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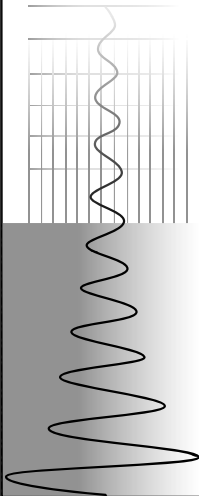
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PCI-6071E

Measure



Measure™ Data Acquisition User Manual

August 1998 Edition
Part Number 321004C-01

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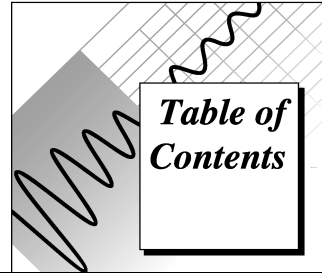
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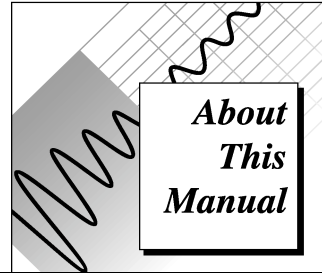
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The *Measure Data Acquisition User Manual* describes how to use the Measure Data Acquisition Add-In with National Instruments data acquisition boards to acquire data into Microsoft Excel. You should be familiar with the operation of Microsoft Excel, your computer, your computer's operating system, and your data acquisition (DAQ) board.

Organization of This Manual

The *Measure Data Acquisition User Manual* is organized as follows.

- Chapter 1, *Introduction*, helps you install the Measure Data Acquisition (DAQ) Add-In. You should have installed and configured your DAQ hardware already.
- Chapter 2, *Getting Started with Data Acquisition Tasks*, contains a tutorial for the following basic functions: selecting a data acquisition task, configuring an analog input task, configuring an analog output task, adding tasks to the DAQ menu, saving tasks, and managing tasks in a workbook.
- Chapter 3, *Using SCXI with Measure DAQ*, describes how to use the Measure Data Acquisition Add-In in Excel with your Signal Conditioning Extension for Instrumentation (SCXI) equipment.
- Chapter 4, *Analog Input Reference*, introduces some basic concepts of data acquisition and contains a reference for analog input configuration, hardware digital triggering, analog input modes, and advanced timing. You should be familiar with the hardware characteristics of your data acquisition device.
- Chapter 5, *Analog Output Reference*, introduces some concepts of data acquisition and contains a reference for basic and advanced Analog Output Configuration.

- Chapter 6, *Using Measure Data Acquisition Tasks with VBA*, describes how to run tasks from within Visual Basic for Applications.
- Appendix A, *DAQ Hardware Capabilities*, contains tables that summarize the analog I/O capabilities of National Instruments data acquisition devices you might use with Measure for Windows.
- Appendix B, *Error Codes*, describes the errors that can occur while using the Measure DAQ Add-In.
- Appendix C, *Troubleshooting*, describes solutions to problems that you might encounter using the Measure DAQ Add-In.
- Appendix D, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.
- The *Glossary* contains an alphabetical list and descriptions of terms used in this manual, including abbreviations, acronyms, metric prefixes, mnemonics, and symbols.
- The *Index* contains an alphabetical list of key terms and topics in this manual, including the page where you can find each one.

Conventions Used in This Manual

The following conventions are used in this manual.

| | |
|---------------------------|--|
| bold | Bold text denotes a parameter, or the introduction of menus, menu items, or dialog box buttons or options. |
| <i>bold italic</i> | Bold italic text denotes a note, caution, or warning. |
| <i>italic</i> | Italic text denotes emphasis, a cross reference, or an introduction to a key concept. |

monospace Text in this font denotes text or characters that are to be literally input 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, variables, filenames, and extensions, and for statements and comments taken from program code.

» The » symbol leads you through nested menu items, and dialog box options to a final action. The sequence **Files»Page Setup»Options»Substitute Fonts** directs you to pull down the **File** menu, select the **Page Setup** item, select **Options**, and finally select the **Substitute Fonts** option from the last dialog box.



Note: *This icon to the left of bold italicized text denotes a note, which alerts you to important information.*

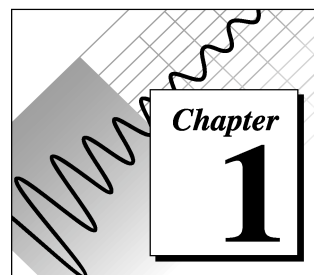
Related Documentation

The *NI-DAQ User Manual for PC Compatibles* contains information that you may find helpful as you read this manual.

Customer Communication

National Instruments wants to receive your comments on our products and manuals. We are interested in the applications you develop with our products, and we want to help if you have problems with them. To make it easy for you to contact us, this manual contains comment and configuration forms for you to complete. These forms are in Appendix D, *Customer Communication*, at the end of this manual.

Introduction



This chapter helps you install the Measure Data Acquisition (DAQ) Add-In. You should have installed and configured your DAQ hardware already. If you have not done so, please refer to the NI-DAQ documentation that came with your device for instructions on installation and configuration.

Using Measure with Your DAQ Device

Measure is designed to work with many different National Instruments DAQ devices. Before you can use Measure, you must install and configure your DAQ device and the NI-DAQ driver software that came with your DAQ device. NI-DAQ is the low-level driver software that controls your DAQ device. Measure is a higher-level software development tool that communicates to your DAQ device through NI-DAQ. Refer to the documentation that comes with your DAQ device to learn how to install it properly.

Once you install your DAQ device, you must install and configure your NI-DAQ driver software.

You use the NI-DAQ Configuration Utility to set up your DAQ device. For some DAQ devices, such as the E Series boards, you do not have to configure many settings. For other devices, you might be required to set jumpers or switches on your device to configure it to work in your system. Refer to the documentation that came with your DAQ device to install your NI-DAQ driver software. The filename for the NI-DAQ Configuration Utility is `WDAQCONF . EXE` in NI-DAQ versions 4.0 and earlier. In NI-DAQ versions 5.0 and later, the filename is `NICFG16 . EXE` for Windows 3.1 and `NIDAQCFG . EXE` for Windows 95/98 or Windows NT 4.0.

Configuring Channels with the Channel Wizard

The NI-DAQ Configuration Utility is a Windows application you can use to configure the analog input channels on your DAQ device. The Channel Wizard feature helps you define the physical quantities you are measuring on each DAQ hardware channel. As you configure channels in the Channel Wizard, you give each channel configuration a unique name that is used when addressing your channels in Measure. The channel configurations you define are saved in a file that instructs the NI-DAQ driver how to scale and process each DAQ channel by its name. National Instruments recommends that you use the Channel Wizard to configure the analog input channels for your DAQ device.

Refer to the NI-DAQ Configuration Utility online help for specific instructions on how to use the Channel Wizard. In Windows 95/98 or Windows NT 4.0, you can find the help file in **Start»Programs»National Instruments DAQ»NI-DAQ Help**.

DAQ Device Overview

Measure is an easy-to-use spreadsheet interface for acquiring data with a wide range of National Instruments DAQ devices. Because Measure works with so many different devices, the functionality and performance of the software often varies based on the particular DAQ device you use. Although Measure senses the type of DAQ device you are using, you might select options in the task configuration that are not supported by your particular device. Measure notifies you when such a conflict occurs when you close the configuration window, or when you test the task you have defined. Make sure to test each task once you define it.

The following pages contain a tutorial to show you how to use Measure. Refer to the *Managing Tasks in a Workbook* section in Chapter 2, *Getting Started with Data Acquisition Tasks*, for detailed information on the analog input and output settings you can configure with Measure.

Installing Measure

1. Insert the Measure 2.0 CD into the CD-ROM drive .
2. Select **Start»Run** from the taskbar in Windows 95 or **File»Run** from the Program Manager in other versions of Windows.
3. Type `X:\SETUP` in the box labeled Command Line, and then select **OK**.
4. Select a location for the setup program to install Measure for Windows.
5. Deselect any Add-Ins that you do not want to install.
6. Select **OK**.

The setup program copies the program files and on-line help files to the directory that you choose and creates a program group. Setup also automatically configures Excel to load the DAQ Add-In when you launch Excel. If you do not want Excel to automatically load the DAQ Add-In, remove the Add-In manually as described in the following section.

Manually Adding or Removing the DAQ Add-In

To add the DAQ Add-In manually, complete the following steps.

1. In Excel, select **Tools»Add-Ins**.
2. In the Add-Ins dialog box, search the Add-Ins Available list box for the **Measure Data Acquisition Add-In** entry. Click in the checkbox next to the Measure Data Acquisition Add-In entry. If you cannot find the entry, click the **Browse** button and look for `DAQ.XLA` in the directory where you installed Measure.

To remove the DAQ Add-In manually, deselect the checkbox next to it, as shown in Figure 1-1. The next time you launch Excel, Excel will not load the DAQ Add-In automatically.

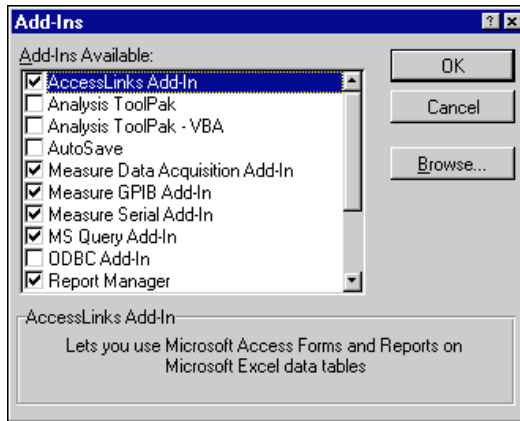
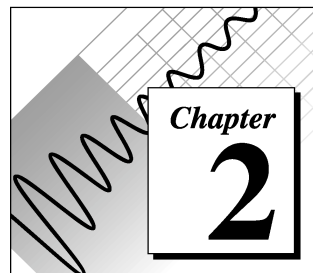


Figure 1-1. Add-Ins Dialog Box

Uninstalling Measure

To uninstall Measure, remove Serial, Data Acquisition, and GPIB Add-Ins from the Add-Ins list in Excel. Double-click the **Uninstall** icon in the Measure folder to remove Measure from your computer.

Getting Started with Data Acquisition Tasks



After you install and configure your hardware and install the Measure Data Acquisition Add-In, you are ready to acquire data. This chapter contains a tutorial for each of the following basic functions.

- Selecting a Data Acquisition task
- Configuring an Analog Input task
- Configuring an Analog Output task
- Adding tasks to the DAQ menu
- Saving tasks
- Managing tasks in a workbook

You only need to read the sections for the functions that you use in your application.

Selecting a Data Acquisition Task

This section contains step-by-step instructions for configuring analog input and output tasks with Measure. To configure tasks, complete the following steps.

1. Launch Excel.
2. Select **DAQ»Configure DAQ Tasks** to display the DAQ Tasks dialog box, as shown in Figure 2-1.

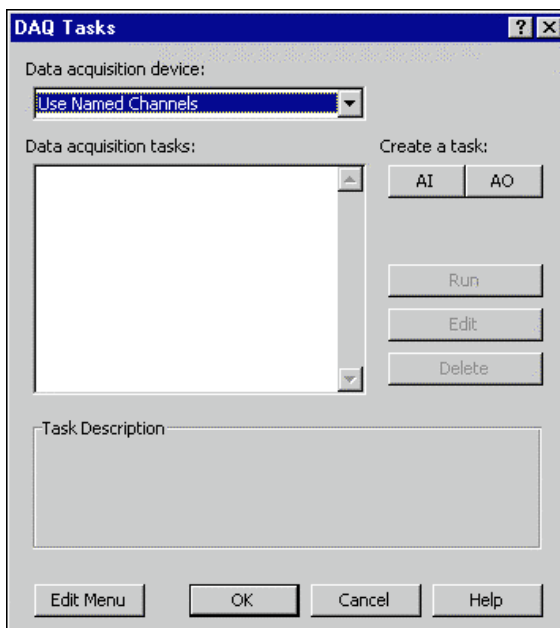


Figure 2-1. DAQ Tasks Dialog Box

The DAQ Tasks dialog box manages the I/O operations, or tasks, that you define with Measure. From this dialog box, you can create new tasks, edit existing tasks, and run I/O tasks interactively to test their operation.

3. Select a DAQ device from the Data acquisition device drop-down listbox at the top of the dialog box. The list of devices available in the drop-down listbox is taken from the devices that you have configured. If you configured your channels with the Channel Wizard, select Use Named Channels in the list box. If you have not run the configuration utility yet, refer to the documentation that came with your DAQ hardware.
4. Click on the **AI** button to display the Analog Input Configuration dialog box, as shown in Figure 2-2.

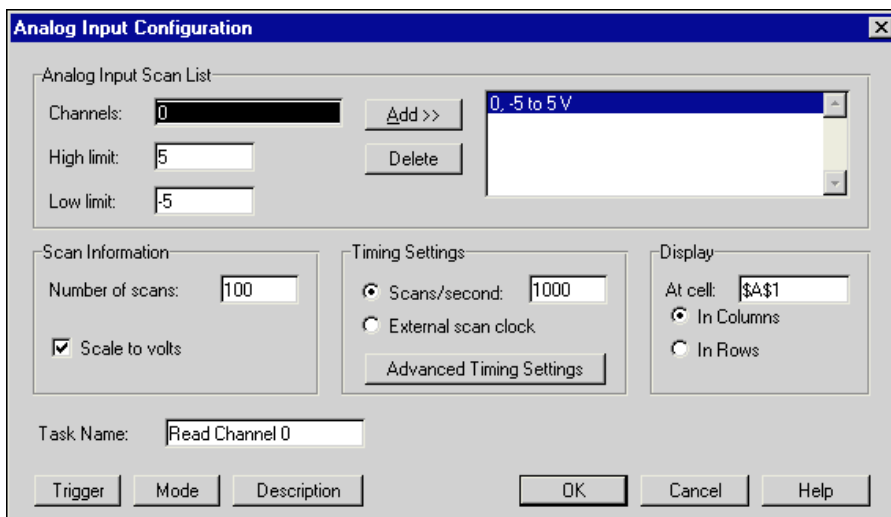


Figure 2-2. Analog Input Configuration

Configuring an Analog Input Task

From the Analog Input Configuration dialog box, you can specify all the parameters for an analog input operation. In the following steps, you create a simple analog input task. Refer to Chapter 4, *Analog Input Reference*, for more detailed information about the different options for analog input.

1. The Analog Input Scan List at the top of the dialog box is where you specify the input channels on your DAQ device from which you would like to acquire data. For each input channel you add to the scan list, you must specify a high- and low-voltage limit for the signals you read. Measure puts default values for your device in the high- and low-limit fields. Measure uses these limits to configure the gain settings on your DAQ device for maximum measurement accuracy.

Type 0 in the Channel field and click on the **Add>>** button to place the channel into your scan list. If you are using named channels, type the channel name in the Channel field and click on the **Add>>** button to place the named channel in you scan list.

You cannot mix channels from multiple devices within a task.



Note: *The High limit and Low limit fields and the Mode button are disabled in the Analog Input Configuration dialog box when you select Use Named Channels for your data acquisition device in the DAQ Tasks dialog box.*

2. In the Scan Information section of the dialog box, you specify how many scans of your channel list are to be acquired. A scan is a single measurement from each channel in your scan list. In this example in which there is only one channel specified, the number of scans is equal to the number of points acquired from Channel 0. If you specified two channels in your channel list, 100 scans would result in 200 points of data acquired (100 from each channel).

Type 100 in the Number of Scans field.

3. The Scan Rate section of the dialog box is where you specify how fast you would like to acquire the data. The default setting of 1000 scans per second means that you acquire a single point from each channel in your channel list 1000 times per second.

Type 1000 in the Scans/second field.

4. The Display section of the dialog box is where you specify the cells on your worksheet to contain the acquired data. You manually can type in a spreadsheet address, such as \$A\$1, or you can highlight the input field and use your mouse to select an area on the spreadsheet to place your acquired data. Measure begins with the upper-left most cell in the range that you supply and places the data in rows or columns from that point in the worksheet.

Type \$A\$1 to place the 100 elements of data in the first column of your worksheet.

5. Type the name Read Channel 0 in the Task Name field.

6. Click on the **Description** button to add a description for your task under development, as shown in Figure 2-3. Type Acquire 100 points of data from channel 0 in the Task Description dialog box, and click on the **OK** button.

Now you have finished specifying your first Measure analog input task.

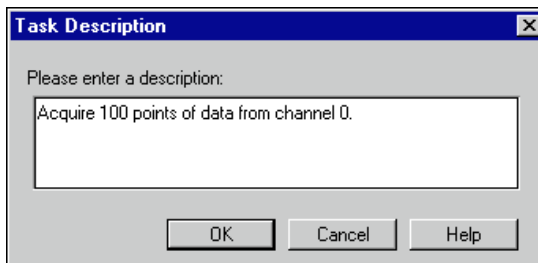


Figure 2-3. Task Description Dialog Box

7. Click on the **OK** button to return to the DAQ Tasks dialog box, as shown in Figure 2-4. Notice that you now have a task named Read Channel 0 in your task list and that the description for this new task appears in the dialog box as well.

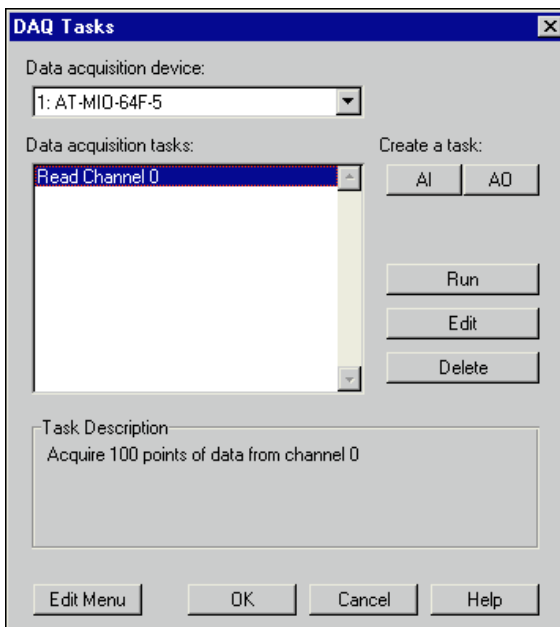


Figure 2-4. DAQ Tasks Dialog Box

8. Click on the **Run** button to execute the task. When the task completes, there are 100 datapoints in column A of your worksheet.

Configuring an Analog Output Task

If your DAQ device has analog output channels, you can use Measure to generate analog output signals based on values in your spreadsheet. You use analog output tasks to generate signals. You specify an area on your worksheet that contains data values, and Measure converts these values to voltages and outputs them through an analog output channel of your DAQ device. For more information on analog output tasks, refer to Chapter 5, *Analog Output Reference*.

1. In the DAQ Tasks dialog box, click on the **AO** button to display the Analog Output Configuration dialog box, as shown in Figure 2-5.

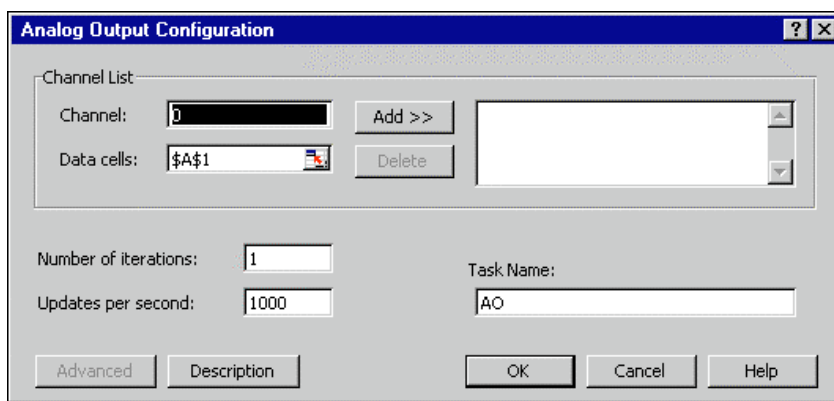


Figure 2-5. Analog Output Configuration Dialog Box



Note: *The **Advanced** button is disabled in the Analog Output Configuration dialog box when you select Use Named Channels for your data acquisition device in the DAQ Tasks dialog box.*

2. Type 0 in the Channel input field. If you are using named channels, type the channel name in the Channel field.
3. Type \$A\$1 : \$A\$10 in the Data cells input field. You can type this range manually, or highlight the input field and drag particular areas of your worksheet to specify a cell range. This parameter specifies which cell values are used as analog output values.
4. Click on the **Add** button.

5. Type 10 in the Number of iterations input field. The number of iterations determines how many times Measure outputs the values specified in the cell range. You can type a value of 0 in this field for continuous output of the values.
6. Type 1000 in the Updates per second input field. As in acquiring data, you must specify an update rate to determine how fast the data outputs through the analog output channel.
7. Type Output 10 iterations in the Task Name input field.
8. Click on the **Description** button, and type Output 10 iterations of data on analog output Channel 0 for the description of your analog output task. Click on the **OK** button.
9. Now you have finished configuring your first Measure analog output task. Click on the **OK** button to return to the DAQ Tasks dialog box. Notice that your new analog output task appears in the task list, as shown in Figure 2-6.

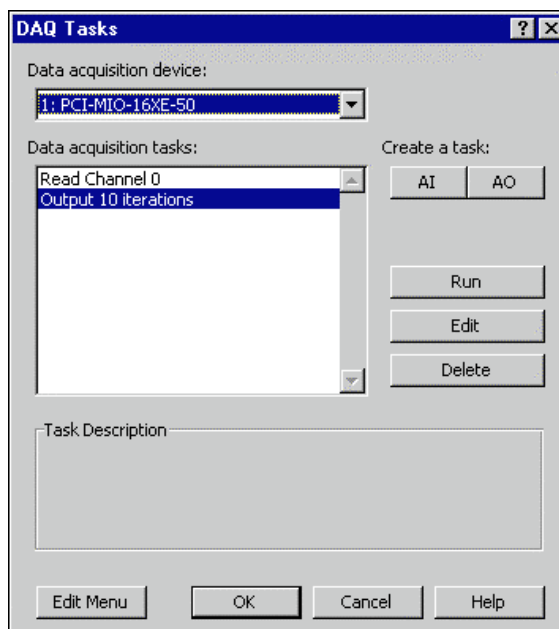


Figure 2-6. DAQ Tasks Dialog Box

10. Highlight the Output 10 iterations task and click on the **Run** button to execute the analog output task. Make sure you have valid voltage data in cells A1:A10 before running the task.

Adding Tasks to the DAQ Menu

Now that the two tasks are configured and tested from the DAQ Tasks dialog box, you might want to make them more accessible from your spreadsheet. With Measure, you can easily add these tasks to the **DAQ** menu.

1. Select **DAQ»Configure DAQ Tasks**.
2. Click on the **Edit Menu** button to display the Edit DAQ Menu dialog box, as shown in Figure 2-7.

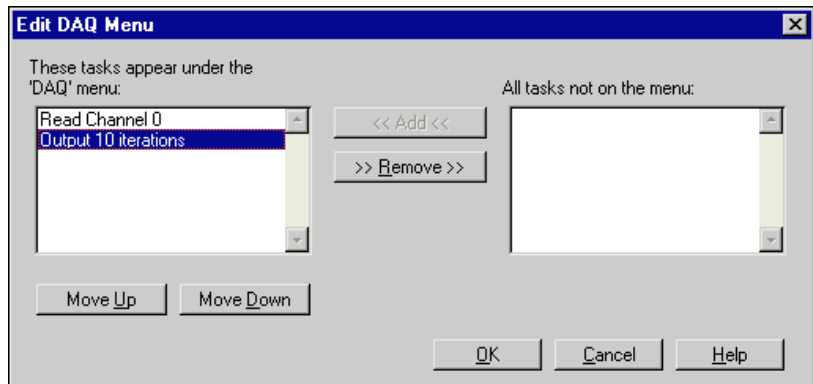


Figure 2-7. Adding Tasks to the DAQ Menu

3. Highlight each of the tasks in the window on the right and click on the **Add** button to add them to the **DAQ** menu.
4. Click on the **OK** button to return to the **Configure DAQ Tasks** menu. Click on the **OK** button to return to the Excel worksheet.
5. Pull down the **DAQ** menu. Notice that two new entries now appear in the **DAQ** menu, as shown in Figure 2-8. Now you can select these tasks and execute them from the worksheet without going into the Measure dialog boxes.

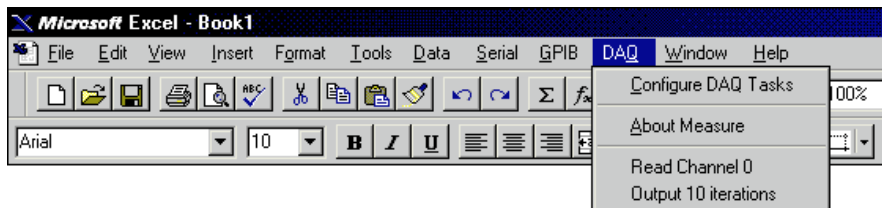


Figure 2-8. The DAQ Menu

Saving Tasks

Each of your tasks are stored in your workbook automatically when you click on the **OK** button in the DAQ Tasks dialog box. If you configure a new task, but click on the **Cancel** button from the DAQ Tasks dialog box, Measure does not store your new task in your workbook.

Your tasks are saved as part of the Excel workbook. Each time you launch Excel and open a workbook that contains Measure tasks, they appear in the task list of the DAQ Tasks dialog box.

Managing Tasks in a Workbook

This section describes how to use the DAQ Tasks dialog box, as shown in Figure 2-9, to manage the tasks in a workbook. You can open this dialog box by selecting **DAQ»Configure DAQ Tasks** from the menu bar.

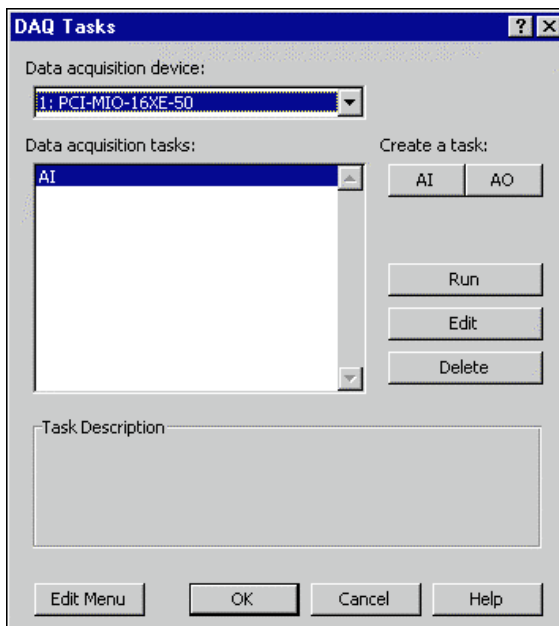


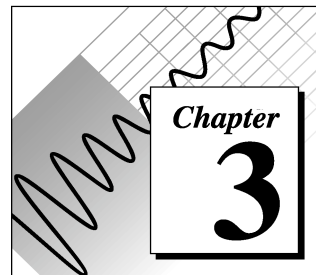
Figure 2-9. DAQ Tasks Dialog Box

Table 2-1 contains a list of the DAQ Tasks dialog box options with descriptions of their use.

Table 2-1. DAQ Tasks Dialog Box Options

| Option/Button | Description |
|-------------------------|---|
| Data acquisition device | Select the National Instrument data acquisition device for which you want to create a task. Measure scans your NI-DAQ configuration for installed devices and lists only those devices that Measure supports. |
| Data acquisition tasks | Measure lists all the tasks that you have created for a data acquisition device. Select a task if you wish to run, edit, or delete it. |
| Task Description | Measure displays the description of the selected task. You can assign a description to a task when you create or edit it. |
| Edit Menu | Add or delete tasks from the DAQ menu. |
| AI | Create an Analog Input task for the selected data acquisition device. |
| AO | Create an Analog Output task for the selected data acquisition device. |
| Run | Run the selected data acquisition task. |
| Edit | Edit the selected data acquisition task. |
| Delete | Delete the selected data acquisition task. |
| OK | Store in the active workbook all the changes that you made (creation of tasks, changes to existing tasks, deletions of tasks, additions or deletions to the DAQ menu). |
| Cancel | Ignore all the changes that you made (creation of tasks, changes to existing tasks, deletions of tasks, additions or deletions to the DAQ menu). |

Using SCXI with Measure DAQ



This chapter describes how to use the Measure data acquisition (DAQ) Add-In in Excel with your Signal Conditioning Extension for Instrumentation (SCXI) equipment.

SCXI is a set of modules and terminal blocks used as a signal condition front-end for your data acquisition devices. These modules perform tasks such as multiplexing large numbers of signals, amplifying low-level signals, providing isolation between your data acquisition devices and transducers, and so on.

To use your SCXI modules with Measure, you must first configure all your DAQ hardware using the NI-DAQ Configuration Utility. In the configuration utility, you must assign a device number to each of your DAQ devices and define the connections to your SCXI modules. In most cases, your DAQ device is a plug-in board in your computer, although it also can be a PC Card (PCMCIA) format DAQCard or a SCXI-1200 module. You use the DAQ devices for the actual A/D conversions of your analog input signals and for controlling SCXI modules. Each SCXI module is controlled by one DAQ device and is assigned as such in the configuration utility. If you have any questions about the NI-DAQ Configuration Utility, consult the NI-DAQ documentation.

Once you have configured the SCXI system, using the Measure DAQ Add-In is very similar to using other DAQ devices. The only difference in the operation is the use of the channel string in the scan list to specify the channels on specific SCXI modules you want to acquire. All other parameters of the DAQ Add-In operate the same.

SCXI Operating Modes

You can operate SCXI modules in two different modes—*multiplexed* and *parallel*. In the multiplexed mode, all analog input channels for each SCXI module are multiplexed (routed) onto one input channel of

your data acquisition device. The multiplexed mode is the default and recommended mode to use with SCXI. In the parallel mode, each SCXI module is directly connected to one data acquisition device and each analog input channel on a SCXI module is connected to a separate analog input channel on the data acquisition device. Not all data acquisition devices or SCXI modules support the parallel mode. Consult your data acquisition hardware user manual for more information.

SCXI Analog Input

The following information is not relevant if you used the Channel Wizard to configure your channels.

To configure channels on a SCXI analog input module in the DAQ task configuration, select the DAQ device in the main DAQ Tasks dialog box to which the SCXI module is directly or indirectly connected. Then, click on the **AI** button to create an AI task or the **Edit** button to modify an existing AI task. In the Analog Input Configuration dialog box, specify the SCXI channel(s) you want to acquire in the Channels field by entering a channel string. This channel string provides information about the DAQ device channel, SCXI chassis number, SCXI module number, and SCXI channel number. The channel string has the following format:

```
ob0!scx!mdy!z
```

In the SCXI channel string, *x* represents the chassis number, *y* the module number, and *z* the channel number.

‘ob0’ in the SCXI channel string indicates which onboard channel (on the DAQ device) to use to acquire the data. In the SCXI multiplexed mode (default mode), all SCXI channels from one SCXI chassis are multiplexed onto one onboard channel. Usually, this is Channel 0 (ob0 in the SCXI string), unless you are using more than one SCXI chassis; in which case each additional chassis uses the next onboard channel (i.e. Chassis 2 uses onboard Channel 1, and so on).

‘scx’ represents the chassis number where *x* is replaced by the actual number (e.g. sc1). The chassis are numbered starting with 1 and the chassis number is assigned in the NI-DAQ Configuration Utility.

‘mdy’ represents the module number where *y* is replaced with the actual number (e.g. md2). The modules are numbered 1 through *n* on

each SCXI chassis with module 1 being in the left-most slot of the SCXI chassis and module n in the right-most slot.

'z' in the SCXI channel string represents the actual channel number (e.g. 3). Channels on the SCXI modules are numbered starting at zero. You specify a range of channels on your SCXI modules by listing the first and last channel separated with a colon (e.g. 0 : 5).

You use the SCXI channel string only when the SCXI is operating in multiplexed mode and channels are multiplexed onto one or more channels of the data acquisition device. In parallel mode, specify the channel of your data acquisition device to acquire. Each channel on your DAQ device is mapped in hardware to one channel on a SCXI module in parallel mode.

Multiple SCXI Modules and Chassis

The following information is not relevant if you used the Channel Wizard to configure your channels.

In the scan list of your DAQ AI task, you can specify channels from multiple SCXI modules or chassis by adding multiple entries to the scan list. Repeat the Add operation for each SCXI module. However, you can specify only one group of consecutive channels per SCXI module in the scan list. You must specify consecutive channels in an incremental order (e.g. `ob0!sc1!md1!0:5`, `ob0!sc1!md2!10:19`). In the DAQ Tasks dialog box, the channel setting would be listed as follows. The two lines in the scan list on the right are added separately by twice filling in the channel field on the left and clicking on the **Add>>** button, as shown in Figure 3-1.

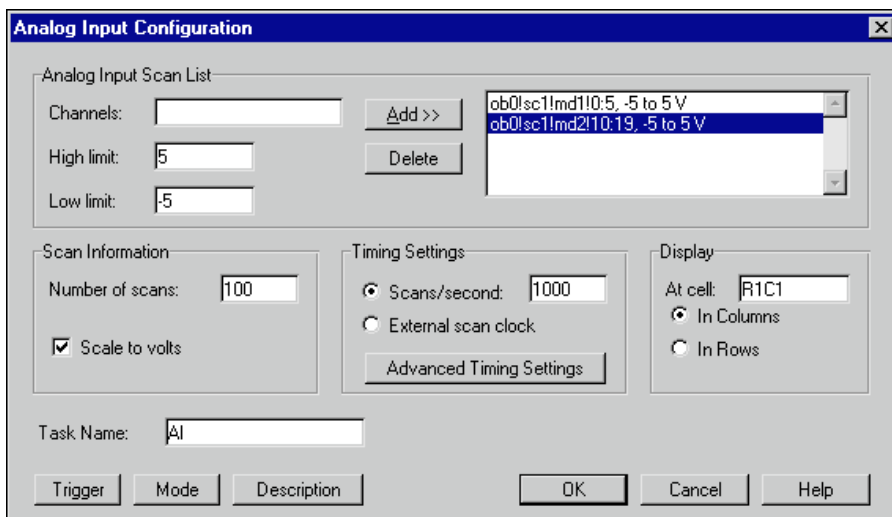


Figure 3-1. Selecting the Add>> button

Table 3-1 lists other possible combinations for SCXI channel strings.

Table 3-1. SCXI Channel Strings Syntax

| String Syntax | Description |
|--------------------------------------|---|
| ob0!sc1!md2!5 | Channel 5 on module 2 of SCXI Chassis 1 is read through onboard Channel 0. |
| ob0!sc1!md2!0:7 ob0!sc1!md4!5:12 | Channels 0-7 on Module 2 and Channels 5-12 on Module 4 of Chassis 1 are read through onboard Channel 0. |
| ob0!sc1!md3!3:4 ob1!sc2!md1!20:24 | Channels 3 and 4 of Module 3 of Chassis 1 are read through onboard Channel 0, and Channels 20-24 of Module 1 on Chassis 2 are read through onboard Channel 1. |

In the parallel mode, each analog input SCXI module is connected directly to a DAQ device and you must specify the channels of your DAQ device in the channel list, not the SCXI channel string.

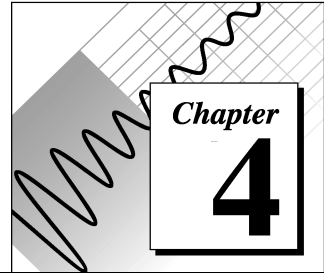


Note: *The SCXI-1200 does not support the parallel mode with other SCXI modules.*

SCXI Analog Output

Only the SCXI-1124 module supports AO channels. This module has six AO channels per module. The channels support only single-point updates, and there is no waveform generation. SCXI AO channel strings are structured the same as SCXI AI channel strings but without the 'ob0' in front.

Analog Input Reference



This chapter introduces some basic concepts of data acquisition and contains a reference for analog input configuration, hardware digital triggering, analog input modes, and advanced timing. You should be familiar with the hardware capabilities of your data acquisition device.

DAQ Device Overview

Measure works with a wide variety of National Instrument DAQ devices. This chapter provides a technical overview and reference information about using Measure for analog input operations. Many of the parameters that you can set up with Measure vary depending on your DAQ device. For example, DAQ devices vary in acquisition speed which affects how fast you can acquire data using Measure. In addition, some DAQ devices have more extensive triggering capabilities than other DAQ devices. Measure does not disable any of its options according to the selected DAQ device. When selecting options which are not supported by a particular DAQ device, you get an error message during configuration or testing. Refer to the documentation included with your DAQ hardware to learn more about the particular capabilities of your DAQ device.

Analog Input Configuration Overview

Select **DAQ»Configure DAQ Tasks** and then click on the **AI** button to open the Analog Input Configuration dialog box, as shown in Figure 4-1. The following sections describe the fields within the Analog Input Configuration dialog box, and Table 4-2 explains the remaining options at the bottom of the Analog Input Configuration dialog box.



Note: *The High limit and Low limit fields and the Mode button are disabled in the Analog Input Configuration dialog box when you select Use Named Channels for your data acquisition device in the DAQ Tasks dialog box.*

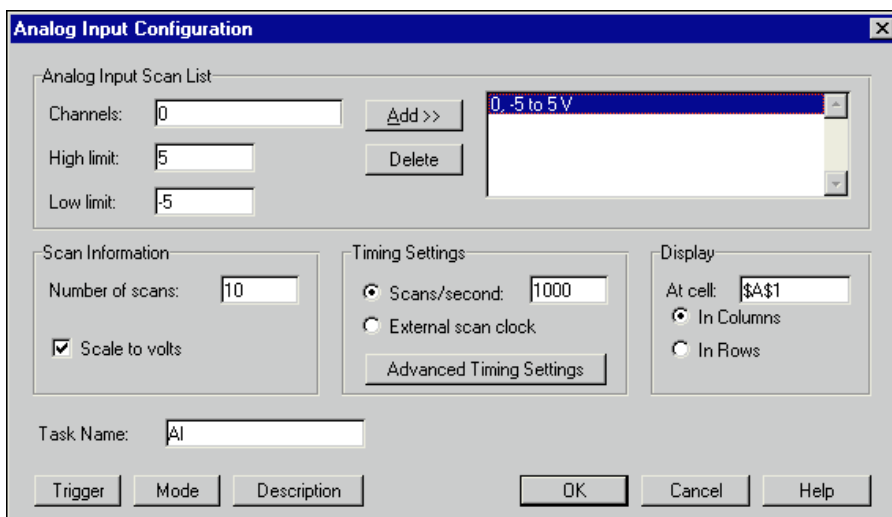


Figure 4-1. Analog Input Configuration Dialog Box

Analog Input Scan List

To configure an acquisition, you must select the channels that you want to scan by entering a channel string in the Channels field. If you configured your channel with the Channel Wizard, you must select the channels you want by entering a channel name in the Channels field. A *scan* is one acquisition or reading from each channel in the Analog Input Scan List. The scan list can have multiple entries of one or more channels. Each entry has its own set of high and low limits which determines the gains on the channels in the entry.

Channels

Specify channels to add to the scan list. A channel string can consist of a named channel defined with the Channel Wizard, a single channel, a list of channels delimited by commas, a range of channels denoted by the first and last channel of the range separated by a colon, or any combination of the previous three types of syntax. The order that you specify the channels in your channel string from left-to-right is the order that Measure scans the channels. The following is a table of valid channel strings.

Table 4-1. Examples of Valid Channel Strings

| Valid Channel Strings | Channels in the Scan List |
|---------------------------------------|---|
| 9 | 9 |
| 3,1 | 3, 1 |
| 4:7 | 4, 5, 6, 7 |
| 9,4:7,3,1 | 9, 4, 5, 6, 7, 3, 1 |
| 0,1 (using one AMUX board) | 0, 1, 2, 3, 4, 5, 6, 7 on the AMUX board |
| 0 (using two AMUX boards) | 0, 1, 2, 3 on the first AMUX board and 0, 1, 2, 3 on the second AMUX board |
| ob0!sc1!md1!0:3 | 0, 1, 2, 3 on the SCXI module in the first slot of the first chassis |
| 0b0!sc1!md3!0:4, ob0!sc!md4!7 | 0, 1, 2, 3, 4 on the SCXI module in the third slot of the first chassis and 7 on the SCXI module in the fourth slot of the first chassis |
| ob0!sc1!md2!20:22, ob1!sc2!md3!5:8 | 20, 21, 22 on the SCXI module in the second slot of the first chassis and 5, 6, 7, 8 on the SCXI module in the third slot of the second chassis |

For more information about using SCXI, refer to Chapter 3, *Using SCXI with Measure DAQ*.



Note: *Some devices, such as the 1200-Series, have a fixed scanning order. If you are using a device that has a fixed scanning order and you want to scan multiple channels, you must list the channels in the scan list in descending order with the last channel in the scan list being Channel 0 (for example, 3, 2, 1, 0). If you are using such a device in differential mode, you must use the even-numbered channels (for example, 6, 4, 2, 0).*

High Limit

Enter the upper voltage limit for the channels in the channel string. This voltage is the maximum voltage that is measured at any of the analog input channels that you specify in the channel string. You can add more than one channel string to your scan list and each channel string can have a different set of high and low limits. When you create an AI task, Measure enters the default value for the device. If you are using named channels, this field is not available.

Low Limit

Enter the lower voltage limit for the channels in the channel string. This voltage is the minimum voltage measured at any of the analog input channels that are specified in the channel string. You can add more than one channel string to your scan list and each channel string can have a different set of high and low limits. When you create an AI task, Measure enters the default value for your device. If you are using named channels, this field is not available.



Note: *Not all devices can have scan lists in which different channels can have different high and low limit settings.*

Scan Information

The following options apply to all channels in the scan list.

Number of Scans

Specify the number of scans for the acquisition. The number of scans is the number of data acquisitions or readings to acquire from each channel.

Scale to Volts

Select this option if you want Measure to display the acquired data in volts. Otherwise, Measure displays the data as the binary values read from the analog-to-digital converter (ADC).

Timing Settings

A scan as a snapshot of the voltages present on your channels at a given instant. The *scan rate* determines how many scans per second Measure executes, which means that Measure samples each channel at the scan rate you choose. If you set your scan rate to 10 scans per

second, you are taking 10 snapshots each second of all the channels in your scan list. If Channel 2 is in your scan list, you sample Channel 2 ten times per second. Your scan rate is your sampling rate per channel.

In reality, your device does not take a snapshot of all your channels instantaneously, unless it has the capability to do simultaneous sampling. Rather, for each scan (as timed by the scan clock), the device proceeds from one channel in the scan list to the next depending on the channel clock rate. The faster the channel clock rate, the more closely in time the channels are sampled within each scan. The reciprocal of the channel clock rate is called the interchannel delay, or channel interval, as shown in Figure 4-2.



Figure 4-2. Scan Clock and Channel Clock

Measure automatically calculates the smallest, safe interchannel delay for your given configuration and device. If you select a scan rate that requires an interchannel delay smaller than the safest interchannel delay, Measure returns a warning and uses round-robin scanning. Round-robin scanning means that the interval between the last channel in one scan and the first channel of the following scan is the same as the interval between any two channels in the middle of the scan, as shown in Figure 4-3.



Figure 4-3. Round Robin Scanning

Scans/Second

Enter a scan rate for the acquisition in this field.

External Scan Clock

Select this option if you want to use an external signal for generating the scan rate. Measure uses the signal on an I/O line on the connector of your DAQ device for generating the scan clock.



Note: *For MIO-E Series devices, the external scan clock signal is connected to the PFI7 pin. For most other devices, the external scan clock signal is connected to the OUT2 line. Refer to the user manual for your DAQ device for more information.*

Display

When determining where to display the acquired data, Measure uses three pieces of information you specify.

- Address of the upper-left cell in the range you select
- Orientation of the channels you select (in rows or columns)
- Number of channels in the scan list

For example, if your scan list has four channels and the upper-left cell of the range has the address **A5** and you specify **In columns** for the orientation, Measure displays the first scan of data in cells **A5:D5**, the second in **A6:D6** and so on. The acquired data from the first channel in your scan list is displayed in the column headed by cell **A5**, the acquired data from the second channel in your scan list is displayed in the column headed by cell **B5**, and so on.

At Cell

Specify the target range of the acquired data. Either explicitly type the cell address, or highlight the text in this field and select a cell on any worksheet in the workbook. Measure automatically records the address of your selection in this field.

In Columns

Select this option if you want to display your data in a channel per column orientation.

In Rows

Select this option if you want to display your data in a channel per row orientation.

Table 4-2 contains a list of the choices for the Analog Input Configuration dialog box with descriptions of their use.

Table 4-2. Analog Input Configuration Buttons/Options

| Option/Button | Description |
|---------------|--|
| Task Name | When you create a new AI task, Measure suggests a unique name for your new task. You can specify a name that is unique to the currently active workbook for this task. |
| Trigger | Most data acquisition devices have a hardware digital trigger input (TTL level). Click this button to configure a digital trigger for your device. |
| Mode | Change the analog input mode from the setting that you specify when you run the NI-DAQ Configuration Utility. Measure automatically selects the option that reflects the current setting for your device. |
| Description | Enter a short description of your task. Measure displays a description of a task below the task list in the DAQ Tasks dialog box. Also, if you add your task to the DAQ menu, Measure displays the task description in the Excel status bar at the bottom of its window when you select the task in the menu. |
| OK | Verify configuration and add a new task or update an existing task in the data acquisition tasks lists. Return to the DAQ Tasks dialog box. |
| Cancel | Ignore changes and return to the DAQ Tasks dialog box. |

Trigger Reference

On most DAQ Series devices, you can configure a digital trigger that starts an acquisition, that stops an acquisition, or both. To set up a hardware trigger, select **Analog Input Configuration»Trigger** to open the Hardware Digital Trigger dialog box, as shown in Figure 4-4.

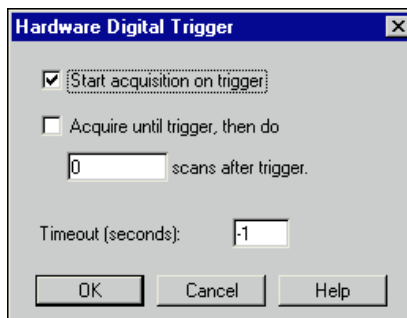
**Figure 4-4.** Hardware Digital Trigger Dialog Box

Table 4-3 contains a list of Hardware Digital Trigger choices with descriptions of their use.

Table 4-3. Choices for Hardware Digital Trigger

| Choices for Hardware Digital Trigger | Description |
|--------------------------------------|--|
| Start acquisition on trigger | Select this option if you want to start your acquisition on the rising edge of the PFI0/EXTTRIG/STARTTRIG (depending on the board you are using) input on the connector. Otherwise, Measure starts the acquisition with a software trigger. |
| Acquire until trigger | Select this option if you want to stop your acquisition on the rising edge of the PFI1/EXTTRIG/STOPTRIG (depending on the board you are using) signal on the connector. Otherwise, the acquisition ends after Measure acquires all the scans. |
| scans after trigger | Specify the number of scans to acquire after the stop trigger occurs. |
| Timeout (seconds) | Specify a timeout value in seconds. If you want Measure to calculate a timeout value for you, enter -1. If you specify an externally generated scan clock and a timeout value of -1, Measure disables the timeout. You can stop the acquisition by pressing the <Q> key. |

Mode Reference

The Analog Input Mode applies to all the channels in your scan list. Select **Analog Input Configuration»Mode** to open the Analog Input Mode dialog box, as shown in Figure 4-5.



Note: *The Mode button is disabled in the Analog Input Configuration dialog box when you select Use Named Channels for your data acquisition device in the DAQ Tasks dialog box.*

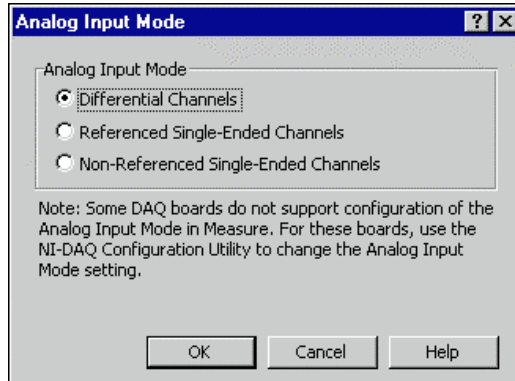


Figure 4-5. Analog Input Mode Dialog Box

Table 4-4 contains a list of Analog Input Mode choices with descriptions of their use.

Table 4-4. Choices for Analog Input Mode Dialog Box

| Choices for Analog Input Mode | Description |
|--------------------------------------|--|
| Differential Channels | Select this option if you want each channel to use two analog channel input lines. One line connects to the positive input of the device amplifier, and the other connects to the negative input of the amplifier. Refer to the user manual for your DAQ device for more information about input modes available on your device. |
| Referenced Single-Ended Channels | Select this option if you want each channel to use one analog input channel line, which connects to the positive input of the amplifier. The negative input of the amplifier is internally tied to analog input ground AIGND. Refer to the user manual for your DAQ device for more information about input modes available on your device. |
| Non-Referenced Single-Ended Channels | Select this option if you want each channel to use one analog input channel line, which connects to the positive input of the amplifier. The negative input of the amplifier connects to the analog input sense AISENSE input. Refer to the user manual for your DAQ device for more information about input modes available on your device. |



Note: *The Analog Input Mode on some devices is not configurable within Measure. If you have such a device, you must exit Measure and change the mode using the NI-DAQ Configuration Utility. If you have a device with jumpers, you must exit Measure, power down your computer, change the jumpers, and run the NI-DAQ Configuration Utility to configure the new setting. Refer to the NI-DAQ User Manual that came with your device for more information.*

Advanced Timing Settings

Usually, you do not configure the advanced timing settings because Measure automatically selects reasonable values for you. In some cases, however, you might want to select an interchannel delay or an external channel clock. You can configure these settings through the Advanced Timing Settings dialog box, as shown in Figure 4-6.

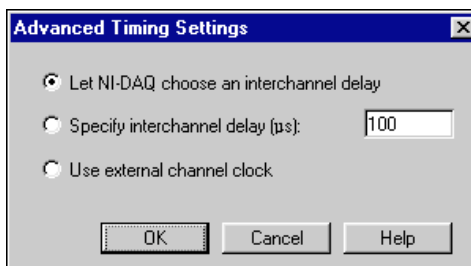


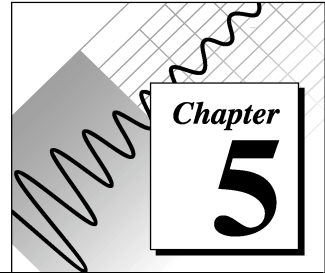
Figure 4-6. Advanced Timing Settings Option

Table 4-5 contains a list of the Advanced timing settings with descriptions of their use.

Table 4-5. Choices for Advanced Timing

| Choice for Advanced Timing | Description |
|--|---|
| Let NI-DAQ choose an interchannel delay | NI-DAQ calculates an interchannel delay for you, based on your hardware, the limit settings for the task, and the scan rate for the task. |
| Specify interchannel delay (μs) | Measure uses the interchannel delay you specify in microseconds. |
| Use external channel clock | Measure configures your DAQ device to use an external channel clock. |

Analog Output Reference



This chapter introduces some concepts of data acquisition and contains a reference for basic and advanced analog output configuration. You should be familiar with the hardware capabilities of your data acquisition device.

Analog Output Configuration Overview

Select **DAQ»Configure DAQ Tasks** and click on the **AO** button to open the Analog Output Configuration dialog box, as shown in Figure 5-1.

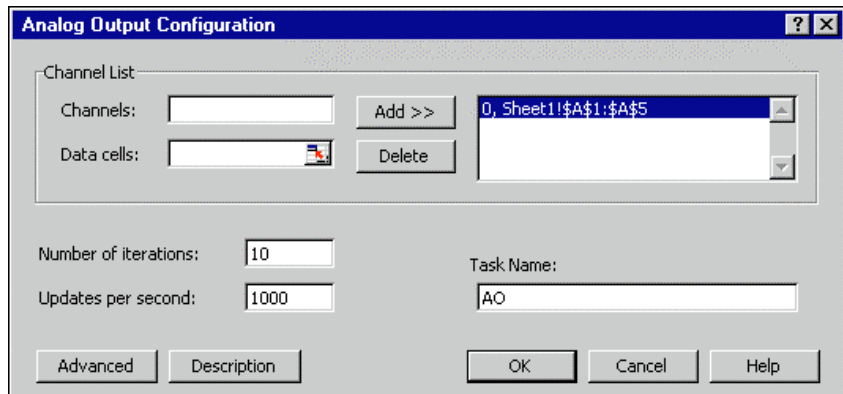


Figure 5-1. Analog Output Configuration Dialog Box



Note: *The Advanced button is disabled in the Analog Output Configuration dialog box when you select Use Named Channels for your data acquisition device in the DAQ Tasks dialog box.*

Table 5-1 describes the fields within the Analog Output Configuration dialog box.

Table 5-1. Analog Output Configuration Reference

| Option | Description |
|----------------------|---|
| Channel | Specify the analog output channel on which to generate a signal. You can specify only one channel at a time. |
| Data cells | Specify the source range of the voltage values to write to the digital-to-analog converter (DAC) for the channel. Either explicitly type the cell address, or highlight the text in this field and then select a row of cells or a column of cells on any worksheet in the workbook. Measure automatically records the address of your selection in this field. |
| Add>> | Click this button after specifying a channel and a data cells range. |
| Remove | Click this button to remove any channels or source ranges that you selected in the list box. |
| Number of iterations | Specify the number of times Measure should iterate through the waveform that you specified for a channel. If you specify 0 for the number of iterations, Measure indefinitely iterates through the waveform until you run another signal generation task on that same device or until you exit Excel. |
| Updates per second | Specify the rate at which Measure writes the voltage values to the DAC. If you specified more than one channel in your channel list, all channels will have the same update rate. |
| Task Name | When you create a new AO task, Measure suggests a unique name for your new task. You can change the name in the Task name edit box; However, the name must be unique to the active workbook. |
| Description | Click on this button to enter a short description of your task. Measure displays a description of a task below the task list in the DAQ Tasks dialog box. Also, if you add your task to the DAQ menu, Measure displays the task description in the Excel status bar at the bottom of its window when you select the task from the menu. |
| Advanced | Click on this button to configure more of the advanced properties for the analog output task. |

| Option | Description |
|--------|---|
| OK | Verify configuration and add a new task or update an existing task in the data acquisition tasks lists. Return to the DAQ Tasks dialog box. |
| Cancel | Ignore changes and return to the DAQ Tasks dialog box. |



Note: *If you want to generate waveforms on more than one channel, you must add each channel separately to the channel list. Also, Measure requires that all channels have the same number of voltage values to generate. If the range of data for one channel is larger than for another channel in the scan list, the shorter range of data is padded with the value 0 when Measure generates the waveforms.*

Advanced Configuration

For most tasks, it is not necessary to use the Advanced Analog Output Configuration dialog box, as shown in Figure 5-2. You cannot use it if you selected Use Named Channel as your data acquisition device. With this dialog box, you can change the output range of your device by specifying new high and low limits, or you can specify a current channel type, if your device supports it. Refer to Table 5-2 for detailed information.

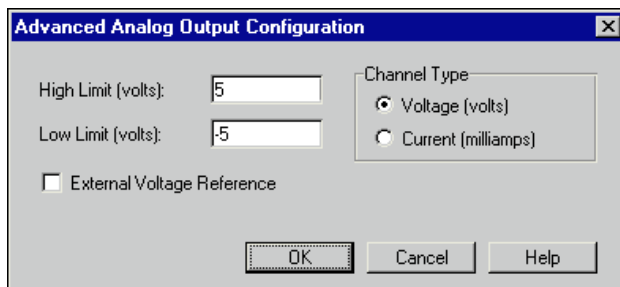
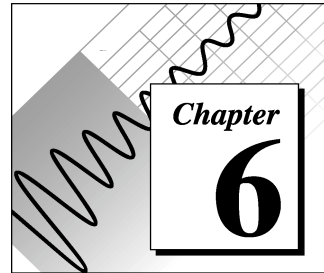


Figure 5-2. Advanced Analog Output Configuration Dialog Box

Table 5-2. Advanced Analog Output Configuration Options

| Option | Description |
|----------------------------|--|
| High Limit (volts) | <p>The high limit is equal to your reference voltage and is the maximum voltage the DAC can produce. If you have an AT-AO-6/10 board and your Channel Type is current, you can calculate the maximum possible current with the following equation.</p> $I_{max} = V_{ref} / 0.625 \text{ mA}$ <p>The following list contains the default settings for high limit. If you want to use a high limit that differs from the ones given in this list, you must supply an external voltage reference on the EXTREF pin of the connector and select the External Voltage Reference option.</p> <p>Most devices: 10.0 V Lab/1200 Series: -5.0 V or 10.0 V</p> |
| Low Limit (volts) | The low limit is either 0.0 Volts or a value equal to, but opposite in sign, to the upper limit. |
| External Voltage Reference | Select this option if you want to supply an external voltage reference on the EXTREF pin of the connector. |

Using Measure Data Acquisition Tasks with VBA



This chapter describes how to run tasks from within Visual Basic for Applications. There are two ways to execute DAQ Add-In functions in a VBA module.

1. Indirectly, you can use `Application.Run`

```
returnValue=Application.Run("FuncName", arg1)
Application.Run "FuncName", arg1
```

2. Directly, after you add a reference to the DAQ Add-In. To add a reference to the DAQ Add-In, select **Tools»References** and select the checkbox next to the Data Acquisition Add-In.

```
returnValue = FuncName(arg1)
FuncName arg1
```

Function Reference

The DAQ Add-In has one function that you can call to run a task that has been configured already and one function to translate an error code to an error description.

DAQ

Runs the task named `TaskName`.

Syntax

```
Function DAQ(TaskName as String, [NewTargetRange as String],
[ReferenceStyle as Variant]) as Integer
```

Parameters

| Option | Description |
|----------------|--|
| TaskName | The name of a task in the active workbook. |
| NewTargetRange | The address of a range on a worksheet that receives the acquired data. If you fail to specify a worksheet explicitly in the address of this macro, Measure assumes that the range is on the active worksheet. If no worksheet is active, Measure returns an error. If this parameter is missing, Measure uses the previously configured range. |
| ReferenceStyle | Use either xIA1 or xIR1C1 to indicate the type of range address being passed into NewTargetRange. If this parameter is missing, then Excel's current reference type is assumed. |

Return Value

Returns 0 if successful, otherwise returns an error code. Refer to Appendix B, *Error Codes* for more information.

Example

```
'Referenced not added to DAQ Add-In; use indirect method
Sub RunMyTask()
    Dim iErr As Integer
    iErr = Application.Run("DAQ", "AI1")
    If iErr <> 0 Then
        MsgBox Application.Run("GetDAQErrorMessage", iErr)
    End If
End Sub

'Referenced added to DAQ Add-In; use direct method
Sub RunMyTask()
    Dim iErr As Integer
    iErr = DAQ("AI1")
    If iErr <> 0 Then
        MsgBox GetDAQErrorMessage(iErr)
    End If
End Sub
```

GetDAQErrorMessage

Finds and returns a description of an error code returned by the DAQ function.

Syntax

```
Function GetDAQErrorMessage(ErrorCode As Integer) As String
```

Parameters

| Option | Description |
|-----------|---|
| ErrorCode | A non-zero number returned by the DAQ function that indicates an error. |

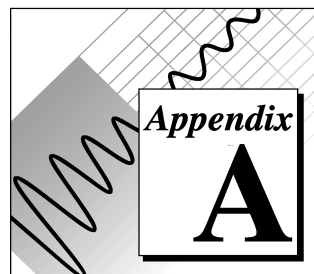
Return Value

A short description of the error code.

Example

See the previous example for the DAQ function.

DAQ Hardware Capabilities



This appendix contains tables that summarize the analog I/O capabilities of National Instruments data acquisition (DAQ) devices you might use with Measure for Windows. The devices in this appendix are grouped into categories. The DAQ device categories for these tables include the following.

- MIO and AI Devices
- Lab, 1200 Series, and Portable Devices
- SCXI Modules
- Analog Output Only Devices

MIO and AI Device Hardware Capabilities

Table A-1. Analog Input Configuration Programmability – MIO and AI Devices

| Device | Gain | Range | Polarity | SE/DIFF | Coupling |
|--|------------|------------|------------|------------|--|
| All MIO-E Series Devices ¹ All AI-E Series Devices | By channel | By channel | By channel | By channel | DC AC, DC (for PCI-6110E, PCI-6111E) |
| AT-MIO-16F-5 | By channel | By group | By group | By group | DC |
| AT-MIO-64F-5 AT-MIO-16X | By channel | By channel | By channel | By channel | DC |
| AT-MIO-16/16D | By channel | By device | By device | By device | DC |

¹ The 64-channel MIO E-series boards have unusual scan strings when the analog input is differential. For example, the possible channels needed to acquire data from a differential input situation is 0:7, 16:23, and etc.

“By device” means you select the value of a parameter with hardware jumpers, and the selection affects any group of channels on the device. “By group” means you program the selection through software, and the selection affects all the channels used at the same time. “By channel” means you program the selection with hardware jumpers or through software on a per channel basis. When a specific value for a parameter is shown, that parameter value is fixed.

Table A-2. Analog Input Characteristics – MIO and AI Devices (Part 1)

| Device | Number of Channels | Resolution | Gains ¹ | Range (V) ¹ | Input FIFO (words) | Scanning ² |
|--|-------------------------|--------------------|---|------------------------|------------------------------------|-----------------------|
| AT-MIO-16E-1 AT-MIO-16E-2 AT-MIO-16E-10 AT-MIO-16DE-10 PCI-MIO-16E-1 PCI-MIO-16E-4 | 16SE, 8DI | 12 bits | 0.5, 1, 2, 5, 10, 20, 50, 100 | ±5, 0 to 10 | 512; E-1: 8,192; E-2 and E4: 2,048 | Up to 512 |
| PCI-6110E PCI-6111E | 4 DI 2 DI | 12 bits 12 bits | 0.2, 0.5, 1.2, 5, 10, 20, 50 | ±10 | 512 | Up to 4 Up to 2 |
| AT-MIO-64E-1 ³ | 64SE, 32DI | 12 bits | 0.5, 1, 2, 5, 10, 20, 50, 100 | ±5, 0 to 10 | 2,048 | Up to 512 |
| PCI-MIO-16XE-10 PCI-6032E (AI-16XE-10) | 16SE, 8DI | 16 bits | 1, 2, 5, 10, 20, 50, 100 | ±10, 0 to 10 | 512 | Up to 512 |
| PCI-6031E (MIO-64XE-10) ³ PCI-6033E (AI-64XE-10) ³ VXI-MIO-64XE-10 ³ | 64SE, 32DI | 16bit | 1, 2, 5, 10, 20, 50, 100 | ±10, 0 to 10 | 512 | Up to 512 |
| PCI-6071E (MIO-64E-1) ³ VXI-MIO-64E-1 ³ | 64SE, 32DI | 12 | 0.5, 1, 2, 5, 10, 20, 50, 100 | 5 to -5 and 0 to 10 | 8192 | Up to 512 |
| PXI-6040E (MIO-16E-4) PXI-6070E (MIO-16E-1) | 16SE, 8DI | 12 bit | 0.5, 1, 2, 5, 10, 20, 50, 100 | 5 to -5 and 0 to 10 | 1024 (6040E) 8192 (6070E) | Up to 512 |
| AT-MIO-16F-5 AT-MIO-64F-5** | 16SE, 8DI 64SE, 32DI | 12 bits | 0.5, 1, 2, 5, 10, 20, 50, 100 | ±5, ±10, 0 to 10 | 16F-5: 256; 64F-5: 512 | Up to 512 |
| AT-MIO-16X | 16SE, 8DI | 16 | 1, 2, 5, 10, 20, 50, 100 | ±10, 0 to 10 | 512 | Up to 512 |
| AT-MIO-16(L) AT-MIO-16(H) AT-MIO-16D(L) AT-MIO-16D(H) | 16SE, 8DI | 12 | (L) 1, 10, 100, 500; (H): 1, 2, 4, 8 | ±5, ±10, 0 to 10 | 16 (L,H); 512 (DL, DH) | Up to 16 |

1 You can determine the limit settings of your device by multiplying the range and the voltage values together. For more information on limit settings in LabVIEW, refer to the Basics LabVIEW Data Acquisition Concepts chapter in the LabVIEW Data Acquisition Basics Manual.

- 2 Scanning = channels, in any order.
- 3 The valid channels for the 64-channel MIO E-series boards in Differential Mode are 0-7, 16-23, 32-39, and 48-55.
- ** The valid channels for the AT-MIO-64F-5 in Differential Mode are 0-7 and 16-39.

Table A-3. Analog Input Characteristics – MIO and AI Devices (Part 2)

| Device | Triggers ¹ | Max Sampling Rate (S/s) | Transfer Method |
|---|--|---|--|
| AT-MIO-16E-1 AT-MIO-16E-2 AT-MIO-64E-11 AT-MIO-16E-10 AT-MIO-16DE-10 AT-MIO-16XE-10 PCI-MIO-16E-1 PCI-MIO-16XE-10 PCI-MIO-16E-4 PXI-6040E (MIO-16E-4) PXI-6070E (MIO-16E-1) PCI-6071E (MIO-64E-1) PCI-6031E (MIO-64XE-10) PCI-6032E (AI-16XE-10) PCI-6033E (AI-64XE-10) PCI-6110E PCI-6111E VXI-MIO-64E-1 VXI-MIO-64XE-10 | SW, Pre, Post, (and Analog on E-1, E-2, E-3, E-4 PCI-6110E, and PCI-6111E) | E-1: 1 M, E-2 and E-3: 500 k, E-4: 250 k, E-10 and DE-10: 100 k PCI-6110E and PCI-6111E: 5M | DMA, interrupts |
| All MIO-16XE-50 Devices | SW, Pre, Post | 20 k | DMA (interrupts on DAQPad-MIO-16XE-50) |
| AT-MIO-16F-5 AT-MIO-64F-5 | SW, Pre, Post | 200 k | DMA, interrupts |
| AT-MIO-16X AT-MIO-16/16D | SW, Pre, Post | 100 k | DMA, interrupts |
| 1 SW=Software Triggering (also called conditional retrieval), Pre=Pretrigger, Post=Posttrigger. | | | |

Table A-4. Internal Channel Support – MIO and AI Devices

| Device | Internal Channels |
|---|--|
| AT-MIO-16XE-10 AT-MIO-16XE-50 DAQPad-MIO-16XE-50 | _AIGnd , _Ref5V , _AOGnd , _AO0vsAOGnd , _AO0vsRef5V , _AO1 , _AO1vsRef5V |
| DAQCard-AI-16E-4 | _AIGnd , _Ref5V , _A0Gnd |
| PCI-MIO-16XE-10 PCI-MIO-16XE-50 PXI-6030E PXI-6011E PCI-6031 CPCI-6030E CPCI-6011E VXI-MIO-64XE-10 | _AIGnd , _Ref5V , _AOGnd , _AO0vsAOGnd , _AO0vsRef5V , _AO1vsAOGnd , _AO1vsRef5V , _AO1VsAO0 , _DevTemp |
| PCI-MIO-16E-1 PCI-MIO-16E-4 PXI-6070E PXI-6040E PCI-6071E CPCI-6070E CPCI-6040E VXI-MIO-64E-1 | _AIGnd , _Ref5V , __CMRef5V , __AOGnd , __AO0vsAOGnd , _AO0vsRef5V , __AO1vsAOGnd , _AO1vsRef5V , __AO1VsAO0 , __DevTemp |
| AT-AI-16XE-10 PCI-6032E PCI-6033E DAQCard-AI-16XE-50 | _AIGnd , _Ref5V , __A0Gnd |
| AT-MIO-16E-1 AT-MIO-16E-2 AT-MIO-16E-3 AT-MIO-16DE-10 AT-MIO-16E-10 DAQPad-6020E | _AIGnd , _Ref5V , _CMRef5V , _AOGnd , _AO0vsAOGnd , _AO0vsRef5V , _AO1vsAOGnd , _AO1vsRef5V |

Table A-5. Analog Output Characteristics – MIO and AI Devices

| Device | Channel Numbers | DAC Type | FIFO Size | Output Limits (V) | Update Clocks | Transfer Method |
|--|-----------------|------------------------|-----------|--|------------------------------------|-----------------|
| AT-MIO-16E-1 AT-MIO-16E-2 AT-MIO-64E-3 VXI-MIO-64E-1 | 0, 1 | 12-bit double buffered | 2048 | 0 to 10, ± 10 , $\pm V_{ref}$, 0 to $V_{ref} \pm V_{ref}$ | Update clock 1 or external update. | DMA, interrupts |
| AT-MIO-16E-10 AT-MIO-16DE-10 | | 12-bit double buffered | 0 | ± 10 , 0 to 10, 0 to V_{ref} , $\pm V_{ref}$ | Update clock 1 or external update. | DMA, Interrupts |
| AT-MIO-XE-50 | | 12-bit double buffered | 0 | ± 10 | Update clock 1 or external update. | DMA, Interrupts |
| DAQPad-MIO-16XE-50 | | 12-bit double buffered | 0 | ± 10 | Update clock 1 or external update. | Interrupts |
| AT-MIO-16XE-10 VXI-MIO-64XE-10 PCI-MIO-16XE-10 CPCI-6030E PXI-6030E PCI-6031E | | 16-bit double buffered | 2048 | ± 10 , 0 to 10 | Update clock 1 or external update. | DMA, Interrupts |
| PCI-MIO-16E-1 CPCI-6070E PXI-6070E PCI-6071E | | 12-bit double buffered | 2048 | ± 10 , 0 to 10 | Update clock 1 or external update. | DMA, Interrupts |
| PCI-MIO-16E-4 CPCI-6040E PXI-6040E | | 12-bit double buffered | 512 | ± 10 , 0 to 10 | Update clock 1 or external update. | DMA, Interrupts |
| PCI-MIO-16XE-50 CPCI-6011E PXI-6011E | | 12-bit double buffered | 0 | ± 10 | Update clock 1 or external update. | DMA, Interrupts |
| DAQPad-6020E | | 12-bit double buffered | 0 | ± 10 , 0 to 10 | Update clock 1 or external update. | DMA, Interrupts |
| PCI-6110E PCI-6111E | | 16-bit double buffered | 4096 | ± 10 | Update clock 1 or external update. | DMA, Interrupts |

| Device | Channel Numbers | DAC Type | FIFO Size | Output Limits (V) | Update Clocks | Transfer Method |
|------------------------------|-----------------|---|-----------|--|--|-----------------|
| AT-MIO-16F-5 AT-MIO-64F-5 | 0, 1 | 12-bit double buffered (64F-5: 2 K FIFO) | | 0 to 10, ± 10 , $\pm V_{ref}$, 0 to V_{ref} | Update clock 1 is first available of ctr 5, 2, 1 or external update. Default is 5. Timebase signal range is 5,000,000, 1,000,000, 100,000, 10,000, 1,000, and 100. | DMA, interrupts |
| AT-MIO-16X | 0, 1 | 16-bit double buffered (2 K FIFO) | | ± 10 , 0 to 10, $\pm V_{ref}$, 0 to V_{ref} | Update clock 1 is first available on ctr 5, 2, 1, or external update. Timebase signal range is 5,000,000, 1,000,000, 100,000, 10,000, 1,000, 100. | DMA, interrupts |
| AT-MIO-16/16D | 0, 1 | 12-bit double buffered | | 0 to 10, ± 10 , $\pm V_{ref}$, 0 to V_{ref} | Update clock 1 is ctr2 or external update. Timebase signal range is 1,000,000, 100,000, 10,000, 1,000, and 100. | Interrupts |

Table A-6. Analog Output Characteristics – E series devices

| Device | Reglitching Capable | Ground Reference Capable | Can Control FIFO Request Modes | AO Gating, Pause/Resume Supported | Multiple Buffers Supported |
|---|---------------------|--------------------------|--------------------------------|-----------------------------------|----------------------------|
| AT-MIO-16E-1 AT-MIO-16E-2 AT-MIO-64E-3 VXI-MIO-64E-1 | Yes | No | No | No | Yes |
| AT-MIO-16E-10 AT-MIO-16DE-10 | No | No | No | Yes | Yes |
| AT-MIO-XE-50 | No | No | No | No | Yes |
| DAQPad-MIO-16XE-50 | No | No | No | No | Yes |
| AT-MIO-16XE-10 | No | No | No | Yes | Yes |
| VXI-MIO-64XE-10 | No | No | No | No | Yes |
| PCI-MIO-16E-1 CPCI-6070E PXI-6070E PCI-6071E | Yes | Yes | Yes | Yes | No |
| PCI-MIO-16E-4 CPCI-6040E PXI-6011E | No | Yes | Yes | Yes | No |
| PCI-MIO-16XE-50 CPCI-6011E PXI-6011E | No | No | No | Yes | No |
| PCI-MIO-16XE-10 CPCI-6030E PXI-6030E PCI-6031E | No | No | Yes | Yes | No |
| DAQPad-6020E | No | Yes | No | Yes | No |
| PCI-6110E PCI-6111E | No | No | Yes | Yes | No |
| * Short form factor AT-MIO-16E-10 only | | | | | |

Lab, 1200 Series, and Portable Devices Hardware Capabilities


 **Note:** *With all the MIO and AI Device You must have a scan string that is contiguous, from highest to lowest channel number, and the scan string must include zero.*

Table A-7. Analog Input Configuration Programmability – Lab, 1200 Series, and Portable Devices

| Device | Gain | Range | Polarity | SE/DIFF | Coupling |
|--|----------|------------------------|-----------|-----------|----------|
| Lab-PC+ | By group | By group | By device | By device | DC |
| SCXI-1200 DAQPad-1200 DAQCard-1200 PCI-1200 | By group | By group | By group | By group | DC |
| DAQCard-500 | 1 | Only 1 range available | Bipolar | SE | DC |
| DAQCard-516 PC-516 | 1 | Only 1 range available | Bipolar | By group | DC |
| DAQCard-700 | 1 | By group | Bipolar | By group | DC |
| PC-LPM-16 | 1 | By device | Bipolar | SE | DC |


 **Note:** *“By device” means you select the value of a parameter with hardware jumpers, and the selection affects any group of channels on the device. “By group” means you program the selection through software, and the selection affects all the channels used at the same time. “By channel” means you program the selection with hardware jumpers or through software on a per channel basis. When a specific value for a parameter is shown, that parameter value is fixed.*

Table A-8. Analog Input Characteristics – Lab, 1200 Series, and Portable Devices (Part 1)

| Device | Number of Channels | Resolution (bits) | Gains ¹ | Range (V) ¹ | Input FIFO (samples) |
|--|--------------------|-------------------|----------------------------|---------------------------|-----------------------|
| Lab-PC+* SCXI-1200 DAQPad-1200 DAQCard-1200* PCI-1200 | 8SE, 4DI | 12 | 1, 2, 5, 10 20, 50, 100 | ±5, 0 to 10 | 2,048; Lab-PC: 512 |
| DAQCard-500 | 8SE | 12 | 1 | ±5 | 16 |
| DAQCard-516 PC-516 | 8SE,4DI | 16 | 1 | ±5V | 512 |
| DAQCard-700 | 16SE, 8DI | 12 | 1 | ±10, ±5, ±2.5 | 512 |
| PC-LPM-16 | 16SE | 12 | 1 | ±5, ±2.5, 0 to 10, 0 to 5 | 16 |
| <p>1 You can determine the limit settings of your device by multiplying the range and the voltage values together. For more information on limit settings in LabVIEW, refer to the Basics LabVIEW Data Acquisition Concepts chapter in the LabVIEW Data Acquisition Basics Manual.</p> <p>* The valid channels for the Lab-PC+ and DAQCard-1200 in Differential Mode are 6, 4, 2, and 0.</p> | | | | | |

Table A-9. Analog Input Characteristics – Lab, 1200 Series, and Portable Devices (Part 2)

| Device | Scanning | Triggers | Max Sampling Rate (S/s) | Transfer Method |
|---|--|--|-------------------------|--------------------------------------|
| Lab-PC+ SCXI-1200 DAQPad-1200 DAQCard-1200 PCI-1200 | Any single channel; for multiple channels, N through 0, where $N \leq 7$. | Software trigger, pretrigger, and posttrigger with digital trigger | 100 k; Lab-PC+: 83 k | Interrupts; Lab-PC+: Interrupts, DMA |
| DAQCard-500 DAQCard-516 PC-516 | Any single channel; for multiple channels, N through 0, where $N \leq 7$ | Software trigger only | 50 k | Interrupts |
| DAQCard-700 | Any single channel; for multiple channels, N through 0, where $N \leq 15$ | Software trigger only | 100 k | Interrupts |
| PC-LPM-16 | Any single channel; for multiple channels, N through 0, where $N \leq 15$ | Software trigger only | 50 k | Interrupts |

Table A-10. Analog Output Characteristics – Lab, 1200 Series, and Portable Devices

| Device | Channel #s | DAC Type | Output Limits (V) | Update Clocks | Waveform Grouping | Transfer Methods |
|---|------------|------------------------|-------------------|---|-------------------|------------------|
| Lab-PC+ SCXI-1200 DAQPad-1200 DAQCard-1200 PCI-1200 | 0, 1 | 12-bit double-buffered | 0 to 10, ± 5 | Update clock 1 is ctrA2 or external update; timebase signal range is 1,000,000, 100,000, 10,000, 1,000, and 100 | 0, 1, or 0 and 1 | Interrupts |



Note: The DAQCard-516 and PC 516 devices do not have analog output.

SCXI Module Hardware Capabilities

Table A-11. Analog Input Characteristics – SCXI Modules

| Module | Number of Channels | Input Voltage Range (V) | Gains ¹ | Filter ¹ | Excitation Channels ¹ | Mode Support |
|--|--------------------------------------|-------------------------|--|--|---|-------------------------|
| SCXI-1100 | 32 DI | ± 10 | 1, 2, 5, 10, 20, 50, 100, 200, 500, 1,000, 2,000 (SW/M) ¹ | lowpass filter (or no filter) with 10 kHz or 4 Hz cutoff frequency (JS/M) ¹ | -- | multiplexed |
| SCXI-1102 SXCI-1102B SCXI-1102C VXI-SC-1102 VXI-SC-1102B VXI-SC-1102C | 32 DI | ± 10 | 1, 100 (SW/C) ¹ | 1 Hz lowpass on each channel | -- | multiplexed |
| SCXI-1120 SCXI-1121 | 8 DI (SCXI-1120) 4 DI (SCXI-1121) | ± 5 | 1, 2, 5, 10, 20, 50, 100, 200, 500, 1,000, and 2,000 (JS/C) ¹ | lowpass filter with 10 kHz or 4 Hz cutoff frequency (JS/C) ¹ | SCXI-1121 only: 4 voltage or current excitation JS/C 1 (channels) | multiplexed or parallel |

| Module | Number of Channels | Input Voltage Range (V) | Gains ¹ | Filter ¹ | Excitation Channels ¹ | Mode Support |
|---|---|-------------------------|---|--|---|-------------------------|
| SCXI-1120D | 8 DI (SCXI-1120) 4 DI (SCXI-1121) | ±5 | 0.5, 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1,000 | 4,500, 24,500 Hz | SCXI-1121 only: 4 voltage or current excitation JS/C 1 (channels) | multiplexed or parallel |
| SCXI-1122 | 16 DI or 8 DI and 8 excitation SW/M1 channels | ±10 | 0.01, 0.02, 0.05, 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50, 100, 200, 500, 1,000, 2,000 (SW/M)1 | lowpass filter with 4kHz or 4 Hz cutoff frequency | 8 voltage or current excitation channels in 4-wire scanning mode | multiplexed |
| SCXI-1140 | 8 DI, sample and hold | ±10 | 1, 10, 100, 200, 500 (DS/C)1 | none | -- | multiplexed or parallel |
| SCXI-1141 | 8 DI | ±5 | 1, 2, 5, 10, 20, 50, 100 (SWy/C)1 | elliptic lowpass filter with 10Hz to 25KHz cutoff frequency ² (SW/M)1 (disabled on a per channel basis) | -- | multiplexed or parallel |
| <p>1 DS/C = dip switch-selectable per channel, JS/C = jumper-selectable per channel, JS/M = jumper-selectable per module, SW/C = software-selectable per channel, SW/M = software-selectable per module</p> <p>2 The SCXI-1141 has an automatic filter setting. LabVIEW sets the filter frequency based on the scan rates used with the module.</p> | | | | | | |

Table A-12. Analog Output Characteristics – SCXI Modules

| Module | Number of Channels | Output Voltage Range (V or mA) | Mode Support |
|-----------|----------------------|---|--------------|
| SCXI-1124 | 6 voltage or current | 0 to 1, 0 to 5, 0 to 10, ± 1 , ± 5 , ± 10 (software-selectable) or 0 to 20 mA | multiplexed |

Table A-13. Terminal Block Selection Guide – SCXI Modules

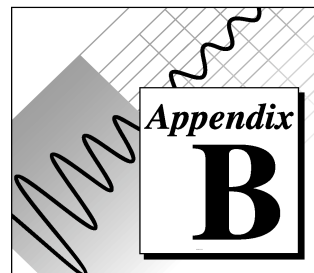
| SCXI Module | Terminal Blocks | Cold-Junction Compensation Sensor (CJC) |
|------------------|-----------------|---|
| SCXI-1100 | SCXI-1303 | Thermistor |
| SCXI-1102 | SCXI-1300 | IC Sensor |
| SCXI-1120 | SCXI-1320 | IC Sensor |
| SCXI-1121 | SCXI-13211 | IC Sensor |
| SCXI-1120D | SCXI-1327 | Thermistor |
| | SCXI-1328 | Thermistor |
| SCXI-1122 | SCXI-1322 | Thermistor |
| SCXI-1124 | SCXI-1325 | -- |
| SCXI-1140 | SCXI-1301 | -- |
| | SCXI-1304 | -- |
| SCXI-1141 | SCXI-1304 | -- |
| SCXI-1180 | SCXI-1302 | -- |
| SCXI-1181 | SCXI-1300 | IC Sensor |
| | SCXI-1301 | -- |
| SCXI-1200 | SCXI-1302 | -- |
| | CB-50 | -- |
| VXI-SC-1102 | VXI-TB-1303 | Thermistor |
| VXI-SC-1102B | VXI-TB-96 | |
| VXI-SC-1102C | | |
| 1 SCXI-1121 only | | |

Analog Output Only Devices Hardware Capabilities

Table A-14. Analog Output Characteristics – Analog Output Only Devices

| Device | Channel #s | DAC Type | Output Limits (V) | Update Clocks | Waveform Grouping | Transfer Method |
|------------------------------|--|--|--|--|--|---|
| AT-AO-6 AT-AO-10 | 0 through 5, 6 through 9* | 12-bit double-buffered with 1 K FIFO for update clock 1 channels | $\pm 10V$, $\pm V_{ref1}$, 0 to 10, 0 to V_{ref1} , 4 to 20 mA, | Update clock 1 is ctr0 or external update. Update clock 1 channels are 0, 1, 2, 3, 4, 5, 6*, 7*, 8*, 9*, 0 to 1, 0 to 3, 0 to 5, 0 to 7*, 0 to 9*. Update clock 2 is ctr1. Update clock 2 channels are 2, 3, 4, 5, 6*, 7*, 8*, 9*, 2 to 3, 2 to 5, 2 to 7*, 2 to 9*; timebase signal range is 1,000,000, 100,000, 10,000, 1,000, 100 | For update clock 1 channels are any one channel N or set of channel pairs: 0-N; for update clock 2 channels are 2-N, same rules as above: N#6, N#10* | Update clock 1 channels: DMA, interrupts; update clock 2 channels: interrupts |
| PC-AO-2DC (Plug and Play) | 0, 1 | | 0 to 10V, $\pm 5V$, 0-20mA sink software-selectable | | | |
| DAQCard-AO-2DC | 0, 1 | | 0 to 10V, $\pm 5V$, 0--20mA sink software-selectable | | | |
| VXI-AO-48XDC | voltage 0 through 47, current 0 through 47 | 18-bit | -10.1 V to +10.1 V, 0.1 mA to 20.1 mA source, voltage and current channels are independent | | | |

Error Codes



This appendix describes the errors that can occur while using the Measure DAQ Add-In.

Table B-1. Data Acquisition Error Codes

| Error Code | Error Description |
|-------------------|--|
| -2001 | Unable to find task. |
| -2002 | The worksheet that is specified in the task's configuration does not exist. |
| -2003 | The range that is specified in the task's configuration is not valid. |
| -2004 | Excel is out of memory. Use a smaller range. |
| -2101 | An analog output channel string represents multiple analog output channels. Measure requires that each analog output channel string contain only one analog output channel. |
| -10001 | An error was detected in the input string; the arrangement or ordering of the characters in the string is not consistent with the expected ordering. |
| -10002 | An error was detected in the input string; the syntax of the string is correct, but certain values specified in the string are inconsistent with other values specified in the string. |
| -10003 | The value of a numeric parameter is invalid. |
| -10004 | The value of a numeric parameter is inconsistent with another one, and therefore the combination is invalid. |
| -10005 | The device is invalid. |
| -10006 | The line is invalid. |
| -10007 | A channel, port, or counter is out of range for the device type or device configuration; or the combination of channels is not allowed; or the scan order must be reversed (0 last). |
| -10008 | The group is invalid. |
| -10009 | The counter is invalid. |
| -10010 | The count is too small or too large for the specified counter, or the given I/O transfer count is not appropriate for the current buffer or channel configuration. |
| -10011 | The analog input scan rate is too fast for the number of channels and the channel clock rate; or the given clock rate is not supported by the associated counter channel or I/O channel. |

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| -10012 | The analog input or analog output voltage range is invalid for the specified channel, or you are writing an invalid voltage to the analog output. |
| -10013 | The driver returned an unrecognized or unlisted error code. |
| -10014 | The group size is too large for the board. |
| -10015 | The time limit is invalid. |
| -10016 | The read count is invalid. |
| -10017 | The read mode is invalid. |
| -10018 | The offset is unreachable. |
| -10019 | The frequency is invalid. |
| -10020 | The timebase is invalid. |
| -10021 | The limits are beyond the range of the board. |
| -10022 | Your data array contains an incomplete update, or you are trying to write past the end of the internal buffer, or your output operation is continuous and the length of your array is not a multiple of one half of the internal buffer size. |
| -10023 | The write mode is out of range or is disallowed. |
| -10024 | Adding the write offset to the write mark places the write mark outside the internal buffer. |
| -10025 | The requested input limits exceed the board's capability or configuration. Alternative limits were selected. |
| -10026 | The requested number of buffers or the buffer size is not allowed. For example, the buffer limit for Lab and 1200 devices is 64K samples, or the board does not support multiple buffers. |
| -10027 | For DAQEvents 0 and 1 general value A must be greater than 0 and less than the internal buffer size. If DMA is used for DAQEvent 1, general value A must divide the internal buffer size evenly, with no remainder. If the TIO-10 is used for DAQEvent 4, general value A must be 1 or 2. |
| -10028 | The cutoff frequency specified is not valid for this device. |
| -10029 | The function you are calling is no longer supported in this version of the driver. |
| -10030 | The specified baud rate for communicating with the serial port is not valid on this platform. |
| -10031 | The specified SCXI chassis does not correspond to a configured SCXI chassis. |
| -10032 | The SCXI module slot that was specified is invalid or corresponds to an empty slot. |
| -10033 | The window handle passed to the function is invalid. |
| -10034 | No configured message matches the one you tried to delete. |
| -10035 | The specified attribute is not relevant. |
| -10036 | The specified year is invalid. |
| -10037 | The specified month is invalid. |
| -10038 | The specified day is invalid. |

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| -10039 | The specified input string is too long. For instance, DAQScope 5102 devices can only store a string up to 32 bytes in length on the calibration EEPROM. In that case, please shorten the string. |
| -10080 | The gain is invalid. |
| -10081 | The pretrigger sample count is invalid. |
| -10082 | The posttrigger sample count is invalid. |
| -10083 | The trigger mode is invalid. |
| -10084 | The trigger count is invalid. |
| -10085 | The trigger range or trigger hysteresis window is invalid. |
| -10086 | The external reference is invalid. |
| -10087 | The trigger type is invalid. |
| -10088 | The trigger level is invalid. |
| -10089 | The total count is inconsistent with the buffer size and pretrigger scan count or with the board type. |
| -10090 | The individual range, polarity, and gain settings are valid but the combination is not allowed. |
| -10091 | You have attempted to use an invalid setting for the iterations parameter. The iterations value must be 0 or greater. Your device might be limited to only two values, 0 and 1. |
| -10092 | Some devices require a time gap between the last sample in a scan and the start of the next scan. The scan interval you have specified does not provide a large enough gap for the board. See your documentation for an explanation. |
| -10093 | FIFO mode waveform generation cannot be used because at least one condition is not satisfied. |
| -10094 | The calDAC constant passed to the function is invalid. |
| -10095 | The calibration stimulus passed to the function is invalid. |
| -10100 | The requested digital port width is not a multiple of the hardware port width or is not attainable by the DAQ hardware. |
| -10120 | Invalid application used. |
| -10121 | Invalid counterNumber used. |
| -10122 | Invalid paramValue used. |
| -10123 | Invalid paramID used. |
| -10124 | Invalid entityID used. |
| -10125 | Invalid action used. |
| -10200 | Unable to read data from EEPROM. |
| -10201 | Unable to write data to EEPROM. |
| -10202 | You cannot write into this location or area of your EEPROM because it is write-protected. You may be trying to store calibration constants into a write-protected area; if this is the case, you should select user area of the EEPROM instead. |

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| -10240 | The driver interface could not locate or open the driver. |
| -10241 | One of the driver files or the configuration utility is out of date, or a particular feature of the Channel Wizard is not supported in this version of the driver. |
| -10242 | The specified function is not located in the driver. |
| -10243 | The driver could not locate or open the configuration file, or the format of the configuration file is not compatible with the currently installed driver. |
| -10244 | The driver encountered a hardware-initialization error while attempting to configure the specified device. |
| -10245 | The driver encountered an operating-system error while attempting to perform an operation, or the operating system does not support an operation performed by the driver. |
| -10246 | The driver is unable to communicate with the specified external device. |
| -10247 | The CMOS configuration-memory for the device is empty or invalid, or the configuration specified does not agree with the current configuration of the device, or the EISA system configuration is invalid. |
| -10248 | The base addresses for two or more devices are the same; consequently, the driver is unable to access the specified device. |
| -10249 | The interrupt configuration is incorrect given the capabilities of the computer or device. |
| -10250 | The interrupt levels for two or more devices are the same. |
| -10251 | The DMA configuration is incorrect given the capabilities of the computer/DMA controller or device. |
| -10252 | The DMA channels for two or more devices are the same. |
| -10253 | Unable to find one or more jumperless boards you have configured using the NI-DAQ Configuration Utility. |
| -10254 | Cannot configure the DAQCard because 1) the correct version of the card and socket services software is not installed; 2) the card in the PCMCIA socket is not a DAQCard; or 3) the base address and/or interrupt level requested are not available according to the card and socket services resource manager. Try different settings or use AutoAssign in the NIDAQ configuration utility. |
| -10255 | There was an error in initializing the driver for Remote SCXI. |
| -10256 | There was an error in opening the specified COM port. |
| -10257 | Bad base address specified in the configuration utility. |
| -10258 | Bad DMA channel 1 specified in the configuration utility or by the operating system. |
| -10259 | Bad DMA channel 2 specified in the configuration utility or by the operating system. |
| -10260 | Bad DMA channel 3 specified in the configuration utility or by the operating system. |
| -10261 | The user mode code failed when calling the kernel mode code. |

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| -10340 | No RTSI signal/line is connected, or the specified signal and the specified line are not connected, or your connection to an RDA server either cannot be made or has been terminated. |
| -10341 | The RTSI signal/line cannot be connected as specified. |
| -10342 | The specified RTSI signal is already being driven by a RTSI line, or the specified RTSI line is already being driven by a RTSI signal. |
| -10343 | The specified SCXI configuration parameters are invalid, or the function cannot be executed with the current SCXI configuration. |
| -10344 | The Remote SCXI unit is not synchronized with the host. Reset the chassis again to resynchronize it with the host. |
| -10345 | The required amount of memory cannot be allocated on the Remote SCXI unit for the specified operation. |
| -10346 | The packet received by the Remote SCXI unit is invalid. Check your serial port cable connections. |
| -10347 | There was an error in sending a packet to the remote chassis. Check your serial port cable connections. |
| -10348 | The Remote SCXI unit is in reprogramming mode and is waiting for reprogramming commands from the host (NI-DAQ Configuration Utility). |
| -10349 | The module ID read from the SCXI module conflicts with the configured module type. |
| -10360 | The DSP driver was unable to load the kernel for its operating system. |
| -10370 | The scan list is invalid; for example, you are mixing AMUX-64T channels and onboard channels, scanning SCXI channels out of order, or have specified a different starting channel for the same SCXI module. Also, the driver attempts to achieve complicated gain distributions over SCXI channels on the same module by manipulating the scan list and returns this error if it fails. |
| -10400 | The specified resource is owned by the user and cannot be accessed or modified by the driver. |
| -10401 | The specified device is not a National Instruments product, the driver does not support the device (for example, the driver was released before the device was supported), or the device has not been configured using the NI-DAQ Configuration Utility. |
| -10402 | No device is located in the specified slot or at the specified address. |
| -10403 | The specified device does not support the requested action (the driver recognizes the device, but the action is inappropriate for the device). |
| -10404 | No line is available. |
| -10405 | No channel is available. |
| -10406 | No group is available. |
| -10407 | The specified line is in use. |
| -10408 | The specified channel is in use. |
| -10409 | The specified group is in use. |

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| -10410 | A related line, channel, or group is in use; if the driver configures the specified line, channel, or group, the configuration, data, or handshaking lines for the related line, channel, or group will be disturbed. |
| -10411 | The specified counter is in use. |
| -10412 | No group is assigned, or the specified line or channel cannot be assigned to a group. |
| -10413 | A group is already assigned, or the specified line or channel is already assigned to a group. |
| -10414 | The selected signal requires a pin that is reserved and configured only by NI-DAQ. You cannot configure this pin yourself. |
| -10415 | This function does not support your DAQ device when an external multiplexer (such as an AMUX-64T or SCXI) is connected to it. |
| -10440 | The specified resource is owned by the driver and cannot be accessed or modified by the user. |
| -10441 | No memory is configured to support the current data-transfer mode, or the configured memory does not support the current data-transfer mode. (If block transfers are in use, the memory must be capable of performing block transfers.) |
| -10442 | The specified memory is disabled or is unavailable given the current addressing mode. |
| -10443 | The transfer buffer is not aligned properly for the current data-transfer mode. For example, the buffer is at an odd address, is not aligned to a 32-bit boundary, is not aligned to a 512-bit boundary, and so on. Alternatively, the driver is unable to align the buffer because the buffer is too small. |
| -10444 | No more system memory is available on the heap, or no more memory is available on the device, or insufficient disk space is available. |
| -10445 | The transfer buffer cannot be locked into physical memory. On PC AT machines, portions of the DMA data acquisition buffer may be in an invalid DMA region, for example, above 16 megabytes. |
| -10446 | The transfer buffer contains a page break; system resources may require reprogramming when the page break is encountered. |
| -10447 | The operating environment is unable to grant a page lock. |
| -10448 | The driver is unable to continue parsing a string input due to stack limitations. |
| -10449 | A cache-related error occurred, or caching is not supported in the current mode. |
| -10450 | A hardware error occurred in physical memory, or no memory is located at the specified address. |
| -10451 | The driver is unable to make the transfer buffer contiguous in virtual memory and therefore cannot lock it into physical memory; thus, the buffer cannot be used for DMA transfers. |
| -10452 | No interrupt level is available for use. |
| -10453 | The specified interrupt level is already in use by another device. |

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| -10454 | No DMA controller is available in the system. |
| -10455 | No DMA channel is available for use. |
| -10456 | The specified DMA channel is already in use by another device. |
| -10457 | DMA cannot be configured for the specified group because it is too small, too large, or misaligned. Consult the device user manual to determine group ramifications with respect to DMA. |
| -10458 | The storage disk you specified is full. |
| -10459 | The NI-DAQ DLL could not be called due to an interface error. |
| -10460 | You have mixed VIs from the DAQ library and the _DAQ compatibility library (LabVIEW 2.2 style VIs). You may switch between the two libraries only by running the DAQ VI Device Reset before calling _DAQ compatibility VIs or by running the compatibility VI Board Reset before calling DAQ VIs. |
| -10461 | The specified resource is unavailable because it has already been reserved by another entity. |
| -10462 | The specified resource has not been reserved, so the action is not allowed. |
| -10480 | The scan list is too large to fit into the mux-gain memory of the board. |
| -10481 | You must provide a single buffer of interleaved data, and the channels must be in ascending order. You cannot use DMA to transfer data from two buffers; however, you may be able to use interrupts. |
| -10540 | At least one of the SCXI modules specified is not supported for the operation. |
| -10541 | CTRB1 will drive COUTB1, however CTRB1 will also drive TRIG1. This may cause unpredictable results when scanning the chassis. |
| -10560 | The DSP handle input is not valid . |
| -10561 | Either DAQ or WFM can use a PC memory buffer, but not both at the same time. |
| -10600 | No setup operation has been performed for the specified resources. Or, some resources require a specific ordering of calls for proper setup. |
| -10601 | The specified resources have already been configured by a setup operation. |
| -10602 | No output data has been written into the transfer buffer. |
| -10603 | The output data associated with a group must be for a single channel or must be for consecutive channels. |
| -10604 | Once data generation has started, only the transfer buffers originally written to may be updated. If DMA is active and a single transfer buffer contains interleaved channel-data, new data must be provided for all output channels currently using the DMA channel. |
| -10605 | No data was written to the transfer buffer because the final data block has already been loaded. |
| -10606 | The specified resource is not armed. |
| -10607 | The specified resource is already armed. |
| -10608 | No transfer is in progress for the specified resource. |

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| -10609 | A transfer is already in progress for the specified resource, or the operation is not allowed because the device is in the process of performing transfers, possibly with different resources. |
| -10610 | A single output channel in a group may not be paused if the output data for the group is interleaved. |
| -10611 | Some of the lines in the specified channel are not configured for the transfer direction specified. For a write transfer, some lines are configured for input. For a read transfer, some lines are configured for output. |
| -10612 | The specified line does not support the specified transfer direction. |
| -10613 | The specified channel does not support the specified transfer direction. |
| -10614 | The specified group does not support the specified transfer direction. |
| -10615 | The clock configuration for the clock master is invalid. |
| -10616 | The clock configuration for the clock slave is invalid. |
| -10617 | No source signal has been assigned to the clock resource. |
| -10618 | The specified source signal cannot be assigned to the clock resource. |
| -10619 | A source signal has already been assigned to the clock resource. |
| -10620 | No trigger signal has been assigned to the trigger resource. |
| -10621 | The specified trigger signal cannot be assigned to the trigger resource. |
| -10622 | The pretrigger mode is not supported or is not available in the current configuration, or no pretrigger source has been assigned. |
| -10623 | No posttrigger source has been assigned. |
| -10624 | The delayed trigger mode is not supported or is not available in the current configuration, or no delay source has been assigned. |
| -10625 | The trigger configuration for the trigger master is invalid. |
| -10626 | The trigger configuration for the trigger slave is invalid. |
| -10627 | No signal has been assigned to the trigger resource. |
| -10628 | A signal has already been assigned to the trigger resource. |
| -10629 | The specified operating mode is invalid, or the resources have not been configured for the specified operating mode. |
| -10630 | The parameters specified to read data were invalid in the context of the acquisition. For example, an attempt was made to read 0 bytes from the transfer buffer, or an attempt was made to read past the end of the transfer buffer. |
| -10631 | Continuous input or output transfers are not allowed in the current operating mode, or continuous operation is not allowed for this type of device. |
| -10632 | Certain inputs were ignored because they are not relevant in the current operating mode. |
| -10633 | The specified analog output regeneration mode is not allowed for this board. |
| -10634 | No continuous (double buffered) transfer is in progress for the specified resource. |

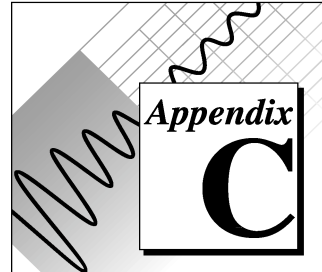
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| -10635 | Either the SCXI operating mode specified in a configuration call is invalid, or a module is in the wrong operating mode to execute the function call. |
| -10636 | You cannot start a continuous (double-buffered) operation with a synchronous function call. |
| -10637 | Attempted to configure a buffer after the buffer had already been configured. You can configure a buffer only once. |
| -10680 | All channels of this board must have the same gain. |
| -10681 | All channels of this board must have the same range. |
| -10682 | All channels of this board must be the same polarity. |
| -10683 | All channels of this board must have the same coupling. |
| -10684 | All channels of this board must have the same input mode. |
| -10685 | The clock rate exceeds the board's recommended maximum rate. |
| -10686 | A configuration change has invalidated the scan list. |
| -10687 | A configuration change has invalidated the acquisition buffer, or an acquisition buffer has not been configured. |
| -10688 | The number of total scans and pretrigger scans implies that a triggered start is intended, but triggering is not enabled. |
| -10689 | Digital trigger B is illegal for the number of total scans and pretrigger scans specified. |
| -10690 | This board does not allow digital triggers A and B to be enabled at the same time. |
| -10691 | This board does not allow an external sample clock with an external scan clock, start trigger, or stop trigger. |
| -10692 | The acquisition cannot be started because the channel clock is disabled. |
| -10693 | You cannot use an external scan clock when doing a single scan of a single channel. |
| -10694 | The scan rate is above the maximum or below the minimum for the hardware, gains, and filters used. |
| -10695 | You have set up an operation that requires the use of interrupts. DMA is not allowed. For example, some DAQ events, such as messaging and LabVIEW occurrences, require interrupts. |
| -10696 | Multi-rate scanning cannot be used with the AMUX-64, SCXI, or pretriggered acquisitions. |
| -10697 | Unable to convert your timebase/interval pair to match the actual hardware capabilities of this board. |
| -10698 | You cannot use this combination of scan and sample clock timebases for this board. |
| -10699 | You cannot use this combination of scan and sample clock source polarities for this operation and board. |
| -10700 | You cannot use this combination of scan and convert clock signal sources for this operation and board. |

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| -10701 | The call had no effect because the specified channel had not been set for later internal update. |
| -10702 | Pretriggering and posttriggering cannot be used simultaneously on the Lab and 1200 series devices. |
| -10710 | The specified port has not been configured for handshaking. |
| -10720 | The specified counter is not configured for event-counting operation. |
| -10740 | A signal has already been assigned to the SCXI track-and-hold trigger line, or a control call was inappropriate because the specified module is not configured for one-channel operation. |
| -10780 | When you have an SC2040 attached to your device, all analog input channels must be configured for differential input mode. |
| -10781 | The polarity of the output channel cannot be bipolar when outputting currents. |
| -10782 | The specified operation cannot be performed with the SC-2040 configured in hold mode. |
| -10783 | Calibration constants in the load area have a different polarity from the current configuration. Therefore, you should load constants from factory. |
| -10800 | The operation could not complete within the time limit. |
| -10801 | An error occurred during the calibration process. Possible reasons for this error include incorrect connection of the stimulus signal, incorrect value of the stimulus signal, or malfunction of your DAQ device. |
| -10802 | The requested amount of data has not yet been acquired. |
| -10803 | The on-going transfer has been stopped. This is to prevent regeneration for output operations, or to reallocate resources for input operations. |
| -10804 | The transfer stopped prior to reaching the end of the transfer buffer. |
| -10805 | The clock rate is faster than the hardware can support. An attempt to input or output a new data point was made before the hardware could finish processing the previous data point. This condition may also occur when glitches are present on an external clock signal. |
| -10806 | No trigger value was found in the input transfer buffer. |
| -10807 | The trigger occurred before sufficient pretrigger data was acquired. |
| -10808 | An error occurred in the parallel port communication with the DAQ device. |
| -10809 | Attempted to start a pulse width measurement with the pulse in the phase to be measured (e.g., high phase for high-level gating). |
| -10810 | An unexpected error occurred inside the driver when performing this given operation. |
| -10840 | The contents or the location of the driver file was changed between accesses to the driver. |
| -10841 | The firmware does not support the specified operation, or the firmware operation could not complete due to a data-integrity problem. |
| -10842 | The hardware is not responding to the specified operation, or the response from the hardware is not consistent with the functionality of the hardware. |

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| -10843 | Because of system limitations, the driver could not write data to the device fast enough to keep up with the device throughput. This error may be returned erroneously when an <code>overRunErr</code> has occurred. |
| -10844 | New data was not written to the output transfer buffer before the driver attempted to transfer the data to the device. |
| -10845 | Because of system limitations, the driver could not read data from the device fast enough to keep up with the device throughput; the onboard device memory reported an overflow error. |
| -10846 | The driver wrote new data into the input transfer buffer before the previously acquired data was read. |
| -10847 | New buffer information was not available at the time of the DMA chaining interrupt; DMA transfers will terminate at the end of the currently active transfer buffer. |
| -10848 | The driver could not obtain a valid reading from the transfer-count register in the DMA controller. |
| -10849 | The configuration file or DSP kernel file could not be opened. |
| -10850 | Unable to close a file. |
| -10851 | Unable to seek within a file. |
| -10852 | Unable to read from a file. |
| -10853 | Unable to write to a file. |
| -10854 | An error occurred accessing a file. |
| -10855 | NI-DAQ does not support the current operation on this particular version of the operating system. |
| -10856 | An unexpected error occurred from the operating system while performing the given operation. |
| -10857 | An unexpected error occurred inside the kernel of the device while performing this operation. |
| -10858 | The system has reconfigured the device and has invalidated the existing configuration. The device requires reinitialization to be used again. |
| -10880 | A change to the update rate is not possible at this time because 1) when waveform generation is in progress, you cannot change the interval timebase or 2) when you make several changes in a row, you must give each change enough time to take effect before requesting further changes. |
| -10881 | You cannot do another transfer after a successful partial transfer. |
| -10882 | The data collected on the Remote SCXI unit was overwritten before it could be transferred to the buffer in the host. Try using a slower data acquisition rate if possible. |
| -10883 | New data could not be transferred to the waveform buffer of the Remote SCXI unit to keep up with the waveform update rate. Try using a slower waveform update rate if possible. |
| -10884 | Could not rearrange data after a pretrigger acquisition completed. |

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| -10920 | One or more data points may have been lost during buffered GPCTR operations due to speed limitations of your system. |
| -10940 | No response was received from the Remote SCXI unit within the specified time limit. |
| -10941 | Reprogramming the Remote SCXI unit was unsuccessful. Please try again. |
| -10942 | An invalid reset signature was sent from the host to the Remote SCXI unit. |
| -10943 | The interrupt service routine on the remote SCXI unit is taking longer than necessary. You do not need to reset your remote SCXI unit, however, please clear and restart your data acquisition. |

Troubleshooting



This appendix describes solutions to problems that you might encounter using the Measure DAQ Add-In.

- Problem:** No DAQ menu appears.
- Solution:** From the **Tools»Add-Ins**. Click on the **Browse** button and look for DAQ .XLA in the directory where you installed Measure. Once you find it, select it and click on the **OK** button. If a dialog box appears with the message Replace existing 'DAQ.XLA' ? click on the **Yes** button. You will see a Measure Data Acquisition Add-In entry in the list box and the checkbox next to it will be checked. Click on the **OK** button.
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- Problem:** The list of data acquisition devices is empty.
- Solution:** Verify with the NI-DAQ Configuration Utility that you have properly installed and configured your device. Verify that your device is supported by Measure. Refer to Appendix A, *DAQ Hardware Capabilities*.

Problem: You are using Windows 3.1 or Windows for Workgroups 3.11 and you get a dialog box entitled Measure with the message, Error -10243 The driver could not locate or open the configuration file, or the format of the configuration file is not compatible with the currently installed driver.

Solution: Delete the WDAQCONF.CFG file in your Windows directory. Then reconfigure your hardware using the NI-DAQ Configuration Utility. If the problem persists, contact National Instruments for an updated version of the NI-DAQ driver.

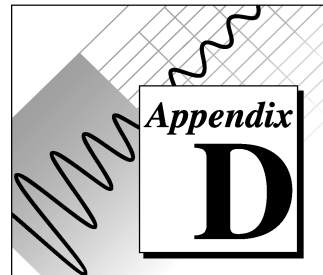
Problem: You get a dialog box entitled Measure with a message that begins Fatal error.

Solution: Congratulations! It is likely that you have found a deficiency in our code! Please write down the information in the dialog box as well as the actions that you took preceding the error. Try to reproduce the error. Then, call National Instruments technical support.

Problem: After you remove the Measure Data Acquisition Add-In in the Add-Ins dialog box, a dialog box entitled Microsoft Excel appears with the message Cannot access 'DAQ.XLA'.

Solution: Click on the **Cancel** button. This behavior, which occurs because of Microsoft Excel or the OLE libraries, is harmless and you can safely ignore it.

Customer Communication



For your convenience, this appendix contains forms to help you gather the information necessary to help us solve technical problems you might have as well as a form you can use to comment on the product documentation. Filling out a copy of the *Technical Support Form* before contacting National Instruments helps us help you better and faster.

National Instruments provides comprehensive technical assistance around the world. In the U.S. and Canada, applications engineers are available Monday through Friday from 8:00 a.m. to 6:00 p.m. (central time). In other countries, contact the nearest branch office. You may fax questions to us at any time.

Electronic Services



Bulletin Board Support

National Instruments has BBS and FTP sites dedicated for 24-hour support with a collection of files and documents to answer most common customer questions. From these sites, you can also download the latest instrument drivers, updates, and example programs. For recorded instructions on how to use the bulletin board and FTP services and for BBS automated information, call (512) 795-6990. You can access these services at:

United States: (512) 794-5422 or (800) 327-3077
Up to 14,400 baud, 8 data bits, 1 stop bit, no parity

United Kingdom: 01635 551422
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity

France: 1 48 65 15 59
Up to 9,600 baud, 8 data bits, 1 stop bit, no parity



FTP Support

To access our FTP site, log on to our Internet host, `ftp.natinst.com`, as anonymous and use your Internet address, such as `joesmith@anywhere.com`, as your password. The support files and documents are located in the `/support` directories.



Fax-on-Demand Support

Fax-on-Demand is a 24-hour information retrieval system containing a library of documents on a wide range of technical information. You can access Fax-on-Demand from a touch-tone telephone at (512) 418-1111.



E-Mail Support (Currently USA Only)

You can submit technical support questions to the applications engineering team through e-mail at the Internet address listed below. Remember to include your name, address, and phone number so we can contact you with solutions and suggestions.

support@natinst.com

Telephone and Fax Support

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Operating system: Windows 3.1, Windows for Workgroups 3.11, Windows NT 3.1, Windows NT 3.5, Windows 95, other (include version number) _____

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Programming Language _____

Programming Language Version _____

Other Boards in System _____

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For each instrument you are using:

Name of instrument _____

Manufacturer of instrument _____

Parity: None, Even, Odd, Mark, Space

Baud rate _____

Stop bits _____

Data bits _____

Flow control: Hardware, Software, None

Version of Measure: (look at the about box) _____

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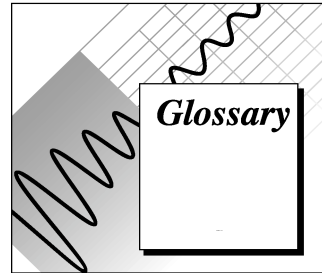
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| Prefix | Meaning | Value |
|---------|---------|------------|
| p- | pico- | 10^{-12} |
| n- | nano- | 10^{-9} |
| μ - | micro- | 10^{-6} |
| m- | milli- | 10^{-3} |
| k- | kilo- | 10^3 |
| M- | mega- | 10^6 |

Numbers/Symbols

1D One-dimensional.

2D Two-dimensional.

A

A/D Analog-to-digital.

ADC Analog-to-digital converter. An electronic device, often an integrated circuit, that converts an analog voltage to a digital number.

ADC resolution The resolution of the ADC, which is measured in bits. An ADC with 16 bits has a higher resolution, and thus a higher degree of accuracy than a 12-bit ADC.

AI Analog input.

| | |
|-----------------------------|---|
| Analog Input Configuration | The specification of the analog input channels, input limits, input mode, and scan rate that Measure will use to acquire a waveform. |
| Analog Output Configuration | The specification of the analog output channels, output limits, data points, and update rate that Measure will use to generate a waveform. |
| analog trigger | A trigger that occurs at a user-selected point on an incoming analog signal. Triggering can be set to occur at a specified level on either an increasing or a decreasing signal (positive or negative slope). Analog triggering can be implemented either in software or in hardware. When implemented in software (Measure), all data is collected, transferred into system memory, and analyzed for the trigger condition. When analog triggering is implemented in hardware, no data is transferred to system memory until the trigger condition has occurred. |
| AO | Analog output. |
| array | Ordered, indexed set of data elements of the same type. |
| Asynchronous | A method of data communications in which information is transmitted one character at a time. A start bit precedes each character and a stop bit follows each character. The start bit signals the beginning of the character transmission and the stop bit indicates its completion. The Serial Add-In uses asynchronous communications in its data exchanges. |
| B | |
| bipolar | A signal range that includes both positive and negative values—for example, -5 to 5 V. |
| buffer | Temporary storage for acquired or generated data. |
| Byte | The standard method of representing numbers or characters in a computers. Eight binary digits (bits) make up a byte. |

C

| | |
|-------------------|---|
| channel | Pin or wire lead to which you apply or from which you read the analog or digital signal. Analog signals can be single-ended or differential. For digital signals, you group channels to form ports. Ports usually consist of either four or eight digital channels. |
| channel clock | The clock controlling the time interval between individual channel sampling within a scan. Boards with simultaneous sampling do not have this clock. |
| clock | Hardware component that controls timing for reading from or writing to groups. |
| conversion device | Device that transforms a signal from one form to another. For example, analog-to-digital converters (ADCs) for analog input, digital-to-analog converters (DACs) for analog output, digital input or output ports, and counter/timers are conversion devices. |
| coupling | The manner in which a signal is connected from one location to another. |

D

| | |
|------------------|--|
| D/A | Digital-to-analog. |
| DAC | Digital-to-analog converter. An electronic device, often an integrated circuit, that converts a digital number into a corresponding analog voltage or current. |
| data acquisition | Process of acquiring data, typically from A/D or digital input plug-in boards. |
| device | A plug-in data acquisition board that can contain multiple channels and conversion devices. |
| device number | The slot number or board ID number assigned to the board when you configured it. |
| DIFF | Differential. A differential input is an analog input consisting of two terminals, both of which are isolated from computer ground and whose difference you measure. |

DMA Direct memory access. A method by which data you can transfer data to computer memory from a device or memory on the bus (or from computer memory to a device) while the processor does something else. DMA is the fastest method of transferring data to or from computer memory.

driver Software that controls a specific hardware device, such as a data acquisition board.

E

EISA Extended Industry Standard Architecture.

external trigger A voltage pulse from an external source that triggers an event such as A/D conversion.

F

FIFO A first-in-first-out memory buffer. In a FIFO, the first data stored is the first data sent to the acceptor.

G

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

I

input limits The upper and lower voltage inputs for a channel. You must use a pair of numbers to express the input limits. The VIs can infer the input limits from the input range, input polarity, and input gain(s). Similarly, if you wire the input limits, range, and polarity, the VIs can infer the onboard gains when you do not use SCXI.

input range The difference between the maximum and minimum voltages an analog input channel can measure at a gain of 1. The input range is a scalar value, not a pair of numbers. By itself the input range

does not uniquely determine the upper and lower voltage limits. An input range of 10 V could mean an upper limit of +10 V and a lower of 0 V or an upper limit of +5 V and a lower limit of -5 V.

The combination of input range, polarity, and gain determines the input limits of an analog input channel. For some boards, jumpers set the input range and polarity, while you can program them for other boards. Most boards have programmable gains. When you use SCXI modules, you also need their gains to determine the input limits.

interrupt

A signal indicating that the central processing unit should suspend its current task to service a designated activity.

I/O

Input/output. The transfer of data to or from a computer system involving communications channels, operator interface devices, and/or data acquisition and control interfaces.

ISA

Industry Standard Architecture.

K

Kwords

1,024 words of memory.

M

MB

megabytes of memory

multiplexer

A set of semiconductor or electromechanical switches with a common output that can select one of a number of input signals and that you commonly use to increase the number of signals measured by one ADC.

N

NRSE

Nonreferenced single-ended.

O

onboard channels

Channels provided by the plug-in data acquisition board.

output limits The upper and lower voltage or current outputs for an analog output channel. The output limits determine the polarity and voltage reference settings for a board.

P

PGIA Programmable gain instrumentation amplifier.

postriggering The technique you use on a data acquisition board to acquire a programmed number of samples after trigger conditions are met.

pretriggering The technique you use on a data acquisition board to keep a continuous buffer filled with data, so that when the trigger conditions are met, the sample includes the data leading up to the trigger condition.

R

Range A group of rows and columns on a spreadsheet.

RMS Root mean square.

RSE Referenced single-ended.

S

scan One reading from each channel or port in an analog or digital input group.

scan clock The clock controlling the time interval between scans. On boards with interval scanning support (for example, the AT-MIO-16F-5), this clock gates the channel clock on and off. On boards with simultaneous sampling (for example, the EISA-A2000), this clock clocks the track-and-hold circuitry.

scan rate The number of scans per second. For example, at a scan rate of 10Hz, Measure samples each channel in a group 10 times per second.

scan width The number of channels in the channel list or number of ports in the port list you use to configure an analog or digital input group.

| | |
|---------------------|---|
| SCXI | Signal Conditioning eXtensions for Instrumentation. The National Instruments product line for conditional low-level signals within an external chassis near sensors, so only high-level signals in a noisy environment are sent to data acquisition boards. |
| sec | Seconds |
| single-ended inputs | Analog inputs that you measure with respect to a common ground. |
| software trigger | A programmed event that triggers an event such as data acquisition. |
| Synchronous | A method of data communications in which a prearranged number of bits are transferred per second. Synchronization occurs before and after the transmission of blocks of data, rather than before and after every character. There are no start bits or stop bits, as there are in asynchronous communications. All transmitted bits represent information or are parity bits. See Asynchronous. |
| T | |
| trigger | A condition for starting or stopping clocks. |
| U | |
| unipolar | A signal range that is always positive—for example, 0 to 10 V. |
| update | The output equivalent of a scan. One update is one write to each channel or port in the group. Updates apply to both analog output and digital output groups. |
| update rate | The number of output updates per second. |
| update width | The number of channels in the channel list or number of ports in the port list you use to configure an analog or digital output group. |

V

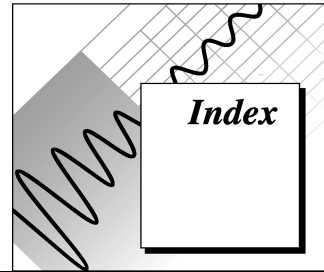
V volts.

Visual Basic for Applications (VBA) The programming language built into Microsoft Excel.

Vref Voltage reference.

W

waveform Multiple voltage readings taken at a specific sampling rate.



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