

Measurement & Automation Explorer Help for Traditional NI-DAQTM (Legacy), version 7.x

August 2005 Edition, Part Number 370041G-01

This help file contains information on configuring and testing DAQ and SCXI products using Measurement & Automation Explorer (MAX) for Traditional NI-DAQ (Legacy), and information on special considerations for operating systems.



Caution Traditional NI-DAQ (Legacy) is an older driver with outdated application programming interfaces (APIs) for developing data acquisition, instrumentation, and control applications for older National Instruments DAQ devices. You should use Traditional NI-DAQ (Legacy) only in certain circumstances. Refer to the NI-DAQ Readme for more information about when to use Traditional NI-DAQ (Legacy), including a complete list of supported devices, operating systems, application software versions, and language versions. Refer to the NI-DAQmx Help, which you can access from **StartProgramsNational InstrumentsNI-DAQNI-DAQmx Help**, for an overview of the two NI-DAQ APIs and the advantages of NI-DAQmx. In NI application software, this same help is available by searching for NI-DAQmx. You can install the <u>latest version of NI-DAQmx software</u>, available at ni.com/downloads.

To navigate this help file, use the **Contents**, **Search**, and **Index** tabs to the left of this window.

For more information about this help file, refer to the following topics:

Conventions—formatting and typographical conventions in this help file

Related Documentation

<u>Glossary</u>

Important Information

Technical Support and Professional Services

To comment on National Instruments documentation, refer to the <u>National</u> <u>Instruments Web site</u>.

© 1999–2005 National Instruments Corporation. All rights reserved.

Conventions

The following conventions appear in this help file:

- The » symbol leads you through nested menu items and dialog box options to a final action. The sequence File»Page Setup»Options directs you to pull down the File menu, select the Page Setup item, and select Options from the last dialog box.
- The symbol indicates closed drop-down text. Click the symbol to display the text.
- The \checkmark symbol indicates open drop-down text. Click the symbol to hide the text.



This icon denotes a note, which alerts you to important information.

 \wedge

This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash.

- **bold** Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names, emphasis, or an introduction to a key concept.
- dark red Text in this color denotes a caution.
- green Underlined text in this color denotes a link to a help topic, help file, or Web address.
- *italic* Italic text denotes variables or cross references. This font also denotes text that is a placeholder for a word or value that you must supply.
- monospace Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames, and extensions.

Related Documentation

The following documents contain information that you might find helpful as you use this help file:

- *DAQ Getting Started Guide*—This guide describes how to install your NI-DAQ 7.*x* software, your DAQ device, and how to confirm that your device is operating properly.
- *SCXI Quick Start Guide*—This guide describes how to install and configure your SCXI chassis and modules, and how to confirm that the chassis is operating properly.
- *Getting Started with SCXI*—This guide is a handbook to the installation and use of the SCXI chassis, modules, and associated DAQ devices.
- Device documentation—This documentation describes the electrical and mechanical aspects of your device and contains information concerning its operation and programming.

Introduction to Measurement & Automation Explorer (MAX)

You use MAX to perform the following actions with your National Instruments measurement and SCXI devices:

- Configure resources and other device-specific settings for measurement devices in your system
- Test the resources and the functionality of measurement devices in your system
- Add and remove a measurement or SCXI device

MAX informs other NI programs which products you have in your system and how they are configured. When you run an application using NI-DAQ, the software reads the configuration to determine which devices you have configured.



Note Special considerations exist for specific operating systems. Refer to <u>Operating System</u> <u>Considerations</u> for more information.

To check the system resources a DAQ device is using and to select attached accessories, expand **Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices** in the configuration tree. Click your device to see information on the device resources. The information appears on the Attributes tab in the middle MAX panel. For more information, refer to <u>Accessing DAQ Devices</u>.



Note Press **<F5>** or select **View»Refresh** to refresh the screen if your device does not appear under Devices and Interfaces.

Getting Started



Note If you are using LabVIEW Real-Time, refer to <u>Remote Device Access and DAQ for</u> <u>LabVIEW Real-Time</u>.

The following dropdown lists include links to information on completing the most common configuration tasks in MAX.

DAQ Devices

• RT Series DAQ Devices

SCXI Chassis

SCXI Modules

Virtual Channels

Custom Scales

DAQ Devices

Refer to the following topics for more information on adding, configuring, testing, and removing DAQ devices.

Accessing DAQ Devices Adding DAQ Devices Configuring DAQ Devices Testing DAQ Devices Removing DAQ Devices Remote Device Access

Accessing DAQ Devices

To access DAQ devices, expand **Devices and Interfaces** in the configuration tree. From this location, you can perform the following tasks:

- Add a new device to your system
- Configure a device in your system
- Test a device in your system
- Remove a device from your system
- <u>Add NI-DAQ Remote Device Access</u>

For information on configuring system settings, refer to System Settings.



Note If your device is supported in both Traditional NI-DAQ (Legacy) and NI-DAQmx, your device appears under both **Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices** and **Devices and Interfaces»NI-DAQmx Devices**.



Note Refer to the <u>Hardware Installation/Configuration Troubleshooter</u> at ni.com/support/install for setup instructions for remote devices using the LabVIEW Real-Time module.

Adding DAQ Devices

Select the operating system you are using for information on how to add a DAQ device.

- Windows 2000/XP
- Windows NT

To add a remote device, refer to Adding NI-DAQ Remote Device Access.

Adding DAQ Devices in Windows 2000/XP

Plug and Play Devices

Windows 2000/XP automatically detects Plug and Play devices. To add a Plug and Play device, follow these steps:

- 1. Install your DAQ device according to the DAQ Getting Started *Guide*.
- 2. Launch MAX, which scans your operating system for new devices.
- 3. The new device appears beneath Devices and Interfaces. For information on configuring your DAQ device, refer to <u>Configuring DAQ Devices</u>.

If Windows 2000/XP did not detect your Plug and Play device, refer to Plug and Play Devices.

Remote Device Access

To add a remote device, refer to Adding NI-DAQ Remote Device Access.

Adding DAQ Devices in Windows NT

Plug and Play Devices

ISA and PCI Devices

After you install your ISA or PCI device, Windows NT detects it. Complete the following steps:

- 1. Power off your computer.
- 2. Install your DAQ device.
- 3. Restart your computer.
- 4. Launch MAX, which scans your operating system for new devices.
- 5. The new device appears beneath Devices and Interfaces. For information on configuring your DAQ device, refer to <u>Configuring</u> <u>DAQ Devices</u>.

Refer to <u>ISA Devices</u> or <u>PCI Devices</u> for more information.

PC Card Devices

Follow the same steps for non-Plug and Play and parallel port devices below.

Refer to <u>PC Card Devices</u> for more information.

Non-Plug and Play and Parallel Port Devices

To add your DAQ devices, follow these steps:

- 1. Right-click **Devices and Interfaces** and select **Create New** from the shortcut menu.
- 2. Select the appropriate device option in the Create New wizard, and click **Next**.
- 3. Select the device you want to add.
- 4. The device configuration wizard guides you through the basic device setup.
- 5. Click **Finish** when you are done.

 $\overline{\mathbb{N}}$

Note Refer to <u>Operating System Considerations</u> for more detailed operating system and device information.

Configuring DAQ Devices

To configure your DAQ devices, follow these steps:

- 1. Expand **Devices and Interfaces**»**Traditional NI-DAQ (Legacy) Devices** in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click the **Properties** button at the top of the Attributes pane.

- 3. Select the appropriate tab to set the following configuration options. The configuration options you see depend on your DAQ device.
 - <u>System</u>—System resources
 - <u>AI</u>—Device-specific analog input settings
 - <u>AO</u>—Device-specific analog output settings
 - <u>Accessory</u>—Signal conditioning accessories
 - OPC—OPC settings
- 4. Click Apply to apply changes.
- 5. Click **OK** when you are finished.



Note Refer to <u>Operating System Considerations</u> for specific operating system and device information.

System Settings

To configure your system settings, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click **Properties** at the top of the Attributes pane.

- 3. Click the **System** tab to set up the following DAQ device settings.
 - Device Number
 - Test Resources
 - Run Test Panels

AI (Analog Input) Settings

To configure your AI settings, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click **Properties** at the top of the Attributes pane.

- 3. Click the **AI** tab to set up the following DAQ device analog input settings. The settings you see depend on your DAQ device.
 - Polarity/Range
 - Mode

AO (Analog Output) Settings

To configure your AO settings, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click **Properties** at the top of the Attributes pane.

- 3. Click the **AO** tab to set up the following DAQ device analog output settings. The analog output settings you see depend on your DAQ device.
 - Polarity
 - External Reference Voltage
 - Output Channel Type

Accessory Settings

To configure your accessory settings, follow these steps:

- 1. Expand **Devices and Interfaces**»**Traditional NI-DAQ (Legacy) Devices** in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click **Properties** at the top of the Attributes pane.

3. If your DAQ device requires an external accessory, click the **Accessory** tab, and select the external accessory. Some accessories require additional configuration. Depending on the accessory, configuration settings either appear on the Accessory tab or require you to click the **Configure** button to set additional options. Refer to the device documentation for more information.

OPC Settings

To configure your OLE for Process Control (OPC) settings, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click **Properties** at the top of the Attributes pane.

3. Click the **OPC** tab and set the analog input calibration period for the DAQ/OPC server.

Note You must install the OPC server during NI-DAQ installation to enable OPC settings.



Remote Access Settings

You need to configure remote access settings only if you plan to remotely control measurement devices. To configure your remote access settings, follow these steps:

- 1. Expand **Devices and Interfaces**»**Traditional NI-DAQ (Legacy) Devices** in the configuration tree.
- 2. Right-click the device you want to configure, and select **Properties**.

–or–

Select the device, and click **Properties** at the top of the Attributes pane.

3. Click the **Remote Access** tab and click **Set Password**. The password you set must be provided by all remote device access (RDA) clients to remotely access the DAQ device.

For more information on remote device access, refer to <u>Remote Device</u> <u>Access</u>.

Testing DAQ Devices

Test panels provide a way for you to test the functionality of your DAQ device. To run test panels, complete the following steps:

- 1. Expand **Devices and Interfaces**»**Traditional NI-DAQ (Legacy) Devices** in the configuration tree.
- 2. Right-click the device you want to test. Select **Test Panels** to display the test panel for the device.

–or–

Select the device you want to test. Click **Test Panels** in the MAX toolbar.

The test panel appears. You can view the <u>analog input</u>, <u>analog</u> <u>output</u>, <u>counter I/O</u>, and <u>digital I/O</u> functions of the device by clicking the tabs near the top of the window. If the device you are testing is not a multifunction DAQ device, the window might have fewer tabs.

- 3. If there is a problem with the device, the Error indicator turns red. Click **Error Codes** to display detailed information about the error.
- 4. Click **Close** when you are finished.



Note Neither DAQ devices running in LabVIEW Real-Time nor the PCI-7041 RT Series DAQ device currently support test panels.

Testing Analog Input

To test the AI functions of a DAQ device, complete the following steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to test. Select **Test Panels** to display the test panel for the device.

–or–

Select the device you want to test. Click **Test Panels** in the MAX toolbar.

The test panel appears. The Analog Input tab is selected by default.

- 3. Select a DAQ device channel from **Channel**.
- 4. Enter **High** and **Low** input limits for the y-axis of the chart.
- 5. Select a **Data Mode**.
 - **Strip Chart**—Acquire samples continuously at a softwaredetermined rate.
 - **One-Shot**—Acquire 1000 samples at the frequency defined by Sample Rate (Hz).
 - **Continuous**—Acquire continuous samples at the frequency defined by Sample Rate (Hz).

Selecting either one-shot or continuous data mode enables both Start and Sample Rate (Hz). Enter a sampling frequency in **Sample Rate (Hz)**. Click **Start** to begin data acquisition. Click **Stop** to cancel the test.

Selecting Strip Chart runs the test automatically.

- 6. Select a **Y Scale Mode**.
 - Auto Scale—MAX selects the scaling that best fits the data.
 - **Full Range**—The y-axis is scaled using the High and Low input range values.
- 7. If there is a problem with the device, the Error indicator turns red. Click **Error Codes** to display detailed information about the error.

8. Click **Close** when you are finished.

Testing Analog Output

To test the AO functions of a DAQ device, complete the following steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to test. Select **Test Panels** to display the test panel for the device.

–or–

Select the device you want to test. Click **Test Panels** in the MAX toolbar.

The test panel appears. Click the Analog Output tab.

- 3. Select a DAQ device channel from **Channel Selection**.
- 4. Select an **Output Mode**.
 - **DC Voltage**—Output a user-defined DC voltage.
 - Sine Generator—Output a user-defined AC voltage.

Selecting DC Voltage enables the **DC Voltage** slider. Select a value using the slider, or enter a value in the field.

Selecting Sine Generator enables both Update Rate and Sinewave Amplitude. Enter a refresh rate for **Update Rate**. Use the slider bar to select a value for **Output Voltage/Amplitude**, or enter a value in the field.

- 5. Click **Update Channel** to output the voltage on the selected channel.
- 6. If there is a problem with the device, the Error indicator turns red. Click **Error Codes** to display detailed information about the error.
- 7. Click **Close** when you are finished.

Testing Counter I/O

To test the counter I/O functions of a DAQ device, complete the following steps:

- 1. Expand **Devices and Interfaces**»**Traditional NI-DAQ (Legacy) Devices** in the configuration tree.
- 2. Right-click the device you want to test. Select **Test Panels** to display the test panel for the device.

–or–

Select the device you want to test. Click **Test Panels** in the MAX toolbar.

The test panel appears. Click the **Counter I/O** tab.

- 3. Select a DAQ device GPCTR channel from **Counter**.
- 4. Select a Counter Mode.
 - **Pulse Train Generation**—Output a periodic signal with user-defined frequency and duty cycle.
 - **Single Pulse Generation**—Output a single pulse with userdefined delay and pulse width.
 - **Simple Event Counting**—Count a user-defined event.

If you select Pulse Train Generation, enter **Frequency** and **Duty Cycle** values.

If you select Single Pulse Generation, enter **Delay (sec)** and **Pulse Width (sec)** values.

If you select Simple Event Counting, select an **Event Source** from the list of available signals. When you start the counter, **Counter Value** continuously updates with the current value.

- 5. Click **Start** to begin the test. Click **Reset** to cancel the test.
- 6. If there is a problem with the device, the Error indicator turns red. Click **Error Codes** to display detailed information about the error.
- 7. Click **Close** when you are finished.

Testing Digital I/O

To test the DIO functions of a DAQ device, complete the following steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to test. Select **Test Panels** to display the test panel for the device.

```
–or–
```

Select the device you want to test. Click **Test Panels** in the MAX toolbar.

The test panel appears. Click the **Digital I/O** tab.

- 3. For each line listed under Line Direction Selection, click the **Input** or **Output** radio button to select an I/O direction.
- 4. If output is selected, click the **Logic Level** for the line to select either a high (1) or low (0) state. Line State identifies high output by turning the indicator red, and low output by leaving the indicator unlit.
- 5. If there is a problem with the device, the Error indicator turns red. Click **Error Codes** to display detailed information about the error.
- 6. Click **Close** when you are finished.

Removing DAQ Devices

To remove a DAQ device, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices in the configuration tree.
- 2. Right-click the device you want to remove, and select **Delete**.

–or–

Select the device, and click **Delete** at the top of the Attributes pane.

3. A dialog box asks you to confirm you want to remove the selected DAQ device. Click **Yes** to remove the device, or click **No** to cancel this action.

Remote Device Access (RDA) and DAQ for LabVIEW Real-Time

Refer to the following topics for more information on adding and configuring RDA devices.

Adding Traditional NI-DAQ (Legacy) Remote Device Access

Starting Remote DAQ Configuration

Using the Remote DAQ Configuration Dialog Box

Creating an RDA Server

Adding Traditional NI-DAQ (Legacy) Remote Device Access

The Traditional NI-DAQ (Legacy) Remote Device Access (RDA) feature lets you use your computer to control National Instruments DAQ devices plugged into other computers on the same network. This feature works only with programs written using the LabVIEW Traditional NI-DAQ (Legacy) VIs. Your programs do not require modifications to use this feature. Access to the remote devices is transparent to your program.

To add a remote device, follow these steps:

- 1. Right-click Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices, and select Add Device.
- 2. In the Add Device window, select the **Remote Device** option, and click **Next**.
- 3. In the Select Remote Computer window, enter the remote computer name or IP address in the Remote Computer Name/IP Address edit box. Or, click **Browse** to browse the network for the computer name. Click **Next**.



Note Your computer may not recognize a remote computer name starting with numbers or using apostrophes.

- 4. Select the device you want to use from the Remote Configuration device list. Click **Next**.
- 5. Select the local device number you want to use.
- 6. Click Finish.

To set a password for your RDA system, refer to <u>Remote Access</u> <u>Settings</u>.

Starting Remote DAQ Configuration

To connect to a computer for remote configuration of DAQ devices, follow these steps:

- From the MAX toolbar, select Tools»NI-DAQ Configuration»Remote DAQ Configuration. The Select Remote Computer window opens.
- 2. Type in the name or IP address of the remote computer, or click **Browse** to browse the network.
- 3. Type in the RDA password. For more information on setting the RDA password, refer to <u>Remote Access Settings</u>.
- Click OK. If the connection is successful, the <u>Remote DAQ</u> <u>Configuration</u> dialog box opens. If the connection fails, an error message opens. Click OK to continue.

Using the Remote DAQ Configuration Dialog Box

The left pane of the Remote DAQ Configuration dialog box shows a tree view of the configured objects on the remote computer. Objects can be DAQ devices, SCXI chassis and modules, virtual channels, and custom scales. Click an object, then do one of the following:

- To view and edit the properties of the object, click **Properties**.
- To delete the object, click **Delete**.
- To add an object to a category, select the category and click Add.
- To save your changes, click **Save**.

When you are finished configuring the remote computer, click Exit.

To modify the configuration of a remote computer, the remote computer must be running the NI-DAQ RDA Server, or it must be a LabVIEW Real-Time target. If the computer is not a LabVIEW Real-Time target, it must have a valid DAQ configuration file. You can create a DAQ configuration file by running MAX on the remote computer.

For information on connecting to a remote computer, see <u>Starting</u> <u>Remote DAQ Configuration</u>.

Creating an RDA Server

To create an RDA server, follow these steps:

- 1. Install NI-DAQ on both the RDA server and client according to the DAQ Getting Started Guide.
- 2. Install and configure your DAQ devices on the RDA client.
- 3. Confirm the devices on the RDA client are working properly by testing their resources. For more information, refer to <u>Testing DAQ</u> <u>Devices</u>.
- 4. On the RDA server, launch the NI-DAQ RDA Server Utility by clicking Start»Programs»National Instruments»NI-DAQ»Remote Device Access Server. For your computer to act as an RDA server, you must leave the RDA Server Utility running.



Note If you want this computer to become an RDA server every time it starts up, place a shortcut to the NI-DAQ RDA Server Utility in your Startup folder.

RT Series DAQ Devices (NI PCI-7041/6040E)

Refer to the following topics for more information on adding, configuring, and removing RT Series DAQ devices.

Adding RT Series DAQ Devices Configuring RT Series DAQ Devices Locking RT Series DAQ Devices Rebooting RT Series DAQ Devices Removing RT Series DAQ Devices

Adding RT Series DAQ Devices

To add an RT Series DAQ device, complete the following steps:

- 1. Install the RT Series DAQ device according to the device documentation.
- 2. Open MAX to scan your operating system for new devices. The new device appears in **Devices and Interfaces** as **RT::<device number>**.

For information on configuring the DAQ device, refer to <u>Configuring RT</u> <u>Series DAQ Devices</u>.

Configuring and Renaming RT Series DAQ Devices

To configure an RT Series DAQ device, complete the following steps:

- 1. Expand **Devices and Interfaces** in the configuration tree.
- Right-click the device you want to configure. Select **Properties**.
 –or–

Select the device you want to configure. Click **Properties** in the MAX toolbar.

- 3. Select the appropriate tab to set the configuration options.
 - General
 - Settings
- 4. Click **OK** when you are finished.

To rename a device, complete the following steps:

- 1. Expand **Devices and Interfaces** in the configuration tree.
- 2. Right-click the device you want to rename. Select **Rename**.
- 3. Type the new device name. Use only alphanumeric characters for the name. Do not use punctuation or spaces. Press **<Enter>** or click anywhere on the screen when finished.

Locking RT Series DAQ Devices

Locking an RT Series DAQ device protects the device from other users by requiring a password to perform any functions on the device. Complete the following steps to lock a device:

- 1. Expand **Devices and Interfaces** in the configuration tree.
- 2. Right-click the device you want to lock. Select **Lock**.

–or–

Select the device you want to lock. Click **Lock** in the MAX toolbar.

3. Enter a password. Enter the password again for confirmation. Click **OK** to lock the device.

Complete the following steps to unlock the device.

- 1. Expand **Devices and Interfaces** in the configuration tree.
- 2. Right-click the device you want to unlock. Select **Unlock**.

–or–

Select the device you want to unlock. Click **Unlock** in the MAX toolbar.

3. Enter the password. Click **OK** to unlock the device.

Rebooting RT Series DAQ Devices

Rebooting an RT Series DAQ device performs a hardware reboot of the device. A reboot aborts any running tasks and restores the device to its default settings. Complete the following steps to reboot a device:

- 1. Expand **Devices and Interfaces** in the configuration tree.
- 2. Right-click the device you want to reboot. Select **Reboot**.

–or–

Select the device you want to reboot. Click **Reboot** in the MAX toolbar.

3. A message appears, indicating success or failure. Click **OK** to continue.

Removing RT Series DAQ Devices

To remove an RT Series DAQ device, complete the following steps:

- 1. Expand **Devices and Interfaces** in the configuration tree.
- 2. Right-click the device you want to remove and select **Delete**.
- 3. A dialog box prompts you to confirm removal of the device. Click **Yes** to remove the device or **No** to cancel.

SCXI Devices

Note If you are using a system running LabVIEW Real-Time, refer to the Remote Systems help for configuration instructions for remote targets. Click Help»Help Topics»Remote Systems. For additional DAQ device configuration instructions with RT Series products, refer to the <u>Hardware Installation/Configuration Troubleshooter</u> at ni.com/support/install for SCXI configuration instructions with RT Series products. Select Real-Time (RT) from the left menu, click Real-Time Configuration Wizard, and select SCXI on RT Systems.

Refer to the following topics for more information on adding, configuring, testing, and removing SCXI devices.

Accessing SCXI Devices

SCXI Chassis

SCXI Modules

Testing SCXI Configuration

Accessing SCXI Devices

The SCXI chassis and modules you add to your configuration appear beneath **Devices and Interfaces** in the configuration tree. From this location, you can perform the following tasks:

- Add SCXI chassis and SCXI modules to your configuration
- <u>Configure SCXI chassis</u> and <u>SCXI modules</u> in your configuration
- Test an SCXI chassis and its modules
- Remove SCXI chassis and SCXI modules from your configuration

SCXI Chassis

Refer to the following topics for more information on adding, configuring, and removing SCXI chassis.

Adding SCXI Chassis

Configuring SCXI Chassis

Removing SCXI Chassis

Adding SCXI Chassis

To add your SCXI chassis, follow these steps:

- 1. Right-click **Devices and Interfaces**, and select **Create New**.
- In the Create New window, go to Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices. Select the SCXI chassis you want to add.
- 3. Click Finish.
- 4. In the dialog boxes that follow, <u>configure</u> your settings.
- 5. Click **Finish** when you are done.

You also can add an SCXI chassis without using the Create New window. Complete the following steps:

- 1. Right-click **Devices and Interfaces**»**Traditional NI-DAQ** (Legacy) **Devices**, and select **Add SCXI Chassis**.
- 2. In the Add SCXI Device window, select **SCXI Chassis**. Click **Next**.
- 3. In the dialog boxes that follow, <u>configure</u> your settings.
- 4. Click Finish when you are done.



Note See <u>Operating System Considerations</u> for specific operating system and device information.

Configuring SCXI Chassis

To configure your SCXI chassis, follow these steps:

- 1. Right-click the SCXI chassis you want to configure, and select **Properties**.
- 2. The General dialog box opens. The following configuration settings appear in the window (depending on the device you choose):
 - Chassis ID
 - Chassis Address
 - Control SCXI with Internal Bus (PXI-1010 Only)
- 3. Click Next.
- 4. In the SCXI Auto-Detect dialog box, select Yes if you want NI-DAQ to automatically detect the SCXI modules in your chassis. If you do not want NI-DAQ to automatically detect the SCXI modules in your chassis, select No. You can manually <u>add SCXI</u> <u>modules</u> to your configuration.

Note Neither DAQ devices running in LabVIEW Real-Time nor the PCI-7041 RT Series DAQ device currently support the SCXI auto-detect option.

- 5. Click Next.
- 6. In the Select SCXI Communication Path dialog box, select the communication path between your chassis and the computer, if necessary.
- 7. Click Next.
- 8. The SCXI Auto-Detection Results dialog box displays the modules found in the chassis. Select the module cabled to the DAQ device.
- 9. Click Finish when you are done.



N

Note Refer to <u>Operating System Considerations</u> for specific operating system and device information.

Removing SCXI Chassis

To remove your SCXI chassis, follow these steps:

1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices. Right-click the chassis you want to remove, and select Delete.

-or-

Select the chassis you want to remove, and click **Delete** at the top of the Attributes pane.

2. A dialog box opens for you to confirm the removal of the selected SCXI chassis. Click **Yes** to remove the chassis or click **No** to cancel.



Caution Removing an SCXI chassis also removes any SCXI module configuration information you have configured in the selected chassis.

SCXI Modules

Refer to the following topics for more information on adding, configuring, and removing SCXI modules.

Adding SCXI Modules

Configuring SCXI Modules

Removing SCXI Modules

Adding SCXI Modules

Before you can add an SCXI module, you must <u>add an SCXI chassis</u>. To add an SCXI module, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices.
- 2. Expand the SCXI chassis.
- 3. Right-click a module labeled **Empty**, and select **Insert**.
- 4. In the Select SCXI Module window, select the module you want to add from the list. Click **Next**.
- 5. In the General, Channel, and Accessory windows, <u>configure your</u> <u>module settings</u>.
- 6. Click **Finish** when you are done.

Note Refer to <u>Operating System Considerations</u> for specific operating system and device information.



Configuring SCXI Modules

To configure your SCXI module, follow these steps:

- 1. Expand Devices and Interfaces»Traditional NI-DAQ (Legacy) Devices.
- 2. Right-click the module you want to configure, and select **Properties**.

–or–

Select the module, and click **Properties** at the top of the Attributes pane.

- 3. A configuration dialog box opens. The following configuration tab options vary depending on the selected module.
 - General
 - Channel
 - Accessory
- 4. Click **OK** when you are done.



Note Refer to <u>Operating System Considerations</u> for specific operating system and device information.

Removing SCXI Modules

To remove your SCXI module, follow these steps:

- 1. In the configuration tree, right-click the module you want to remove and select **Delete**.
- 2. A dialog box opens asking you to confirm you want to remove the selected SCXI module. Click **Yes** to remove the module or click **No** to cancel.

Testing SCXI Configuration

To test your SCXI configuration, follow these steps:

- 1. In the configuration tree, right-click the SCXI chassis you want to test.
- 2. Select Test.

MAX verifies your SCXI configuration by reading the module ID of each configured SCXI module and comparing it against the modules you configured. MAX notifies you if there is any discrepancy, or if the SCXI communication path was not set up correctly.

Refer to your SCXI device documentation for troubleshooting information.



Note Neither DAQ devices running in LabVIEW Real-Time nor the PCI-7041 RT Series DAQ device currently support SCXI configuration testing.

Virtual Channels

To access the channel list, expand **Data Neighborhood** in the configuration tree.

To <u>create</u> a virtual channel, right-click **Data Neighborhood**, and select **Create New**. Select **Traditional NI-DAQ Virtual Channel**.

To <u>edit</u> a virtual channel, right-click the channel you want to edit from the list of channels. Select **Properties**.

To <u>copy</u> a virtual channel, right-click the channel you want to edit from the list of channels. Select **Duplicate**.

To <u>test</u> a virtual channel, right-click the channel you want to edit from the list of channels. Select **Test**.

To <u>delete</u> a virtual channel, right-click the channel you want to edit from the list of channels. Select **Delete**.

To define a custom scale for use by the channel, right-click <u>Scales</u>.

Creating Virtual Channels

To create a virtual channel, follow these steps:

- 1. Right-click **Data Neighborhood** and select **Create New** from the shortcut menu.
- 2. Select Traditional NI-DAQ Virtual Channel, and click Finish.
- 3. The Create New Channel wizard opens. Use this wizard to configure your virtual channel.
- 4. Select the type of channel you want to configure. Click **Next**.
- 5. Enter the name of your channel and a description of the channel. Click **Next**.
- 6. The rest of the wizard helps you with configuration specific to the type of channel.
 - Analog Input
 - <u>Analog Output</u>
 - Digital I/O

Analog Input

Click any of the following items to configure your analog input channels.

- Voltage Input Channel
- Current Input Channel
- Resistance Input Channel
- Frequency Input Channel
- Known-Type Thermocouple Channel
- Custom Thermocouple Channel
- RTD Channel
- Accelerometer Channel
- LVDT/RVDT Channel
- Strain Gauge Channel

Built-In

Select **Built-In** as your CJC type if your DAQ device or its accessory contains a CJC sensor.

User-Supplied CJC Channel

Select **User-Supplied CJC Channel** as your CJC type to use one of your configured input channels as your CJC channel. In the CJC Channel Name menu, MAX displays the channels that meet the following criteria:

- The channel must be an existing analog input channel.
- The channel must be configured to measure temperature in degrees C, F, K, or R.
- The channel must be configured in one of the following ways:
 - If you have specified a plug-in board as your device, configure the channel to use the plug-in board or any of the modules connected to that plug-in board.
 - If you have specified a module as your device, configure the channel to use the module, the plug-in board to which the module is connected, or any of the other modules connected to that plug-in board.

Connect the user-supplied CJC channel to a sensor that reads the ambient temperature at the location where you terminate your thermocouple channel.

User Value

Select **User Value** as your CJC type if you do not have an ambient temperature sensor available for CJC. With this option, the ambient temperature is estimated but not measured. The default is 25° C (typical room temperature) as the CJC value to use in the thermocouple conversion. Edit this value to use a different temperature.

Analog Output

Click any of the following items to configure your analog output channels.

- Voltage Output Channel
- Current Output Channel

Digital I/O

Click any of the following items to learn more about the types of digital input and output channels.

- Digital Input Channel—Read from Port
- Digital Input Channel—Read from Line
- Digital Output Channel—Write to Port
- Digital Output Channel—Write to Line

Editing Virtual Channels

To edit a channel, follow these steps:

- 1. Expand **Data Neighborhood** in the configuration tree.
- 2. Right-click the channel you want to edit, and select **Properties**.

–or–

Select the channel, and click **Properties** at the top of the Attributes pane.

- 3. The configuration window opens and displays your editing options:
 - Settings common to all configurations
 - Analog Input
 - Analog Output
 - Digital I/O
- 4. Click **OK** when you are finished.

All Configurations

Refer to the following topics for more information on editing configuration options for all virtual channels.

Editing Channel Names

Editing Channel Descriptions

Editing Channel Names

To edit your channel name, follow these steps:

1. Right-click the channel you want to edit, and select **Properties**.

–or–

Select the channel, and click **Properties** at the top of the Attributes pane.

- 2. Click Edit Name.
- 3. Edit the text in the Channel Name selection box.
- 4. Click outside the selection box or press the tab key when you are finished.

Editing Channel Descriptions

To edit your channel description, follow these steps:

1. Right-click the channel you want to edit, and select **Properties**.

–or–

Select the channel, and click **Properties** at the top of the Attributes pane.

2. Edit the text in the Description edit box.

AI Configuration

Refer to the following topics for more information on editing configuration options for AI virtual channels.

Editing AI Physical Quantity Editing the Sensor Editing the AI Hardware Editing AI Miscellaneous Properties

Editing AI Physical Quantity

The physical quantity field defines the unit and range of the physical quantity you are measuring with a given DAQ device channel.

- Units In the Units selection box, enter the appropriate unit. For non-temperature measurements, you can enter any unit you want to use. For temperature measurements, you can choose Deg C, Deg F, Deg K, or Deg R.
- Range In the Range selection boxes, enter the minimum and maximum values of the physical quantity you are measuring.

For example, to configure a channel to read a temperature that can vary from 0 to 100° C, set the Units to Deg C, the minimum range to 0, and the maximum range to 100.

Editing the Sensor

The Sensor section defines the sensor type connected to the DAQ channel. The sensor you select determines which scaling options are available for the conversion of the sensor measurement to the physical quantity.

Sensor, In the Sensor selection box, select a sensor. For information on analog input sensor types,

Unit, refer to <u>Analog Input</u>. The sensor you select controls the sensor unit displayed for this

Range channel. The sensor also determines the physical quantity unit you can select. Some sensor selections have pre-selected ranges. When you select one of these sensors, your sensor range automatically changes to the appropriate range in terms of the measurement units.

Scaling In the <u>Scaling Formula</u> selection box, select your scaling option. Standard RTD and Formula Thermocouple measurement options already contain defined scaling formulas, so you do not specify the conversion.

Scaling Formula

The scaling formula section defines which formula Traditional NI-DAQ (Legacy) uses to scale the data on the specified channel.

No Scaling—Matches the physical quantity range to the sensor or actuator range.

Map Ranges—Computes a linear conversion between the sensor or actuator range and the physical quantity range.

New Custom Scale—Enables you to create a custom scale for your channel.

If you have previously configured a <u>custom scale</u>, the scale name is included in the Scaling Formula list.

Editing the AI Hardware

The Hardware section defines which DAQ device and which channel on the device you are assigning to this virtual channel. You also can define the input mode for the DAQ device you choose.

- Device In the Device selection box, select a DAQ device. The selection box lists all devices in your system with analog input channels. The options in the Hardware panel change depending on which sensor you selected. MAX determines whether the sensor you have selected measures voltage, current, resistance, or frequency. It also determines the quantities you can measure directly with a DAQ device and prompts you for any further information needed. If you use a thermocouple to measure temperature, you must supply additional information in the Hardware section.
- Channel In the Channel selection box, select a channel for your DAQ device. Some channels are reserved because they are used by your system configuration and therefore are not available for configuration. The Channel menu marks these channels with a (sys) next to the channel number. The Channel selection box also marks channels already used by other virtual channels with a (cfg).

If you select channels marked with a (sys) or a (cfg), your virtual channel is marked as invalid. However, if you are swapping two channels, this invalid situation is only temporary, and the configuration becomes valid when another configuration is no longer attached to the DAQ hardware channel.

- Pin # After you select a device and channel, the Hardware section displays the pin number or name corresponding to the selected channel as labeled on the device accessory if one is connected, or on the device output connector if no accessory is connected to the device.
- Input In the Input Mode selection box, select the appropriate mode for your DAQ device.
- Mode Depending on the capability of your DAQ device, you can choose between **Differential**, **Referenced Single Ended**, **Nonreferenced Single Ended**, or **4-Wire**. If the input mode selection is hardware jumper-configurable or is not software-selectable by channel, the Hardware panel only offers the mode currently configured. Be sure to set your actual hardware jumper configuration correctly in the device configuration panel. MAX automatically selects the factory-default setting for your device, so your configuration should be correct as long as you have not changed any device jumpers. Refer to the device documentation for information on when to use each input mode and how to wire the input for the mode selected.

Editing AI Miscellaneous Properties

The Miscellaneous section defines values used only with specific types of measurement. Depending on the measurement, some or all of the properties may be disabled.

Current Sense Resistor Value	Enter the resistor value in ohms. Selecting a current input channel enables this value for editing.
Resonant Frequency	Enter the resonant frequency value in hertz. Selecting an accelerometer input channel enables this value for editing.
Excitation Source, Current/Voltage	Select the excitation source. Depending on the measurement, either enter a current value in milliamps or a voltage value in volts. Selecting a resistance, RTD, accelerometer, LVDT/RVDT, or strain gauge input channel enables this value for editing.
Sensitivity Units, Value	Select the sensitivity value units. Enter a sensitivity value. Selecting a RTD, accelerometer, or LVDT/RVDT input channel enables this value for editing.
CJC Source, User Channel, Temperature	Select a value for CJC source. If the source is a user value, enter a value in the Temperature edit box. If the source is user-supplied, select a user-defined channel. Selecting a known-type thermocouple or custom thermocouple input channel enables this value for editing.

AO Configuration

Refer to the following topics for more information on editing configuration options for AO virtual channels.

Editing AO Physical Quantity

Editing the Actuator

Editing the AO Hardware

Editing AO Physical Quantity

The Physical Quantity section defines the unit and range of the physical quantity you are controlling with a given DAQ device channel.

- Units In the Units selection box, enter the appropriate unit.
- Range In the Range selection boxes, enter the minimum and maximum values of the physical quantity you are controlling.

Editing the Actuator

The Actuator section defines the actuator type connected to the DAQ channel. The actuator you select gives you complete control over how the scaling is done to convert from the actuator to the physical quantity.

Actuator,In the Actuator selection box, select an actuator. For information on analog output types, seeUnit,Analog Output. The actuator you select controls the actuator units displayed for this channel.RangeSome actuator selections also have pre-selected ranges. Your actuator range automatically
changes to the appropriate range in terms of your actuator units when you select one of
these actuators.

Actuator In the <u>Scaling Formula</u> selection box, select your scaling option. The voltage or current Scaling output options give you complete control over how the actuator is scaled.

Editing the AO Hardware

The Hardware section defines which DAQ device and which channel on the device you are assigning to this virtual channel.

- Device In the Device selection box, select a DAQ device. The selection box lists all devices in your system with analog output channels. The devices in the DAQ device selection box change depending on which actuator you have selected. MAX determines whether the actuator you have selected uses voltage or current.
- Channel In the Channel selection box, select a channel for your DAQ device. Some channels are reserved because they are used by your system configuration and therefore are not available for configuration. The Channel menu marks these channels with a (sys) next to the channel number. The Channel selection box also marks channels already used by other virtual channels with a (cfg).

If you select channels marked with a (sys) or a (cfg), your virtual channel is marked as invalid. However, if you are swapping two channels, this invalid situation is only temporary, and the configuration becomes valid when another configuration is no longer attached to the DAQ hardware channel.

Pin # After you select a device and channel, the Hardware panel displays the pin number or name corresponding to the selected channel as labeled on the device accessory, if one is connected, or on the device output connector if no accessory is connected to the device.

DIO Configuration

Refer to the following topics for more information on editing configuration options for DIO virtual channels.

Editing the DIO Hardware

Editing Signal Inversion

Editing the DIO Hardware

The Hardware section defines which DAQ device and which port and line on the device you are assigning to this virtual channel.

- Device In the Device selection box, select a DAQ device. The selection box lists all devices in your system with digital ports. If you have selected **Read from Line** or **Write to Line**, you select a port and a line. If you have selected **Read from Port** or **Write to Port**, you only select a port.
- Port In the Port selection box, select the port connected to your signals.

Unidirectional ports are marked by read only or write only following the port name. If you configure your signal to use a unidirectional port in the wrong direction, the configuration is marked as invalid.

Ports with at least one line already reserved are marked by a (sys) or a (cfg) following the port name. A (sys) denotes that at least one line of the port is reserved by the system. A (cfg) denotes that at least one line of the port is reserved by another virtual channel. An (N/A) following a port name indicates that the port is not available on the device. If you configure your signal to use a reserved or unavailable port, the configuration is marked as invalid.

Line For some devices, all lines on the same port must be configured in the same direction. If you select a line on a port and other digital virtual channels are using other lines of the same port for the opposite direction, your virtual channel will become invalid if the DAQ device cannot mix directions on the port.

When you select a device, port, and line, the Hardware section displays the pin number or name corresponding to the selected line.

If you are configuring the channel to Read from Line or Write to Line, the Line menu lists all the available lines on the selected device port. The Line menu marks lines already used by your system configuration or other virtual channels with a (sys) or a (cfg), respectively. If you select lines marked with a (sys) or a (cfg), your virtual channel is marked as invalid. However, in the (cfg) case, if you are swapping two lines, this situation is only temporary and the configuration becomes valid when another virtual channel is no longer attached to the DAQ hardware line.

Editing Signal Inversion

The Signal Inversion section turns on or off the inversion of individual lines in your selected digital port. If you are reading or writing on a single line, you can turn inversion on or off for just that line in the port. If you are reading or writing the entire port, you can specify inversion on a per-line basis. Inversion on a per-line basis is a method of scaling the digital port —converting it to a value that is more usable for you.

Any values read from or written to the line or port are inverted according to the Signal Inversion setting before being written or after being read.

Duplicating Virtual Channels

To copy a virtual channel, follow these steps:

- 1. Right-click the channel you want to copy in Data Neighborhood and select **Duplicate**.
- 2. Select or deselect the **Increment the Channel Number** box. Incrementing the channel number is not valid for digital channels configured to read from or write to a port.
- 3. Enter the number of copies you want to make.
- 4. Click OK.

MAX copies the channel the specified number of times and adds them to the list of channels that appears in Data Neighborhood.

Testing Virtual Channels

To use the Virtual Channel Test Panels to view actual readings or to directly control the different channels you have configured, follow these steps:

- 1. Right-click a channel in the configuration tree and select **Test**.
- 2. From here you can select, view, and test the following channel types:
 - Analog Input
 - Analog Output
 - Digital Input
 - Digital Output
- 3. Click **Close** when you are done.



Note Neither DAQ devices running in LabVIEW Real-Time nor the PCI-7041 RT Series DAQ device currently support virtual channel testing.

Deleting Virtual Channels

To delete a channel, follow these steps:

- 1. Right-click the channel you want to delete from the Data Neighborhood.
- 2. Click Delete.
- 3. A dialog box opens to ask if you are sure you want to remove the selected channel. Click **Yes** to remove the channel, or click **No** to cancel this action.

Scales

Scales displays the custom scales you define as part of your analog input or output virtual channel and their attributes. From Scales, you can perform the following tasks:

- Create a <u>new</u> custom scale
- Edit a custom scale
- <u>Delete</u> a custom scale

Creating Custom Scales

To create a custom scale for an analog channel, follow these steps:

1. In the Analog Input Configuration or Analog Output Configuration windows, select the **New Custom Scale** option in the Scaling Formula selection box. To access the configuration windows, right-click on a channel in the configuration tree and select **Properties**.

You also can launch the Create New Custom Scale Wizard from the configuration tree. Right-click **Scales** in the configuration tree and select **Create New**. Select **NI-DAQ Custom Scale** and click **Finish**.

- 2. The Create New Custom Scale Wizard opens. Enter a scale name and description in the Scale Name and Scale Description selection boxes.
- 3. Select one of the following options from the Scale Type selection box, and click **Next**.
 - Linear Scale
 - Polynomial Scale
 - Table Scale

Creating Linear Scales

In the Create New Custom Scale wizard, follow these steps:

- 1. Enter the scale name and description.
- 2. Select Linear Scale in the Scale Type selection box and click Next.
- 3. Enter the **m** (slope) and **b** (y-intercept) values in the selection boxes. Click **Next**.
- 4. Verify the scale plot. If it is not correct, click **Back** and adjust your coefficient values.
- 5. Adjust the raw minimum and maximum values, if necessary, and click **Apply**.
- 6. Click **Finish** when you are done.

Creating Polynomial Scales

In the Create New Custom Scale wizard, follow these steps:

- 1. Enter the scale name and description.
- 2. Select **Polynomial Scale** in the Scale Type selection box and click **Next**.
- 3. In the Enter Forward Polynomial Coefficients dialog box, select the forward coefficients a_0 , a_1 , a_2 ,... a_n for your polynomial scale:

 $y=a_0+a_1x+a_2x^2+...+a_nx^n$

where *y* is the scaled data and *x* is the raw data.

- a. In the coefficient list box, select the coefficient you want to change by highlighting the corresponding row and click Change. Specify the coefficient in the Add Coefficient dialog box and click OK.
- b. Click **Remove** to remove a coefficient. Click **Import from File** to <u>import the coefficients from a spreadsheet file</u>.
- c. Click **Next** to continue.
- 4. In the Enter Reverse Polynomial Coefficients dialog box, select the reverse coefficients a_0 , a_1 , a_2 ,... a_n for your polynomial scale:

 $x = a_0 + a_1 y + a_2 y^2 + ... + a_n y^n$

where *y* is the scaled data and *x* is the raw data.

- a. To enter the reverse coefficients, follow the same steps as the forward coefficients, or click **Auto Compute** and MAX automatically estimates the reverse coefficients using regression analysis. To compute reverse coefficients, enter minimum and maximum values for the raw range. Enter an order value. Click **OK** to calculate reverse coefficients.
- b. Click **Next** to continue.
- 5. Verify the scale plot in the Verify Scale dialog box. If it is not correct, click **Back** and adjust your coefficient values. Adjust the raw minimum and maximum values, if necessary, and click **Apply**.
- 6. Click **Finish** when you are done.

Creating Table Scales

In the Create New Custom Scale wizard, follow these steps:

- 1. Enter the scale name and description.
- 2. Select **Table Scale** from the Scale Type selection box and click **Next**.
- 3. In the Enter Table Values dialog box, click **Add** and enter the raw and scaled values for your table scale entry.

To modify a table entry, select the entry in the table list box and click **Change**. To remove a table entry, select the entry and click **Remove**.

To import table values from a file, click **Import from File**.

- 4. Click Next.
- 5. Verify the scale plot in the Verify Scale dialog box. If it is not correct, click **Back** and adjust your coefficient values. Adjust the raw minimum and maximum values, if necessary, and click **Apply**.
- 6. Click **Finish** when you are done.

Editing Custom Scales

To edit a custom scale for an analog channel, follow these steps:

- 1. Expand **Scales** in the configuration tree.
- 2. Right-click the scale you want to edit, and select **Properties**.

–or–

Select the scale, and click **Properties** at the top of the Attributes pane.

- 3. The Custom Scale Configuration dialog boxes opens. You can edit the following settings:
 - <u>Scale Name</u>
 - <u>Description</u>
 - <u>Scale Type</u>
- 4. Click **OK** when you are finished.

Editing Scale Name

To edit your scale name, follow these steps:

- 1. Right-click the scale in the configuration tree and select **Properties**.
- 2. Edit the text in the Scale Name edit box.
- 3. Click OK.

Editing Scale Description

To edit the scale description, follow these steps:

- 1. Right-click the scale in the configuration tree and select **Properties**.
- 2. Edit the text in the Description edit box.
- 3. Click OK.

Editing Scale Type

- 1. Right-click the scale and select **Properties**.
- 2. Select one of the following options from the selection box. Click the options for editing information. Each scale type has different settings to configure.
 - Linear
 - <u>Table</u>
 - <u>Polynomial</u>

Editing Linear Scales

When you select **Linear Scale** in the Scale Type dialog box, the following configurable settings are displayed:

Linear Enter the **m** and **b** coefficients for the y = mx + b formula, where x is the raw value read from the sensor or output to the actuator in sensor or actuator units, and y is the physical-quantity engineering value.

Update Click this button to view your scale plot with the new coefficient edits. Plot

Editing Table Scales

When you select **Table Scale** in the Scale Type dialog box, the following configurable settings are displayed:

TableClick Add or Change to enter the raw and scaled (engineering unit) value pairs. This tableValuesscales both raw sensor value to physical quantity for analog input and physical quantity to raw
actuator value for analog output. Click Remove to delete a raw and scaled value pair.

File Click **File** to import values from a tab- or comma-delimited spreadsheet file. Then select the text file containing the table lookup values. This opens the <u>Import Table Value</u> dialog box.

Update Click **Update Plot** to view your scale plot with the new values. Plot

Importing Table Values from a File

Select the delimiter used in your text file (tab is the default), the starting row and ending row, and the column numbers for the Raw and Scaled Values. This dialog box assumes your raw and scaled values are contained in columns. All row and column numbering begins at 1. As you edit the column and row numbers, the dialog box plots the points it reads from the file.

Editing Polynomial Scales

When you select Polynomial Scale in the Scale Type dialog box, the following configurable settings are displayed:

Polynomial Click **Change** button to enter coefficients for each polynomial in the respective input coefficients in the Polynomial scale displays controls for both the forward polynomial (used to scale from the raw sensor units to the physical engineering unit) and the reverse polynomial (used to scale from the physical engineering unit to the raw sensor units). Select the **View Reverse Coefficients** checkbox to view the reverse coefficients. Click **Remove** to delete a coefficient.

File Click **File** to import values from a tab- or comma-delimited spreadsheet file. Then select the text file containing the coefficient values. This opens the <u>Import Polynomial</u> <u>Coefficients</u> dialog box.

Update Click **Update Plot** to view your scale plot with the new values.

Plot

Importing Polynomial Coefficients from a File

Select the delimiter used in your text file (tab is selected by default), the starting row and ending row, and the column number for the polynomial coefficients. For this dialog box, your polynomial coefficients should be contained in columns. All row and column numbering begins at 1. As you edit the column and row numbers, the dialog box plots the points it reads from the file.

Deleting Custom Scales

To delete a scale, follow these steps:

- 1. Right-click the scale you want to delete from the configuration tree.
- 2. Click Delete.
- 3. A dialog box opens to ask if you are sure you want to remove the selected scale. Click **Yes** to remove the scale, or click **No** to cancel this action.

Operating System Considerations

Special considerations exist for the following operating systems:

- Windows 2000/XP
- Windows NT

Special Considerations for Windows 2000/XP

Devices

The Windows 2000/XP <u>Device Manager</u> manages all hardware devices in your computer system. However, the Windows 2000/XP operating system may not automatically detect all DAQ devices. For information on adding or configuring specific DAQ devices, refer to the following topics:

- Plug and Play Devices
- PCI and PXI Devices
- AT E Series Devices

Computers

For special device information on EISA bus computers, refer to EISA Bus Computers.

Windows 2000/XP Device Manager

The Device Manager allocates system resources for all devices you have in the system and makes sure no two devices are using the same system resources such as base address or interrupt level. In Windows 2000/XP, you open the Device Manager by expanding **Start**»**Settings**»**Control Panel**»**System**, and then selecting the **Hardware** tab. Click **Device Manager**.

The Device Manager detects Plug and Play devices when your system starts and automatically assigns resources for your device. For more information, refer to <u>Plug and Play Devices</u>.

You can also change system resources for your DAQ device using the Device Manager. For more information, refer to <u>Resource Allocation</u>.

Plug and Play Devices

If you have installed your Plug and Play DAQ device before installing NI-DAQ, or if MAX did not automatically detect your device, follow these steps:

- 1. Go to **Start»Settings»Control Panel»System**, and select the **Hardware** tab.
- 2. Click Device Manager.
- 3. Select a National Instruments DAQ device under **Other Devices** in the device type list. Right-click the device and select **Uninstall**. Repeat with each National Instruments device in the list.
- 4. Right-click in the Device Manager window and select **Scan for hardware changes**. Windows 2000/XP detects Plug and Play device(s).
- 5. Click **OK** when you are finished.

If you have not yet installed the Plug and Play DAQ device, power off your computer and install the device. Power on the computer after installation is complete. When Windows 2000/XP starts up, it should assign resources to the device automatically.

If Windows 2000/XP does not detect the Plug and Play device, refer to <u>ni.com/support</u> for troubleshooting help.

PCI and PXI Devices

PCI and PXI DAQ devices are Plug and Play devices; however, because of the PCI bus architecture, there are some differences in how you must configure these devices as compared to ISA Plug and Play devices. You generally cannot modify any system resources for PCI and PXI DAQ devices. In Windows 2000, you can modify the Memory Window only by using the Device Manager. Refer to <u>Resource Allocation</u> for more information.

AT E Series Devices

The following topics discuss special considerations for AT E Series devices in Windows 2000/XP.

Resource Allocation for AT E Series Devices

Distributing DMA Channels among Multiple Devices

Freeing All DMA Channels from an AT E Series Device

Resource Allocation for AT E Series Devices

To change or view the allocation of I/O space, interrupts, and DMA for your AT E Series device in Windows 2000/XP, follow these steps:

- 1. In Windows 2000/XP, open the Device Manager by going to **Start»Settings»Control Panel»System**. In the System Properties window, select the **Hardware** tab. Click **Device Manager**.
- 2. Expand **Data Acquisition Devices** to see a list of installed DAQ devices. You will see two entries for each AT E Series device, distinguished by the suffix *Logical Device (1 of 2)* and *Logical Device (2 of 2)*. This is due to a Plug and Play limitation.
- 3. Select the first logical device, and click **Properties**. In the Device Properties window, select the **Resources** tab. Next to the field labeled **Setting based on**, there is a drop-down box of Basic Configurations as follows:
 - Basic configuration 0000 (Base address, one IRQ, two DMA)
 - Basic configuration 0001 (Base address, one IRQ, one DMA)
 - Basic configuration 0002 (Base address, one IRQ)
 - Basic configuration 0003 (Base address only)

If you do not see the last entry for Base address only, your device has an older version of the EEPROM, which you can <u>update</u>.

- 4. You can select from the Basic Configurations offered to reduce the number of DMA channels your device will use or to configure the device to have Base address only.
- 5. If you view the resources for your second logical device, there is only one logical configuration:
 - Basic configuration 0000 (DMA)

If a DMA channel was not available for your second logical device, you will see no entries in the Resource Settings box. There are no other options besides Basic configuration 0000. To free the DMA channel that has been assigned to the second logical device, refer to <u>Distributing DMA Channels among Multiple Devices</u> and Freeing All DMA Channels from an AT E Series Device.

6. Click **OK** when you are done to close the Device Properties window. Then click **OK** to close the System Properties window.

Distributing DMA Channels among Multiple Devices

If you have more than one AT E Series device, the first device that Windows 2000/XP configures may receive all available DMA channels, allocating none to the second device.

To free one or two of the DMA channels allocated to Logical Device 1 of the first device, choose Basic configuration 0001 or 0002. Each configuration allocates one or no DMA channels, respectively. One or two DMA channels are now free for other devices.

To allocate the available DMA channels to a second AT E Series device, do one of the following:

- Restart your computer.
- Remove the second device from the Device Manager. In Windows 2000/XP, right-click any device in the Device Manager window and select **Scan for hardware changes**. The Device Manager detects the second device again and allocates resources to it.

If Logical Device 2 of your first device was allocated a DMA channel, your first device now has one or two DMA channels available to use, depending on which Basic configuration you chose for Logical Device 1. To free the DMA channel allocated to Logical Device 2, refer to Freeing <u>All DMA Channels from an AT E Series Device</u>.

Freeing All DMA Channels from an AT E Series Device

If you want your AT E Series device to use interrupts only, although the device has DMA channels allocated to it, call the NI-DAQ function Set_DAQ_Device_Info (or the LabVIEW Set DAQ Device Information VI) and change the transfer mode to Interrupts Only. Alternately, you can use the Device Manager to remove all the DMA channels allocated to an AT E Series device. Follow these steps to free DMA channels in Windows 2000/XP:

- 1. In Windows 2000/XP, open the Device Manager by going to **Start»Settings»Control Panel»System**. In the System Properties window, select the **Hardware** tab. Click **Device Manager**.
- 2. Expand **Data Acquisition Devices** to see a list of installed DAQ devices. You will see two entries for each AT E Series device, distinguished by the suffix *Logical Device (1 of 2)* and *Logical Device (2 of 2)*. This is due to a Plug and Play limitation.
- Select the first logical device, and click Properties. In the Device Properties window, select the Resources tab. Next to the field labeled "Setting based on," select basic configuration 0002 or 0003 for the first logical device to take away both of its DMA channels.
- 4. To remove the DMA channel assigned to the second logical device, deselect the second logical device under the Device Usage section in the lower left-hand corner of the General tab. Restart your computer.
- 5. The next time you run MAX, you should see no DMA channels associated with your device. If this does not work (even though the second logical device is disabled, Windows 2000/XP sometimes reports that it has a DMA channel allocated to it), try one of the following two approaches:
 - The easiest approach is to reserve resources in the Computer Properties page for your computer. Access this by right-clicking the **Computer** icon in the Device Manager and selecting **Properties**. When the Computer Properties box opens, select the **Direct Memory Access** (DMA)

option and then the **Reserve Resources** tab. If you have an ISA bus computer and do not want an AT E Series device to be assigned any DMA resources, reserve any of the channels 5, 6, and 7 that are not already in use by some other device.

 Another approach is to make sure that other devices are assigned all of your available DMA channels before your AT E Series device. If you have other hardware that needs DMA channels, you can install that hardware first. If your AT E Series device has already been installed, you can remove it from the Device Manager and refresh again after your other hardware has been added.

If you have an AT E Series device and an EISA bus computer, refer to EISA Bus Computers.

Resource Allocation

The Windows 2000/XP operating system handles the allocation of system resources such as I/O space, IRQ, and DMA. To view or change the allocation of I/O space, IRQ, and DMA for your DAQ device, follow these steps:

- 1. Open the Device Manager by selecting **Start»Settings»Control Panel»System**. Select the **Hardware** tab. Click **Device Manager**.
- 2. Double-click **Data Acquisition Devices** for a list of installed DAQ devices.

Viewing Allocated Resources

To view the properties for a device in the <u>Device Manager</u>, double-click that device, then select the **Resources** tab. This tab shows the resources allocated to your device.

The Setting based on selection box shows basic configurations. Each of these basic configurations contains a list of valid resources that the device can use. Typically, Basic configuration 0000 contains all resources a device could possibly need. Each subsequent configuration contains a subset of the desired resources. The following are the basic configurations.

- Basic configuration 0000 (Base address, one IRQ, two DMA)
- Basic configuration 0001 (Base address, one IRQ, one DMA)
- Basic configuration 0002 (Base address, one IRQ)
- Basic configuration 0003 (Base address only)

For non-Plug and Play DAQ Devices, these configurations are described in the nidaq.inf and the nidaq1.inf files in your Windows\Inf directory. For Plug and Play DAQ Devices, including PC Cards (PCMCIA), the configurations are stored on the onboard EEPROM, which is read by Windows 2000/XP.

Changing Allocated Resources

To change the resources assigned to a device, follow these steps:

- 1. Deselect the Use Automatic Settings box.
- 2. Select a resource, and click **Change Setting**.
- 3. A window opens with settings you can change. Click **OK** when you are done. Windows 2000/XP may prompt you to restart your computer for the changes to take effect.

For additional information on changing resources for AT E Series devices, see <u>EISA Bus Computer Considerations: AT E Series Devices</u>.

EISA Bus Computers

The following devices use specific DMA channels on EISA bus computers.

AT E Series Devices

EISA Bus Computer Considerations: AT E Series Devices

AT E Series devices manufactured before December 1995 have a Plug and Play EEPROM programmed to request three 16-bit DMA channels (from channels 0, 1, 2, 3, 5, 6, and 7). For AT E Series devices manufactured after December 1995, the EEPROM requests only DMA channels 5, 6, and 7.

If you have an EISA bus computer and want to use DMA channels 0, 1, 2, or 3 with your newer AT E Series device, you need to run the E Series EEPROM Update Utility. For more information, refer to <u>Updating Your AT</u> <u>E Series EEPROM</u>.

Updating Your AT E Series EEPROM

If you have an AT E Series device shipped prior to December 1995, you should run the EEUPDATE Utility to update your EEPROM contents to match those of current AT E Series devices.

You can fix the following problems with the EEUPDATE Utility.

 The configuration manager or PnP BIOS in your computer assigns the DMA level for the floppy drive to your AT E Series device. This typically results in a floppy drive failure during power-up with your AT E Series device in the computer.

Solution—Start your computer without the floppy drive support, then run the EEUPDATE Utility and reprogram the EEPROM with the Default ISA option.

M

Note The EEUPDATE program must already reside on your hard drive for this solution to work. If the EEUPDATE Utility is not already installed on your hard drive, install it before disabling your floppy drive.

 Your ISA bus computer has an EISA DMA controller, which can cause the Plug and Play BIOS of your computer to assign the device some of the lower DMA channels: 0, 1, 2, or 3. NI-DAQ cannot use these DMA channels.

Solution—Run the EEUPDATE Utility and reprogram the EEPROM with the Default ISA option.

 The first logical device of an AT E Series device has only three basic configurations associated with it instead of four. The fourth basic configuration assigns the device only a base address, with no DMA or IRQ resources.

Solution—Run the EEUPDATE Utility and reprogram the EEPROM with the Default ISA option or Default EISA option, depending on the bus type of your computer.

 The AT E Series device is installed in an EISA bus machine and you want to use DMA 0, 1, 2, or 3. (Devices manufactured after December 1995 were factory-configured in a Default ISA mode, and the device will not request DMA channels 0, 1, 2, or 3).

Solution—Run the EEUPDATE Utility and reprogram the EEPROM with the Default EISA option.

• Your AT E Series device is configured for an EISA bus computer, but you now want to use it in an ISA bus computer. (Devices manufactured prior to December 1995 were factory-configured in a Default EISA mode.)

Solution—A custom configuration option is available, but you should not run this option without first <u>consulting an applications</u> <u>engineer</u> at National Instruments.

If you need to update the EEPROM on your AT E Series device, download the file eeupdate.zip from the <u>Web site</u>.

MAX Registry Entries

MAX and its associated Windows 2000/XP drivers and DLLs modify the Windows registry to keep track of the devices you have installed and configured.

The NI-DAQ installer makes its own entries in the Windows 2000/XP registry, and you can remove them by uninstalling NI-DAQ. You can uninstall NI-DAQ using the **Control Panel**»Add/Remove Programs wizard.

Modified Registry Entry

MAX modifies the following place in the Windows 2000/XP registry:

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Class\DAQDev where *nnnn* is a four-digit hexadecimal number.

Added Registry Entries

The Windows <u>Device Manager</u> adds the following registry entries when it detects NI Plug and Play hardware or when you add new hardware using the Add New Hardware wizard:

HKEY_LOCAL_MACHINE\Enum\ISAPNP\NICnnnn, where *nnnn* is a fourdigit hexadecimal number.

HKEY_LOCAL_MACHINE\Enum\PCI\VEN_1093&DEV_nnnn, where *nnnn* is a four-digit hexadecimal number.

HKEY_LOCAL_MACHINE\Enum\PCMCIA\National_Instruments-DAQCARD*, where * consists of the rest of the product name, plus a four-digit hexadecimal CRC code.

HKEY_LOCAL_MACHINE\Enum\Root\DAQDevice

To view these registry entries in the Windows 2000/XP Registry Editor, select **Start»Run** and enter regedt32.exe. This runs the Registry Editor program.

Removing NI-DAQ Configuration Information in Windows 2000/XP

Deleting an NI-DAQ configuration file (default: Niconfig.daq) in your Windows directory will delete all SCXI configuration information as well as your analog input and analog output settings. The next time you run MAX, your devices will reappear, but the configuration information will be lost. You do not need to restart your computer after deleting the NI-DAQ configuration file.

To remove your NI-DAQ configuration, follow these steps:

- 1. Delete the NI-DAQ configuration file (default: Niconfig.daq) in your Windows directory.
- 2. In Windows 2000/XP, open the Device Manager by selecting **Start»Settings»Control Panel»System**. Select the **Hardware** tab and click **Device Manager**.
- 3. From the Device Manager, remove all National Instruments DAQ devices by selecting each device and clicking **Uninstall**. In Windows 2000/XP, if there are any National Instruments devices in the Other Devices category, remove those devices as well.
- 4. Click OK.
- 5. Restart your computer.

The preceding steps remove the association between DAQ devices and NI-DAQ device numbers, and force Windows 2000/XP to reconfigure your Plug and Play devices. You must also reconfigure your non-Plug and Play devices.

Special Considerations for Windows NT Devices

There are some special considerations when adding certain DAQ devices in Windows NT. For information on adding or configuring specific DAQ devices, refer to <u>Plug and Play Devices</u>.

Plug and Play Devices in Windows NT

For information on special considerations for Plug and Play devices in Windows NT, select any of the following topics:

- ISA Devices
- PC Card Devices
- PCI Devices

ISA Devices

If you plan to use ISA Plug and Play DAQ devices on Windows NT, you must first install NI-DAQ, then the Windows NT ISA Plug and Play driver before configuring your device with MAX. This driver is not installed by default. Follow these steps to install the driver:

- 1. Insert your Windows NT CD.
- 2. Go to the \Drvlib\Pnpisa\X86 directory.
- 3. Right-click the Pnpisa.inf file and select Install.
- 4. After you have installed the Pnpisa.inf file, power off your computer.
- 5. Install your ISA Plug and Play DAQ device.
- 6. Power on your computer. When Windows NT detects your ISA Plug and Play DAQ device, it will specify the necessary driver files. Because this will result in a configuration change, restart your computer.
- 7. After restarting, run MAX. MAX will automatically detect the device and ask for a device number.

Refer to <u>Configuring DAQ Devices</u> for more information.



Note After you make any resource changes to ISA Plug and Play devices in MAX, you must restart your system.

PC Card Devices (PCMCIA)

To change the socket your PC Card device resides in, select a PC Card socket in the System Resources.

You must add the device and assign resources manually to the PC Card device. To find out what resources are available to your computer, run the Windows NT Diagnostics Utility by going to

Start»Programs»Administrative Tools (Common)»Windows NT Diagnostics and clicking the Resources tab.



Note After you make any resource changes to PC Card devices in MAX, you must restart your system.

PCI Devices

PCI DAQ devices are Plug and Play devices; however, because of the influence of the PCI bus architecture, there are some differences in how you must configure your PCI device, as compared to ISA Plug and Play devices. You generally cannot modify any system resources for PCI DAQ devices, since under Windows NT, MAX uses the BIOS-assigned resources.

Although assigned resources cannot be modified, follow these steps to verify resources:

- 1. Right-click the device in the configuration tree.
- 2. Select **Test Panel**.

Test panels test the device and make sure the assigned system resources are correct.

Reserving More Acquisition Memory

Windows NT limits the total amount of memory that is page locked. The default amount of memory is determined according to the total amount of physical memory available in your system. If you are working with large data acquisition buffers, you might encounter an outOfMemoryError, unless you increase the default I/O page lock limit using the Windows NT Registry Editor, regedt32.exe.

The IoPageLockLimit registry key is located in:

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\Session Manager\Memory Management

By default, this limit is 0, which indicates to the system that it should use a built-in algorithm to determine the amount of available memory. You can change this value to indicate the number of bytes that can be used.



Caution Use caution when changing this value. The default value computed by the system when IoPageLockLimit equals 0 is tuned specifically for system performance. Allowing the system to lock down more memory can have a detrimental effect on system performance and can even render your machine unusable.

Removing NI-DAQ Configuration Information in Windows NT

To remove your NI-DAQ configuration, follow these steps:

- 1. Expand **Devices and Interfaces** in the configuration tree.
- 2. Remove each configured device by right-clicking the device and selecting **Delete**.
- 3. Save your changes and exit MAX.
- 4. Delete the NI-DAQ configuration file (default: Niconfig.daq) in your Windows directory.



Α

address Character code that identifies a specific location (or series of locations) in memory.

base A memory address that serves as the starting address for programmable registers. All other address addresses are located by adding to the base address.

- BIOS Basic Input/Output System—BIOS functions are the fundamental level of any PC or compatible computer. BIOS functions embody the basic operations needed for successful use of the computer hardware resources.
- bus The group of conductors that interconnect individual circuitry in a computer. Typically, a bus is the expansion vehicle to which I/O or other devices are connected. Examples of PC buses are the ISA and PCI bus.

В

channel

- 1. Physical—A terminal where an analog or digital signal may be input or output. A single physical channel can imply more than one terminal as in the case of a differential analog input channel or a digital port of eight lines.
- 2. Virtual—A collection of property settings that includes a physical channel, type of measurement or generation, and scaling information.

configuration Refers to the left window in Measurement & Automation Explorer, which contains items such as **Data Neighborhood** and **Devices and Interfaces**.

1. Data AcQuisition.

- 2. Collecting and measuring electrical signals from sensors, transducers, and test probes or fixtures and inputting them to a computer for processing.
- 3. Collecting and measuring the same kinds of electrical signals with A/D and/or DIO devices plugged into a computer, and possibly generating control signals with D/A and/or DIO devices in the same computer.
- device 1. An instrument or controller that can be addressed as a single entity and controls or monitors real-world I/O points. A device often is connected to the host computer through some type of communication network, or can be a plug-in device.
 - 2. DAQ. A plug-in data acquisition device, card, or pad that can contain multiple channels and conversion devices. Plug-in devices and PCMCIA cards are all examples of DAQ devices. SCXI modules are distinct from DAQ devices.
- DIO digital input/output

driver Software that controls a specific hardware device such as a DAQ device.

dropdown A graphical box with a down arrow button that lets you select values or options from a list. To select a value or option in the selection box, click the down arrow for a complete list of values listbox or options, then use your arrow keys or mouse to select a value or option from the list.

D

DAQ

G

gain The factor by which a signal is amplified, sometimes expressed in decibels (dB).

н

- hardware The physical components of a computer system, such as the circuit boards, plug-in boards, chassis, enclosures, peripherals, and cables.
- hex Hexadecimal; a base-16 numbering system.

L

- interrupt A computer signal indicating that the CPU should suspend its current task to service a designated activity.
- interrupt The relative priority at which a device can interrupt.

level

- I/O input/output—the transfer of data to/from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.
- IRQ Interrupt ReQuest
- ISA industry standard architecture. Also refers to a common PC expansion bus.

MAX Measurement & Automation Explorer.

multiplexed An SCXI operating mode in which analog input channels are multiplexed into one module output so that the cabled DAQ device has access to the multiplexed output as well as the outputs on all other multiplexed modules in the chassis through the SCXI bus. Also called serial mode.

Μ

Ν

NI-DAQ National Instruments driver software for DAQ hardware.

0

OLE object linking and embedding

OPC OLE for process control.

operating Base-level software that controls a computer, runs programs, interacts with users, and communicates with installed hardware or peripheral devices. Also referred to as OS.

- PCI Peripheral Component Interconnect—a high-performance expansion bus architecture originally developed by Intel to replace ISA and EISA. PCI offers a theoretical maximum transfer rate of 132 Mbytes/s.
- PCMCIA An expansion bus architecture that has found widespread acceptance as a de facto standard in notebook-size computers. PCMCIA originated as a specification for add-on memory cards written by the Personal Computer Memory Card International Association.

Plug Devices that do not require DIP switches or jumpers to configure resources on the devices. and Play Also called switchless devices.

devices

Ρ

- RDA remote device access—A protocol used in NI-DAQ to transparently establish communication, configure, and acquire data on the remote device over a local area network or the Internet.
- RT Real-Time—a property of an event or system in which data is processed as it is acquired instead of being accumulated and processed at a later time.

RT Processor-based DAQ devices for use with the LabVIEW Real-Time module. Series

R

- SCXI Signal Conditioning eXtensions for Instrumentation—the National Instruments product line for conditioning low-level signals within an external chassis near sensors so only high-level signals are sent to DAQ devices in the noisy PC environment.
- sensor A device that responds to a physical stimulus (heat, light, sound, pressure, motion, flow, and so on), and produces a corresponding electrical signal.

S

т

task A channel or group of channels with the same timing and triggering.

Important Information

<u>Warranty</u>

<u>Copyright</u>

<u>Trademarks</u>

Patents

Warning Regarding Use of NI Products

Warranty

The media on which you receive National Instruments software are warranted not to fail to execute programming instructions, due to defects in materials and workmanship, for a period of 90 days from date of shipment, as evidenced by receipts or other documentation. National Instruments will, at its option, repair or replace software media that do not execute programming instructions if National Instruments receives notice of such defects during the warranty period. National Instruments does not warrant that the operation of the software shall be uninterrupted or error free.

A Return Material Authorization (RMA) number must be obtained from the factory and clearly marked on the outside of the package before any equipment will be accepted for warranty work. National Instruments will pay the shipping costs of returning to the owner parts which are covered by warranty.

National Instruments believes that the information in this document is accurate. The document has been carefully reviewed for technical accuracy. In the event that technical or typographical errors exist, National Instruments reserves the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult National Instruments if errors are suspected. In no event shall National Instruments be liable for any damages arising out of or related to this document or the information contained in it.

Except as specified herein, National Instruments makes no warranties, express or implied, and specifically disclaims any warranty of merchantability or fitness for a particular purpose. Customer's right to recover damages caused by fault or negligence on the part of National Instruments shall be limited to the amount theretofore paid by the customer. National Instruments will not be liable for damages resulting from loss of data, profits, use of products, or incidental or consequential damages, even if advised of the possibility thereof. This limitation of the liability of National Instruments will apply regardless of the form of action, whether in contract or tort, including negligence. Any action against National Instruments must be brought within one year after the cause of action accrues. National Instruments shall not be liable for any delay in performance due to causes beyond its reasonable control. The warranty provided herein does not cover damages, defects, malfunctions, or service failures caused by owner's failure to follow the National Instruments installation, operation, or maintenance instructions; owner's modification of the product; owner's abuse, misuse, or negligent acts; and power failure or surges, fire, flood, accident, actions of third parties, or other events outside reasonable control.

Copyright

Under the copyright laws, this publication may not be reproduced or transmitted in any form, electronic or mechanical, including photocopying, recording, storing in an information retrieval system, or translating, in whole or in part, without the prior written consent of National Instruments Corporation.

Patents

For patents covering National Instruments products, refer to the appropriate location: **Help**»**Patents** in your software, the patents.txt file on your CD, or <u>ni.com/patents</u>

Trademarks

National Instruments, NI, ni.com, and LabVIEW are trademarks of National Instruments Corporation. Refer to the *Terms of Use* section on ni.com/legal for more information about <u>National Instruments trademarks</u>.

FireWire® is the registered trademark of Apple Computer, Inc.

Handle Graphics®, MATLAB®, Real-Time Workshop®, Simulink®, and

Stateflow® are registered trademarks, and TargetBox^{2™}, xPC

TargetBox $^{2\,\text{TM}},$ and Target Language Compiler $^{\text{TM}}$ are trademarks of The MathWorks, Inc.

Tektronix® and Tek are registered trademarks of Tektronix, Inc.

Other product and company names mentioned herein are trademarks or trade names of their respective companies.

Members of the National Instruments Alliance Partner Program are business entities independent from National Instruments and have no agency, partnership, or joint-venture relationship with National Instruments.

WARNING REGARDING USE OF NATIONAL INSTRUMENTS PRODUCTS

(1) National Instruments products are not designed with components and testing for a level of reliability suitable for use in or in connection with surgical implants or as critical components in any life support systems whose failure to perform can reasonably be expected to cause significant injury to a human.

(2) In any application, including the above, reliability of operation of the software products can be impaired by adverse factors, including but not limited to fluctuations in electrical power supply, computer hardware malfunctions, computer operating system software fitness, fitness of compilers and development software used to develop an application, installation errors, software and hardware compatibility problems, malfunctions or failures of electronic monitoring or control devices, transient failures of electronic systems (hardware and/or software), unanticipated uses or misuses, or errors on the part of the user or applications designer (adverse factors such as these are hereafter collectively termed "system failures"). Any application where a system failure would create a risk of harm to property or persons (including the risk of bodily injury and death) should not be reliant solely upon one form of electronic system due to the risk of system failure. To avoid damage, injury, or death, the user or application designer must take reasonably prudent steps to protect against system failures, including but not limited to back-up or shut down mechanisms. Because each end-user system is customized and differs from National Instruments' testing platforms and because a user or application designer may use National Instruments products in combination with other products in a manner not evaluated or contemplated by National Instruments, the user or application designer is ultimately responsible for verifying and validating the suitability of National Instruments products whenever National Instruments products are incorporated in a system or application, including, without limitation, the appropriate design, process and safety level of such system or application.

Technical Support and Professional Services

Visit the following sections of the National Instruments Web site at ni.com for technical support and professional services:

- <u>Support</u>—Online technical support resources at ni.com/support include the following:
 - Self-Help Resources—For answers and solutions, visit the award-winning National Instruments Web site for software drivers and updates, a searchable <u>KnowledgeBase</u>, <u>product</u> <u>manuals</u>, step-by-step troubleshooting wizards, thousands of example programs, tutorials, application notes, instrument drivers, and so on.
 - Free Technical Support—All registered users receive free Basic Service, which includes access to hundreds of Applications Engineers worldwide in the <u>NI Developer</u> <u>Exchange</u> at ni.com/exchange. National Instruments Applications Engineers make sure every question receives an answer.

For information about other <u>technical support options</u> in your area, visit ni.com/services or <u>contact</u> your local office at ni.com/contact.

- <u>Training and Certification</u>—Visit ni.com/training for self-paced training, eLearning virtual classrooms, interactive CDs, and Certification program information. You also can register for instructor-led, hands-on courses at locations around the world.
- <u>System Integration</u>—If you have time constraints, limited in-house technical resources, or other project challenges, National Instruments Alliance Partner members can help. To learn more, call your local NI office or visit ni.com/alliance.

If you searched ni.com and could not find the answers you need, contact your <u>local office</u> or NI corporate headquarters. You also can visit the <u>Worldwide Offices</u> section of ni.com/niglobal to access the branch office Web sites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

Branch Offices

Office	Telephone Number
Australia	1800 300 800
Austria	43 0 662 45 79 90 0
Belgium	32 0 2 757 00 20
Brazil	55 11 3262 3599
Canada	800 433 3488
China	86 21 6555 7838
Czech Republic	420 224 235 774
Denmark	45 45 76 26 00
Finland	385 0 9 725 725 11
France	33 0 1 48 14 24 24
Germany	49 0 89 741 31 30
India	91 80 51190000
Israel	972 0 3 6393737
Italy	39 02 413091
Japan	81 3 5472 2970
Korea	82 02 3451 3400
Lebanon	961 0 1 33 28 28
Malaysia	1800 887710
Mexico	01 800 010 0793
Netherlands	31 0 348 433 466
New Zealand	0800 553 322
Norway	47 0 66 90 76 60
Poland	48 22 3390150
Portugal	351 210 311 210
Russia	7 095 783 68 51
Singapore	1800 226 5886
Slovenia	386 3 425 4200
South Africa	27 0 11 805 8197
Spain	34 91 640 0085
Sweden	46 0 8 587 895 00
Switzerland	41 56 200 51 51
Taiwan	886 02 2377 2222
Thailand	662 278 6777
United Kingdom	44 0 1635 523545
United States (Corporate)	512 683 0100