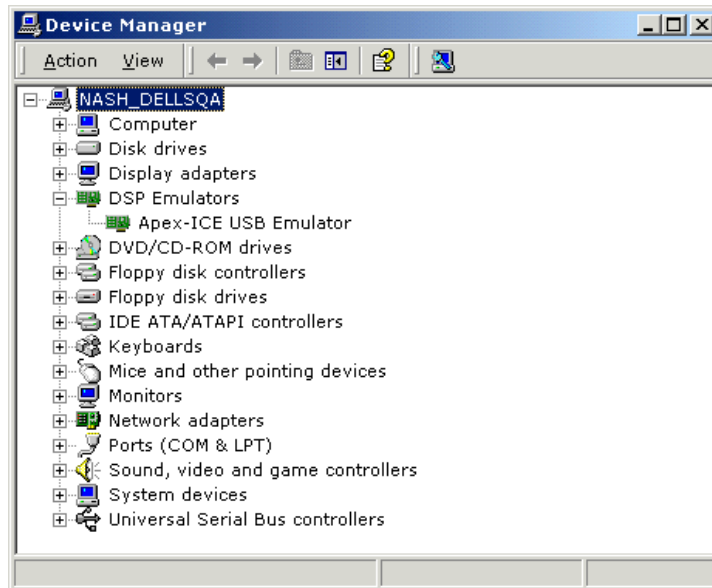
Figure 2-14 Windows 2000 Device Manager

6. Double-click **DSP Emulators**.

The **Apex-ICE USB Emulator Properties** dialog box appears as shown in Figure 2-15, showing the status of the Apex-ICE. The device status should indicate that the device is working properly.

Figure 2-15 Apex-ICE USB Emulator Properties

➢ **Note: The Apex-ICE's Status LED should be blinking.**

7. Click **OK**, and close all dialog boxes.
8. Remove the CD-ROM and store it in a safe place.
9. Proceed to Section 2.7 to install the Apex-ICE ApexControl software.

2.6.3 Windows XP Installation

Before using your Apex-ICE for the first time, you must first install the Windows XP driver. The following installation and verification procedures assume you have connected the Apex-ICE as described in Section 2.4.1.2.

To install the Windows XP driver:

1. Insert the **Emulator Drivers CD-ROM** into the CD-ROM drive.

➢ **Note: If the VisualDSP++ Emulator Tools Installation splash screen displays, click Exit.**

The connection of the device to the USB port will activate the **Windows XP Found New Hardware Wizard** as shown in Figure 2-16.

Figure 2-16 Found New Hardware Wizard

2. Click **Next**.

Windows XP will search all possible location for correct driver and then ask for location of ApexIce.sys file as shown in Figure 2-17.
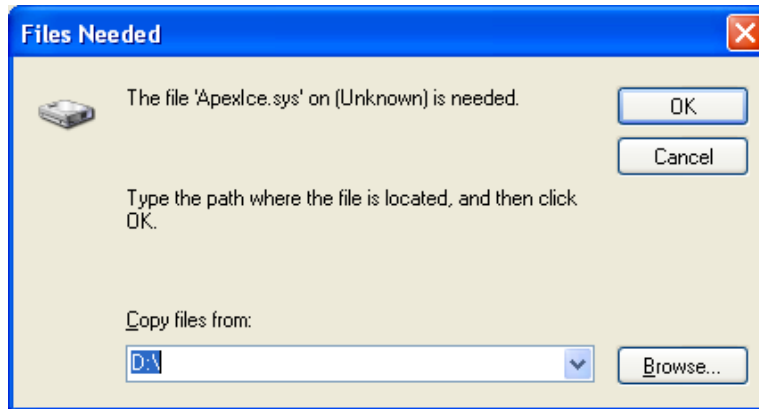

Figure 2-17 File Needed

3. Set path to D:\(CD-ROM). Then select **Next.**

The Add New Hardware Wizard locates and installs the correct driver from the CD. You will see a window similar to that in Figure 2-18.
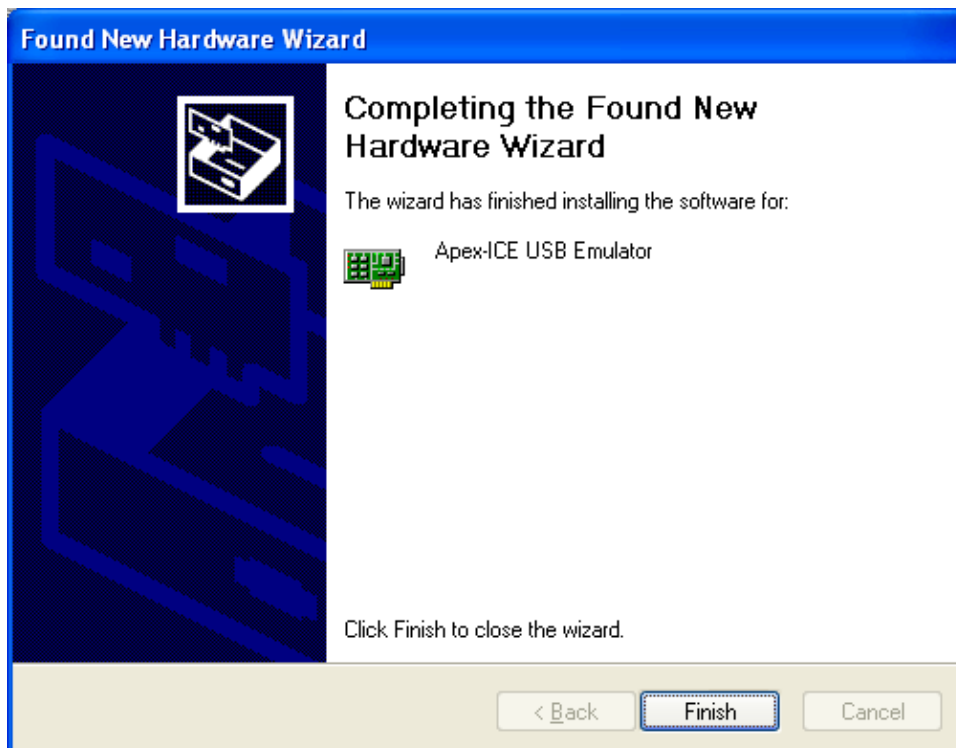

Figure 2-18 Found New Hardware Wizard

4. Click **Finish**.

To verify proper installation of the Apex-ICE through the Windows XP Device Manager:

1. Click the **Start** button.
2. Select **Settings** and then **Control Panel**.
3. Double-click the **System** icon. The **System Properties** dialog box appears.
4. Click the **Hardware** tab.
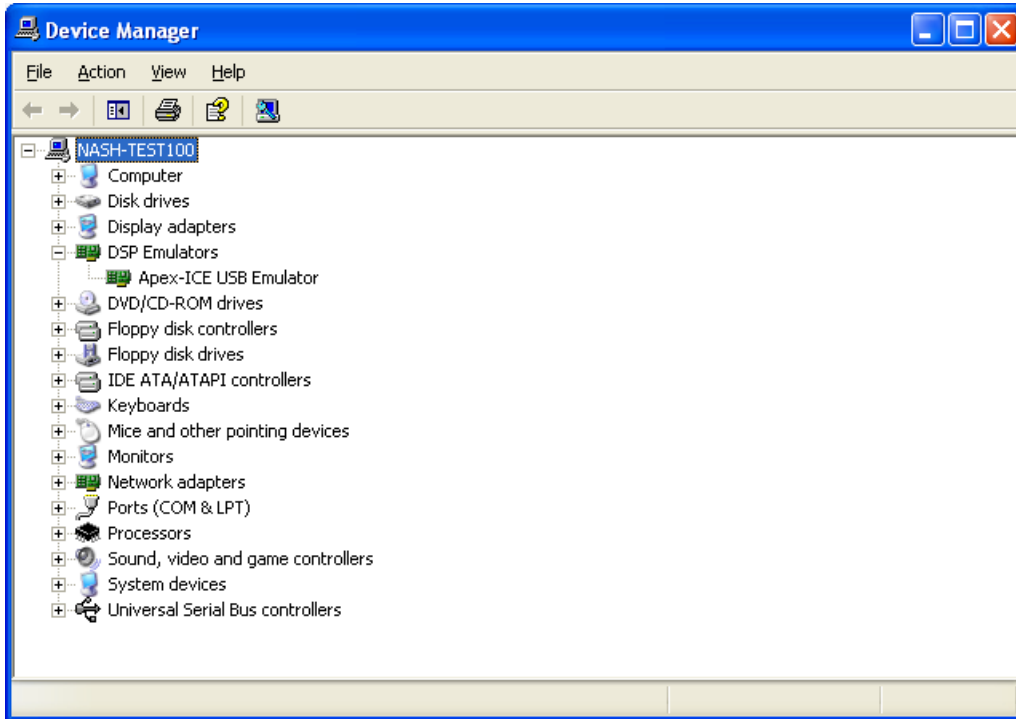5. Click the **Device Manager** button. The **Device Manager** dialog box appears as shown in Figure 2-19.

Figure 2-19 Windows XP Device Manager

6. Double-click **DSP Emulators**.

The **Apex-ICE USB Emulator Properties** dialog box appears as shown in Figure 2-20, showing the status of the Apex-ICE. The device status should indicate that the device is working properly.
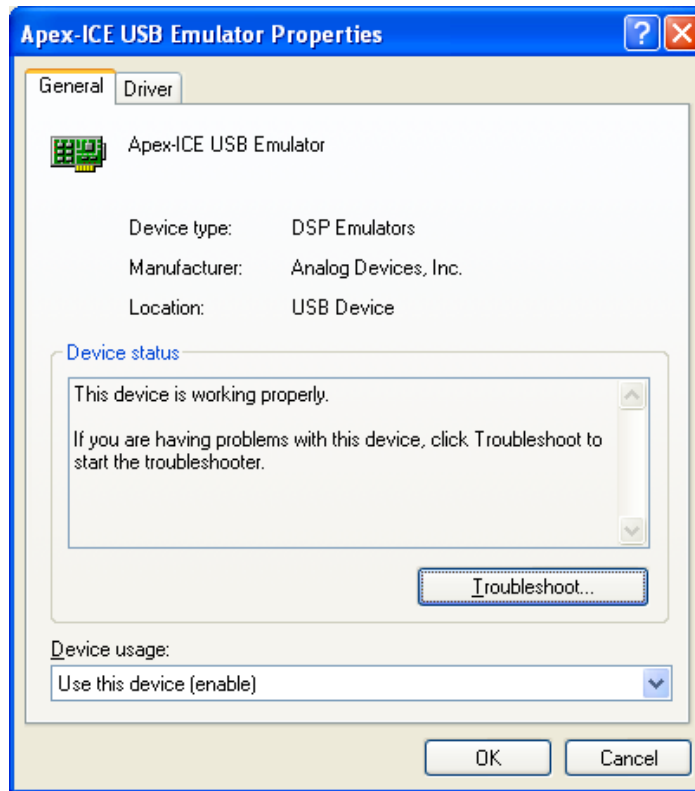
Figure 2-20 Apex-ICE USB Emulator Properties

7. Click **OK**, and close all dialog boxes.
8. Remove the CD-ROM and store it in a safe place.
9. Proceed to Section 2.7 to install the Apex-ICE ApexControl software.

2.7 ApexControl Software

The ApexControl utility is used to download firmware updates. The following sections describe each of the ApexControl functions. This manual assumes the ApexControl application is used with VisualDSP++ software.

2.7.1 Connecting the Apex-ICE

Before you can use any of the Apex-ICE utilities, you must establish connection to the device.

To connect to the Apex-ICE:

1. Confirm that the Apex-ICE device is turned on and operating properly as described in Section 2.4.1.2

➢ **Note: The status LED should be blinking, and the green power LED should be illuminated.**

2. If the ApexControl software is not running, start it from the Windows **start** button (Start→Programs→VisualDSP→ApexControl. Figure 2-21 shows the initial dialog box.
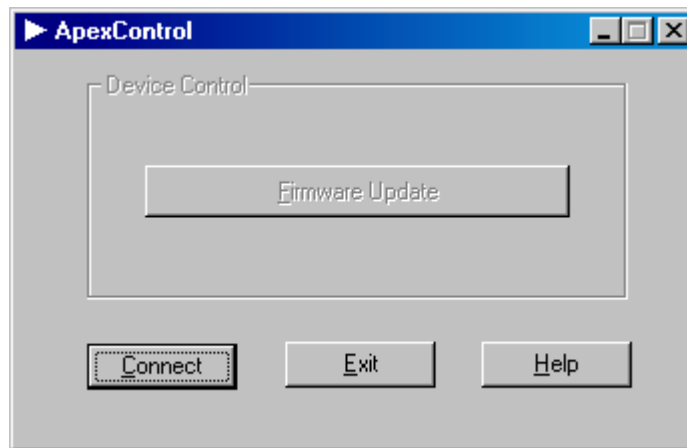

Figure 2-21 Apex Control Utility

3. Click the **Connect** button.

If the connection is successful, the **Firmware Update** button become active.

➢ **Note! If an error message appears, the Apex-ICE device is not configured correctly, not turned on, or is malfunctioning. Review all previous sections for correct configuration.**

2.7.2 Downloading Apex-ICE Firmware

Initially, the Apex-ICE device does not have any target-specific software loaded. You must perform a one-time software download to the Apex-ICE device. Occasionally, software updates may be also necessary. Please refer to the Emulator's Readme file located in the /VisualDSP/Help folder for additional information.

➢ **Note: If no firmware download is needed, proceed to Section 2.7.3.**

➢ **Note: Only software updates from Analog Devices should be downloaded to the Apex-ICE Device. Downloading other software to the Apex-ICE device may cause the device to stop functioning.**

To download Apex-ICE software:

1. Verify that the Apex-ICE device is configured and powered on.
2. Click the **Connect** button to establish a connection to the Apex-ICE device.
3. Click the **Firmware Update** button. The **ApexICE Firmware Version** dialog appears as in Figure 2-22.
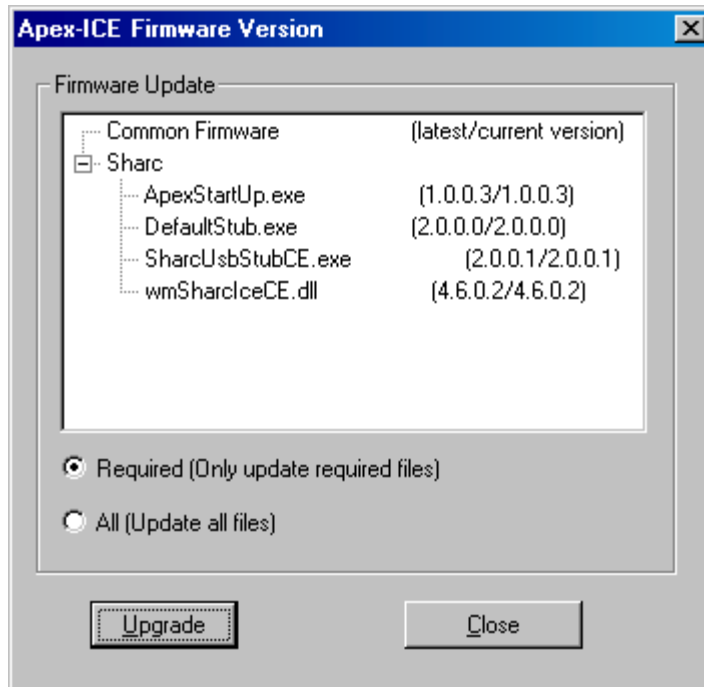
Figure 2-22 Firmware Version Dialog

    4.   Click the **Upgrade** button to download latest version of firmware.

ApexControl only downloads newer version of firmware to the Apex-ICE device.

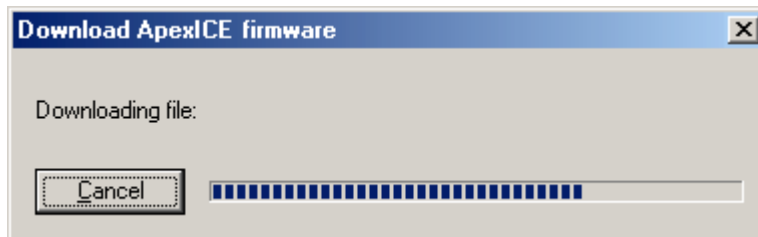A progress indication displays during file downloading. See Figure 2-23.

Figure 2-23 Downloading Firmware Dialog

After downloading finished, the Apex-ICE device is forced to reboot.

2.7.3 Running the IceTest Utility

The IceTest utility is used to verify and test a target JTAG connection.

To run the IceTest utility:

1. If the ICETest Utility software is not running, start it from the Windows **Start** button (Start→Programs→VisualDSP→ ICETest Utility). The IceTest dialog box appears as shown in Figure 2-24.
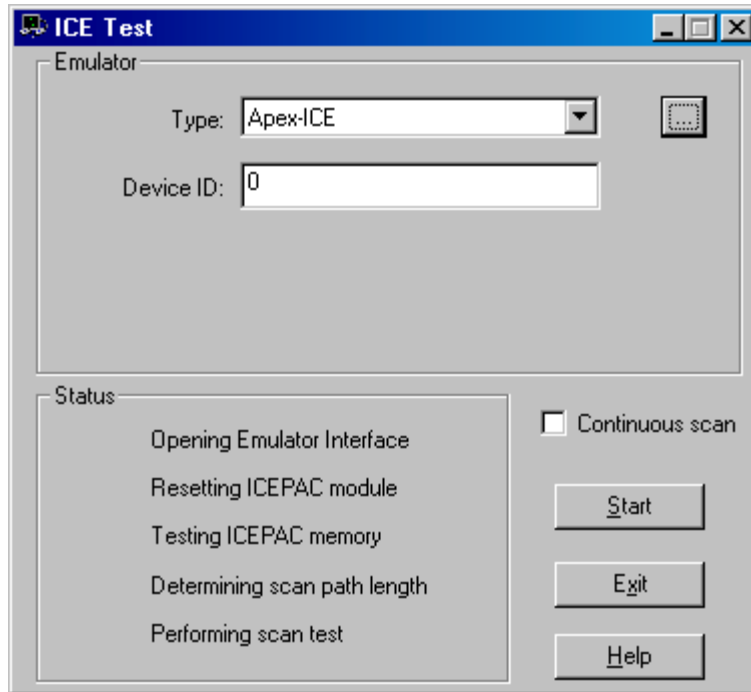
Figure 2-24 ICETest Utility

2. Confirm that the Apex-ICE device is configured and connected as described in Section 2.4.1.2.
3. Confirm that a target DSP board is connected to the Apex-ICE device.
4. If there is more than one emulator installed in the PC click on the **browse** button ("…") to the right of Type as shown in Figure 2-24 to bring up the list of Emulators installed as shown in Figure 2-25. If there is only one emulator installed in the PC then the address information will be filled in automatically when launching IceTest and you can skip to step 5.
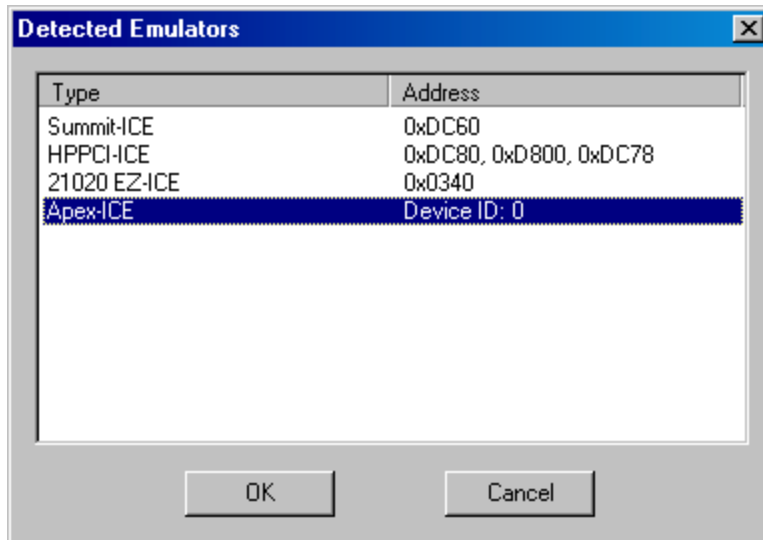
Figure 2-25 Detected Emulators

5. Choose **Apex-ICE** as shown in Figure 2-25 and click **OK**. This will fill in Device ID with the appropriate number as shown in Figure 2-24.
6. Click the **Start** button to run the IceTest utility.

➢ **Note: If Continuous scan is selected, the IceTest runs until you click the Stop button.**

2.7.4 Creating a New Platform

When creating a new platform, use an existing template or create a new template from scratch. Base your platform on one of the existing platforms (Analog Devices evaluation kits) listed in the VisualDSP++ Configurator window's Platform Templates box. To launch the VisualDSP++ Configurator go to Start\Program Files\VisualDSP\VisualDSP++ Configurator.

2.7.4.1 Creating a new platform based on an Analog Devices Evaluation Kit

To create a platform that is based on an Analog Devices, Inc. evaluation kit follow theses instructions:

1. Bring up the **VisualDSP++ Configurator** from the Windows Start menu.
2. In the Platform Templates box, **highlight the template** on which to base your new platform as shown in Figure 2-26.
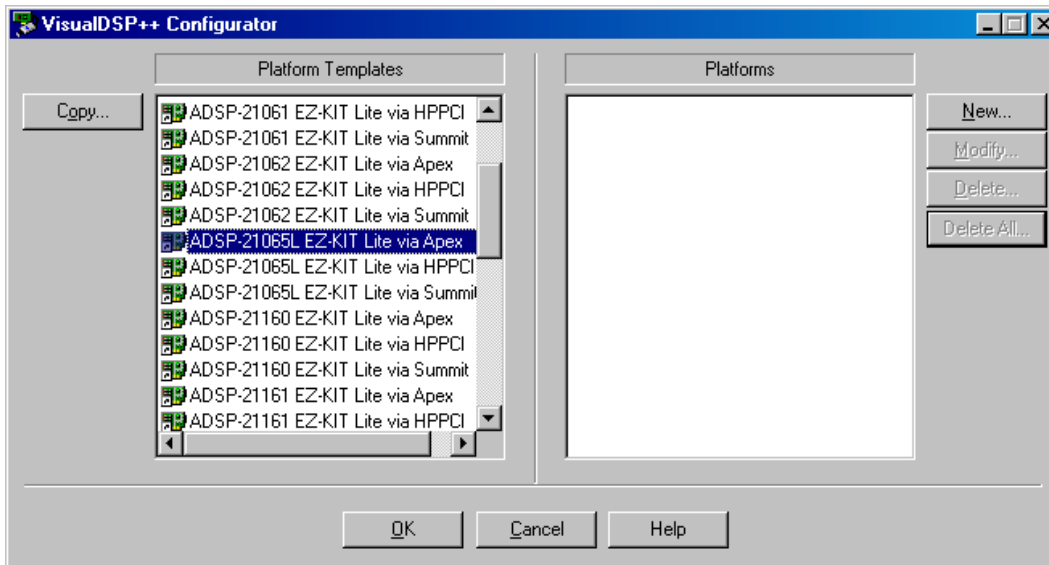
Figure 2-26 VisualDSP++ Configurator (from template)
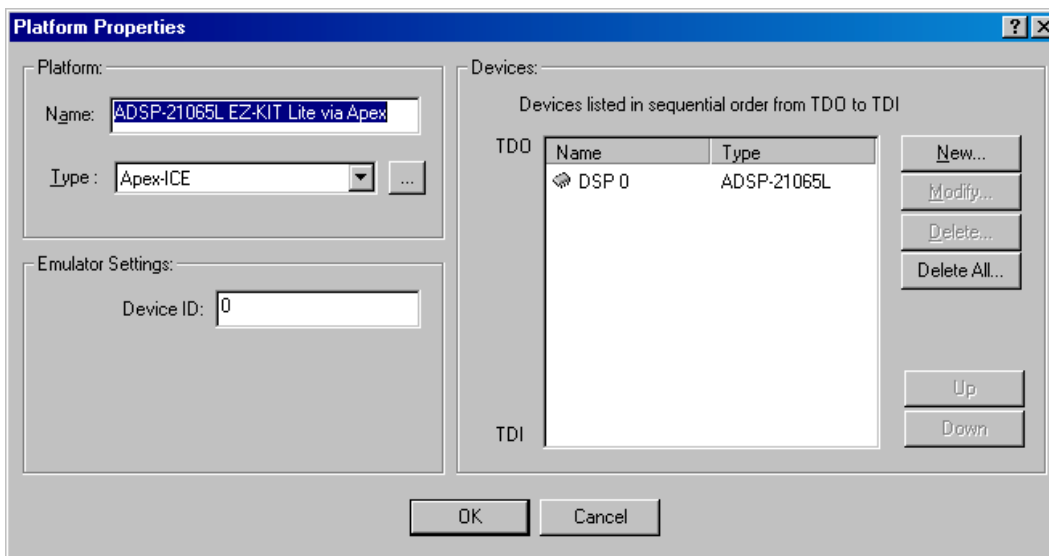
3. Click **Copy** and Figure 2-27 will appear.

Figure 2-27 Platform Properties (from template)

4. If required, you can add a new device by following steps 9 and 10 in Section 2.7.4.2 or click **OK** to add your new platform as shown in Figure 2-28.
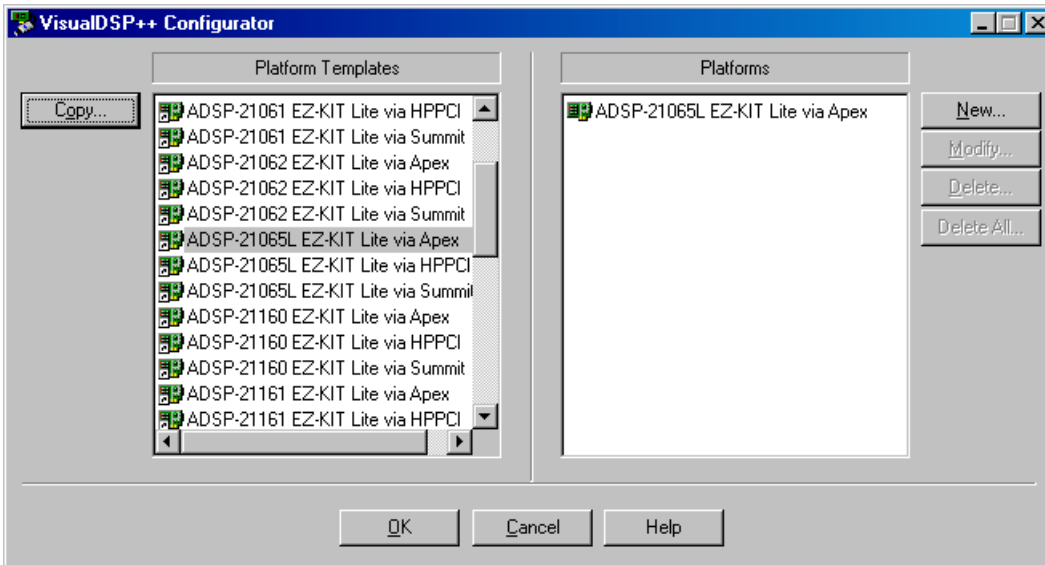
Figure 2-28 VisualDSP++ Configurator (from template) Platform Added

5. Click **OK** to finish the VisualDSP++ Configurator

2.7.4.2 Creating a New Platform from Scratch

Follow the instructions below to create a platform that is **not** based on an Analog Devices evaluation kit.

1. Bring up the **VisualDSP++ Configurator** from the Windows Start menu.
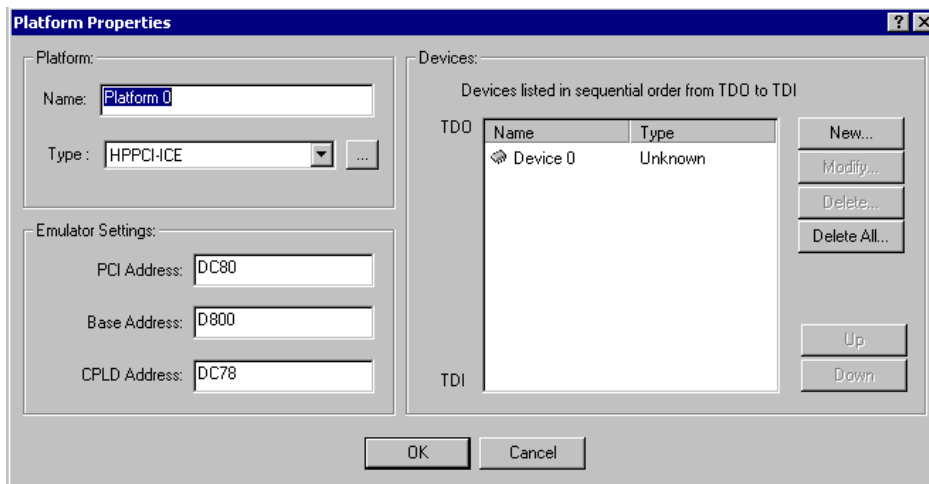2. Click **New** in the VisualDSP++ Configurator to open the Platform Properties dialog box as shown in Figure 2-29, to create a new platform.

Figure 2-29 Platform Properties (from scratch)

3. In the name field**, type** an appropriate name for the platform that is being created. The Type field indicates the type of emulator that you would like to use.
4. If there is more than one emulator installed in the PC click on the **browse** button ("…") to the right of Type as shown in Figure 2-29 to bring up the list of Emulators installed shown in Figure 2-30. If there is only one emulator installed in the PC then the address information will be filled in automatically when launching IceTest and you can skip to step 6.
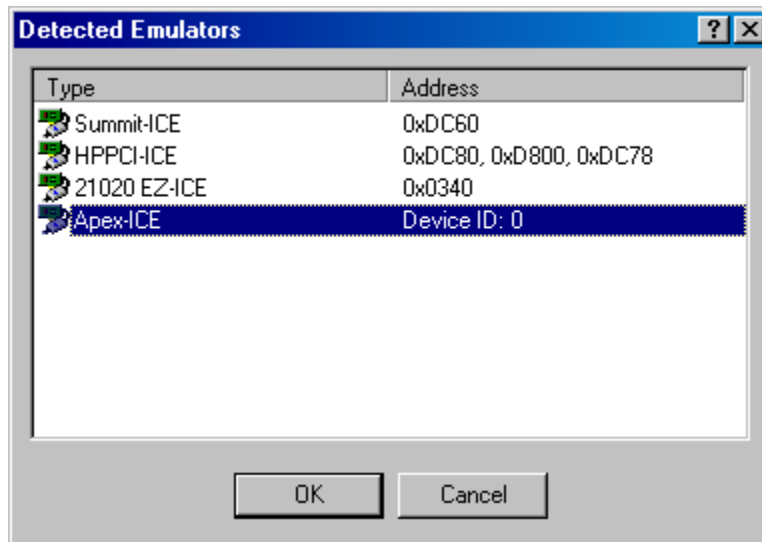
Figure 2-30 Detected Emulators

5. **Highlight** the emulator to be used for your platform and click **OK**.
6. Notice that the Emulator Settings group shown in Figure 2-29 gets filled in with the correct information based on the emulator you chose.
7. **Highlight Device 0** in the Devices list and click **Modify** to display the Device Properties dialog box shown in Figure 2-31.
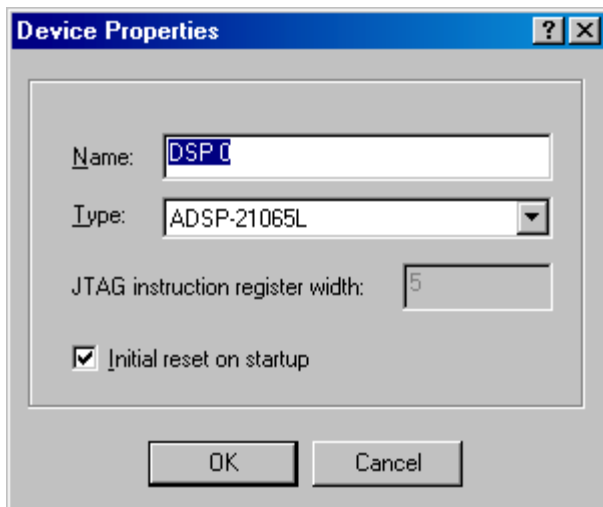
Figure 2-31 Device Properties

8. **Select an appropriate name** for your device and then **select the type of device** to which you will be connecting.
9. Click **OK** and you will see that your device shows up under the Devices list with the appropriate type as shown in Figure 2-32.

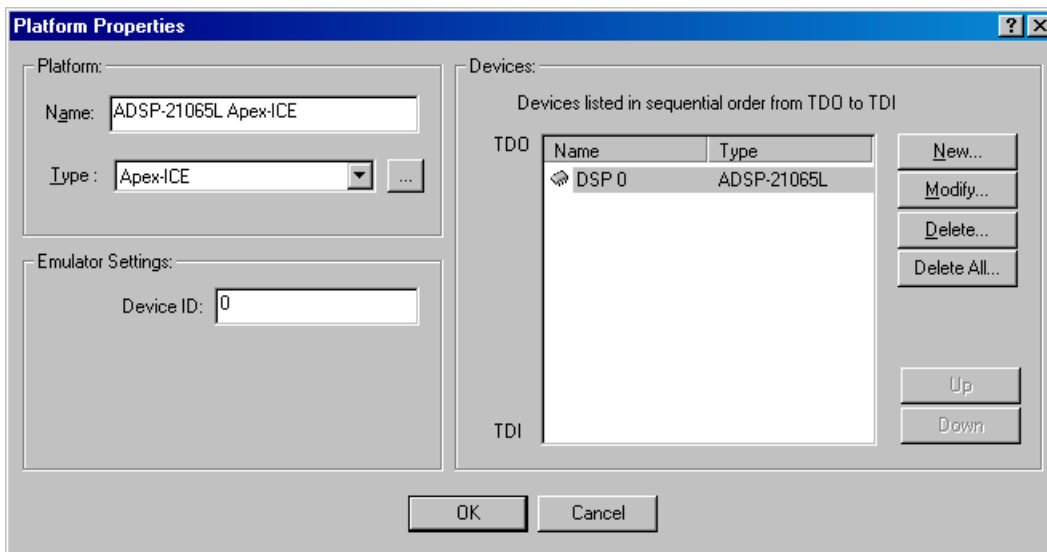**Figure 2-32 Platform Properties (from scratch) Device Added**

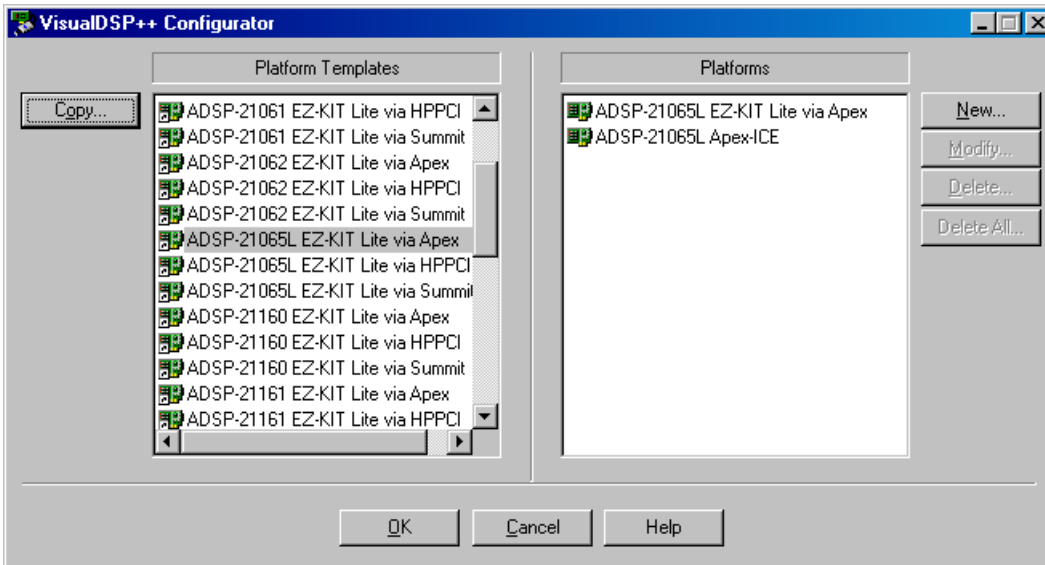10. Click **OK** to add your new platform as shown in Figure 2-33.

Figure 2-33 VisualDSP++ Configurator (from scratch) Platform Added

11. Click **OK** to finish the VisualDSP++ Configurator.

2.7.5 Creating the VisualDSP++ Session

This section assumes that you have installed VisualDSP++ and are familiar with its use.

➢ **Note: The Apex-ICE device must be installed before proceeding with this section.**

To create the VisualDSP++ Session:

1. Verify that the Apex-ICE device is connected and powered on.
2. Start **VisualDSP++** (Start➔Programs➔VisualDSP➔VisualDSP for *DSPfamily*).
3. From the **Session** menu, choose **New Session**.
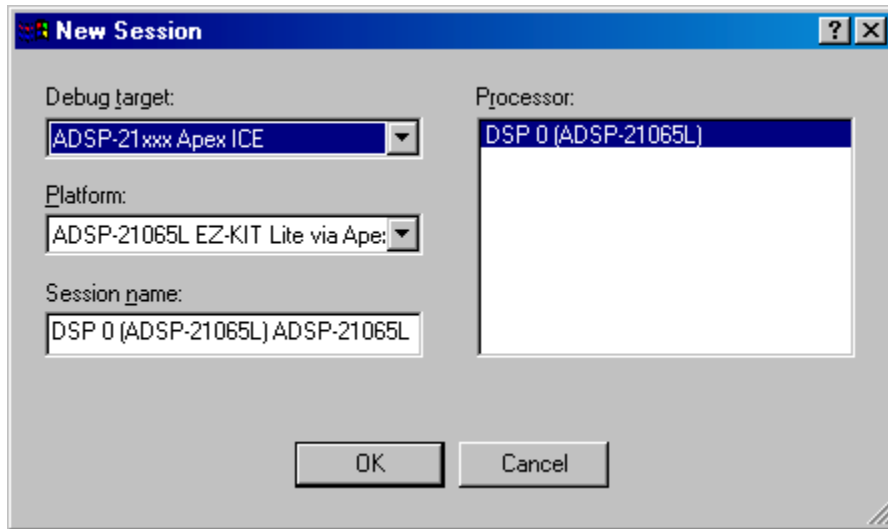4. The **New Session** dialog box appears.

Figure 2-34 New Session Selection

5. In Debug target, select **the target** (such as ADSP-21xxx Apex JTAG Emulator).
6. In Platform, select **the desired DSP target** type connected to the Apex-ICE device.
7. Click **OK**.
8. VisualDSP++ is now ready to use.

3 Support

Analog Devices provides free technical support.

3.1 Technical Support

For technical support, you may contact the Analog Devices DSP Tools Technical Support group in any of the following ways:

- Fill out the DSP Tools Technical Support Web site form at:
  http://forms.analog.com/Form_Pages/DSP/tools/contactDSP.asp
- Send a description of the problem by e-mail to:
  dsptools.support@analog.com
- Call the customer support hotline at 1-800-ANALOG-D (1-800-262-5643 U.S.A. only)

For direct support of the Analog Devices' DSPs, call the Analog Devices' DSP Applications Engineering group at 1-800-ANALOG-D or email dsp.support@analog.com.

3.2 Quality Assurance

Analog Devices is committed to providing quality products and services. To continually provide this quality, please contact our Quality Assurance Department directly if you have any concerns (603) 883-2430, Monday through Friday during normal business hours or via e-mail at *dsptools@analog.com*. Our Quality Assurance Manager will listen to your concerns and provide a timely and effective solution.

4 References

This section describes other documentation resources you may find helpful in developing your application.

- For information on designing the interface between an Analog Devices JTAG DSPs and the emulation header on your custom DSP target board, refer to the latest version of Analog Devices EE-68.
- For information on the architecture and system interface of the ADSP processor, refer to the appropriate Analog Devices *DSP Hardware Reference.*
- For ADSP timing specification and other hardware design information, refer to the appropriate DSP *Data Sheet*.
- For complete information on software development tools (assembler, compiler, linker, and so on), refer to the documentation included with VisualDSP++. This information is available in printed manuals, online help, and online in PDF format.
- For information about your development platform, refer to your operating system manuals and hardware system manuals.
- For information about digital signal processing theory and applications, you may wish to consult:
  - Higgins. *Digital Signal Processing In VLSI*. Prentice-Hall, 1990.
  - Oppenheim and Schafer. *Digital Signal Processing*. Prentice-Hall, 1975.

Index