Getting Started with VirtualBench

VIRTUALBENCH™

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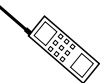BBS France: 01 48 65 15 59

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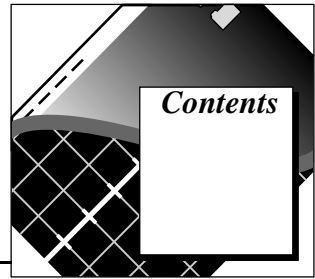
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The VirtualBench suite of tools is a high-performance, easy-to-use virtual instruments application program for Windows 95 or Windows NT. *Getting Started with VirtualBench* gives you step-by-step instructions on how to use each instrument. It also includes a description of the front panel of each instrument.

Organization of This Manual

Getting Started with VirtualBench is organized as follows:

- Chapter 1, *Welcome to VirtualBench*, lists the minimum system requirements for VirtualBench, explains how to install VirtualBench, and tells you what the setup program installs.

- Chapter 2, *VirtualBench-Scope*, explains the VirtualBench oscilloscope (Scope) front panel features and how to acquire data with the oscilloscope.

- Chapter 3, *VirtualBench-DSA*, explains the VirtualBench dynamic signal analyzer (DSA) front panel features and how to acquire and measure signals with the DSA.

- Chapter 4, *VirtualBench-Logger*, explains the VirtualBench-Logger front panel features and how to acquire data with the logger.

- Chapter 5, *VirtualBench-FG*, explains the VirtualBench function generator (FG) front panel features and how to generate a waveform.

- Chapter 6, *VirtualBench-DMM*, explains the VirtualBench digital multimeter (DMM) and how to measure a signal with the DMM.

- Chapter 7, *VirtualBench-Arb*, explains the VirtualBench arbitrary Waveform Generator front panel features, the Waveform Editor front panel features, and how to generate a waveform.

- Chapter 8, *VirtualBench-DIO*, explains the VirtualBench digital input/output controller (DIO) and how to read from and write to digital ports.

- Chapter 9, *VirtualBench-AODC*, explains the VirtualBench DC analog output controller (AODC) front panel features and how to control analog output.

- Chapter 10, *VirtualBench-Device Calibrator*, explains the VirtualBench-Device Calibrator front panel features and how to calibrate a DAQ device.

- The Appendix, *Customer Communication*, contains forms you can use to request help from National Instruments or to comment on our products and manuals.

Conventions Used in This Manual

This manual uses the following conventions:

»	The» symbol leads you through nested menu items and dialog box options to a final action. The sequence **File»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** options from the last dialog box.
☞	This icon to the left of bold italicized text denotes a note, which alerts you to important information.
bold	Bold text denotes the names of menus, menu items, parameters, dialog box, dialog box buttons or options, icons, windows, Windows 95 tabs, or LEDs.
bold italic	Bold italic text denotes a note, caution, or warning.
italic	Italic text denotes emphasis, a cross reference, or an introduction to a key concept. This font also denotes text from which you supply the appropriate word or value, as in Windows 3.*x*.
italic monospace	Italic text in this font denotes that you must supply the appropriate words or values in the place of these items.
`monospace`	Text in this font denotes text or characters that should literally enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and for statements and comments taken from programs.

paths   Paths in this manual are denoted using backslashes (\) to separate drive names, directories, folders, and files.

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 the appendix, *Customer Communication*, at the end of this manual.

Welcome to VirtualBench
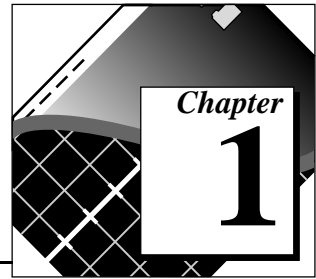
This chapter lists the minimum system requirements for VirtualBench, explains how to install VirtualBench, and tells you what the setup program installs.

VirtualBench Installation for Windows

You must install VirtualBench along with two other items:

- A National Instruments data acquisition (DAQ) device
- NI-DAQ driver software

Minimum System Requirements

To run VirtualBench you must have the following:

- Microsoft Windows 95 or Microsoft Windows NT 4.0 or higher
- Personal computer using at least a 33 MHz 486 or higher microprocessor with floating-point capability (National Instruments recommends a 66 MHz 486 or higher microprocessor with floating-point capability.)
- VGA resolution (or higher) video adapter
- Minimum of 16 MB of RAM
- 28 MB free hard disk space
- Microsoft-compatible mouse
- NI-DAQ 5.0 or later

You cannot use VirtualBench 2.1 in the following situations:

- You are using Windows 3.1.x
- You are using an AT-DSP2200, AT-2150, or EISA-A2000 DAQ device in Windows 95 or Windows NT

In these cases, you have to use VirtualBench 2.0, located in the vbench20 folder on the VirtualBench 2.1 CD. For more information on

installing VirtualBench 2.0, consult the `readme.txt` file in the `vbench20\WIN31` or `vbench20\WIN95-NT` folders.

Installing VirtualBench from Compact Disk

☞ **Note:**   *National Instruments recommends that you close all other applications before you install VirtualBench.*

To install VirtualBench from CD, perform the following steps:

1. Insert your VirtualBench CD into your CD-ROM drive.

☞ **Note:**   *At this point your operating system may prompt you to run* `setup.exe`. *Ignore this prompt. Select* **Close** *and continue to the next step.*

2. Select **Run** from the Windows 95/NT **Start** menu.

3. Enter `x:\vbench21\disk1\setup` (where *x* is your CD drive) in the input box and click on **OK**.

4. Follow the instructions that appear in the dialog boxes.

☞ **Note:**   *Do not rename the VirtualBench folders:* `scope`, `logger`, `dmm`, `fg`, `dsa`, `arb`, `aodc`, `dio`, *and* `cal`. *VirtualBench must have this folder hierarchy to work correctly.*

Installing VirtualBench from Diskettes

VirtualBench 2.1 ships on CD only. You can make installation diskettes by performing the following steps:

1. Insert a formatted 1.44 MB diskette into your floppy disk drive.

2. Insert your VirtualBench CD into your CD-ROM drive.

3. Copy the entire contents of `x:\vbench21\disk1` (where *x* is your CD drive) to your floppy diskette.

4. Repeat steps 1 through 3 for all `x:\vbench21\diskx` folders on the CD.

5. Insert the `disk1` copy into your floppy drive.

6. Select **Run** from the **Start** menu.

7. Enter `A:setup` or `B:setup` (depending on the pathname of your floppy disk drive) in the input box and click on **OK**.

8. Follow the instructions that appear in the dialog boxes.

☞ **Note:** *Do not rename the VirtualBench folders:* `scope`*,* `logger`*,* `dmm`*,* `fg`*,* `dsa`*,* `arb`*,* `aodc`*,* `dio`*, and* `cal`*. VirtualBench must have this folder hierarchy to work correctly.*

What the Setup Program Installs

If you purchased the full VirtualBench suite, the setup program installs the VirtualBench engine and nine virtual instruments: the oscilloscope (Scope), dynamic signal analyzer (DSA), digital multimeter (DMM), function generator (FG), logger, arbitrary waveform generator (Arb), DC analog output controller (AODC), digital input/output controller (DIO), and device calibrator (CAL). Each instrument comes with online help.

If you did not purchase the full VirtualBench suite, the setup program for VirtualBench installs the VirtualBench engine and the instruments you purchased. The VirtualBench toolbar enables only the buttons for the instruments you purchased. However, you can access online help for all the VirtualBench instruments.

☞ **Note:** *Be sure to view the VirtualBench* `readme.txt` *file on the VirtualBench installation CD for the latest information concerning the installation and use of VirtualBench.*

Connecting Signals to Your Data Acquisition Device

Refer to the user manual for your National Instruments DAQ device for instructions on connecting signals to your device.

VirtualBench-Scope
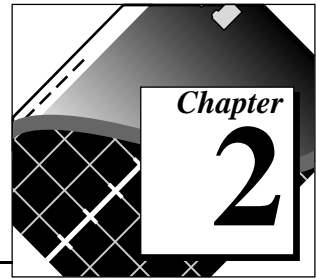
This chapter explains the VirtualBench oscilloscope (Scope) front panel features and how to acquire data with the oscilloscope.

Launching VirtualBench-Scope

You can launch VirtualBench-Scope by selecting **Start»Programs» VirtualBench»VirtualBench-Scope** or by clicking on the **Scope** button on the VirtualBench toolbar.

Front Panel Features

This section explains the features of the VirtualBench-Scope front panel, shown in Figure 2-1.
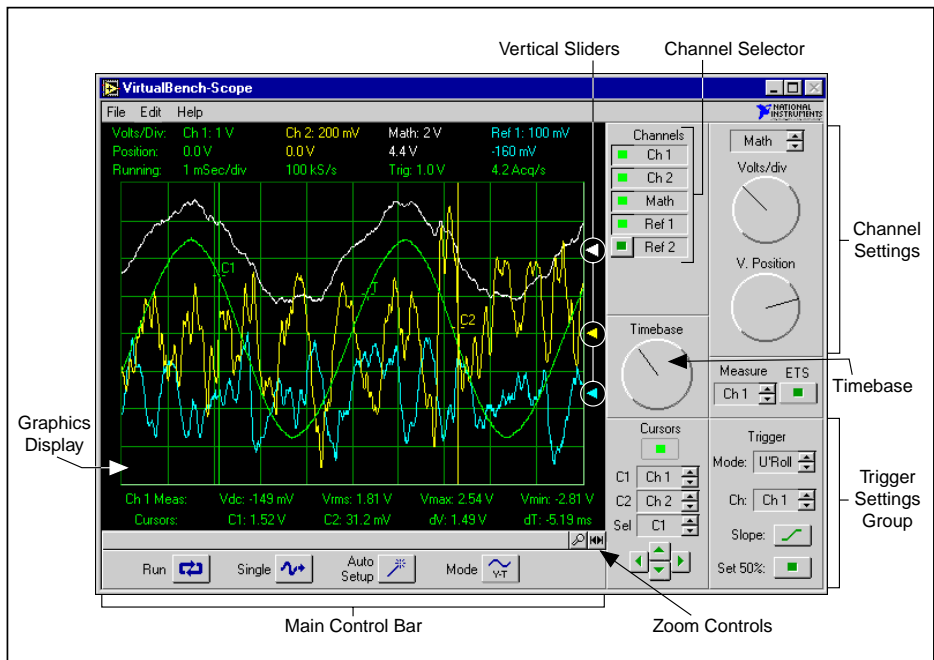
Figure 2-1. Front Panel of VirtualBench-Scope

The front panel of VirtualBench-Scope has the following features:

- **Channel Selector**—selects a waveform for display on the graphics display.

- **Channel Settings**—adjusts the vertical sensitivity of the channel you select. Turning the knob clockwise increases the sensitivity. Each vertical division represents a smaller voltage value.

- **Timebase**—allows you to change the timebase setting. Turning the knob clockwise reduces the time period that appears in the graphics display. Each horizontal division represents one time period.

- **Graphics Display**—displays waveforms.

- **Vertical Sliders**—adjust voltage offset for each channel. Use this slider when you want to adjust multiple waveforms in the graphics display.

- **Trigger Settings Group**—controls the conditions required for signal acquisition; for example, whether to wait for a digital trigger before acquiring data or whether to acquire data in free-run mode (no triggering).

- **Main Control Bar Buttons**

    - **Run**—acquires data continuously. Deselecting this button places the VirtualBench-Scope in idle mode.

    - **Single**—instructs VirtualBench-Scope to perform a single-sweep acquisition.

    - **Auto Setup**—configures the scope for the best timebase, volts per division, and trigger setting for each channel currently selected with the channel selector.

    - **Mode**—sets the mode of the scope to either volts versus time or X versus Y mode.

- **Zoom Controls**—adjusts the view of your display data.

    - **Scroll Bar**—adjusts zoom view.

    - **Zoom In**—zooms in on display data. Each zoom increases the view by a factor of two.

    - **Zoom Out**—zooms out to full X scale.

☞ **Note:**   *Refer to the* VirtualBench-Scope Online Help *for additional help on the front panel items.*

Acquiring Data

When you launch VirtualBench-Scope, it operates in continuous run mode. You can start acquiring signals with VirtualBench-Scope by completing the following steps:

1. Connect a signal to the Channel 0 input of your National Instruments DAQ device. Refer to the user manual of your DAQ device for details. For example, on a 68-pin MIO E-series device, connect a signal to pins 68 (ACH0) and 67 (AIGND) for a Referenced Single-Ended input.

2. Configure VirtualBench-Scope.

   a. Select **General Settings** from the **Edit** menu on the front panel.

   b. Select the National Instruments device you want to use from the **General** tab of the Settings dialog box, shown in Figure 2-2. If a device does not appear in the Device list, make sure you have properly configured the device using the NI-DAQ Configuration Utility.
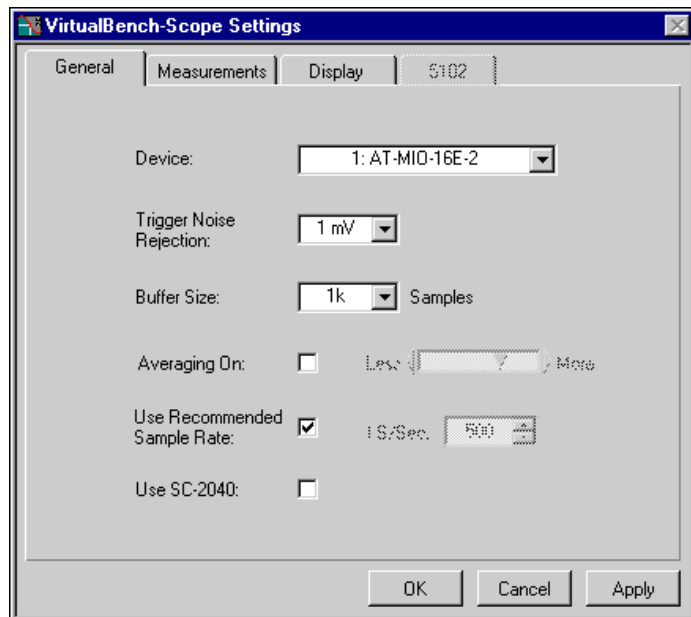
Figure 2-2. General Tab of VirtualBench-Scope Settings Dialog Box

   c. Click on **OK** to use these settings.

   d. Select **Channel Settings** from the **Edit** menu on the front panel. Figure 2-3 shows the Channel Settings dialog box.
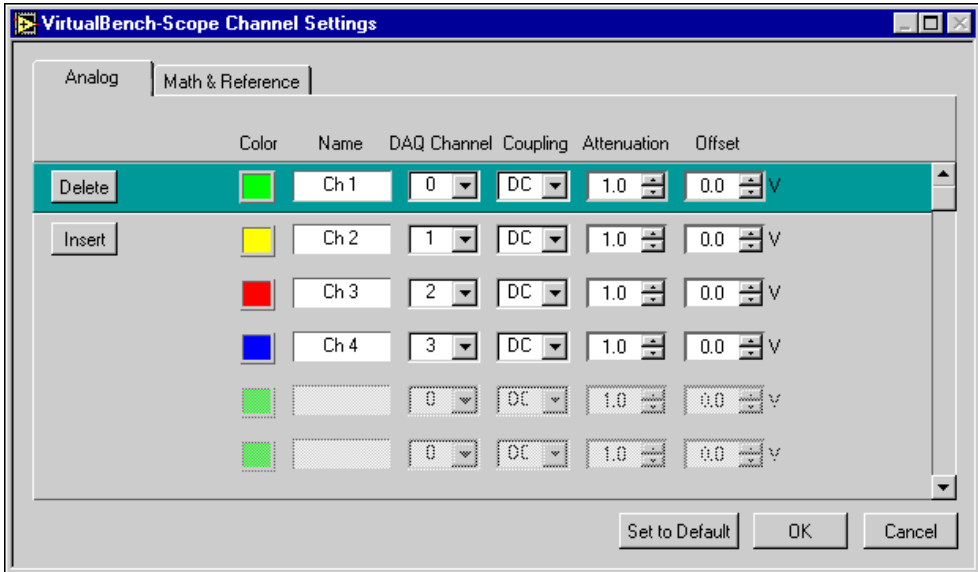
Figure 2-3. VirtualBench-Scope Channel Settings Dialog Box

   e. Click on **Set to Default**.

   f. Click on **OK** to use these settings.

  3. Save your settings by selecting **Edit»Save Settings** from the pull-down menu on the front panel. Enter the name of the file you want to save, such as `MyScope.set`.

☞ **Note:** *When you launch VirtualBench-Scope, it automatically uses the settings of your previous VirtualBench-Scope session.*

  4. Enable the **Ch 1** button in the Channel Selector group. Disable all other channels.

  5. Click on **AutoSetup** on the main control bar.

  6. Click on **Run** to stop the acquisition.

☞ **Note:** *Refer to the* VirtualBench-Scope Online Help *for additional help on configuring VirtualBench-Scope for your specific application.*
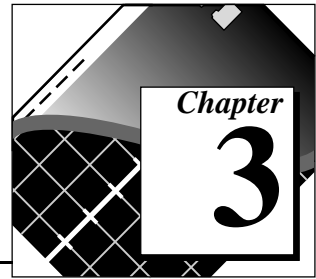
VirtualBench-DSA

This chapter explains the VirtualBench dynamic signal analyzer (DSA) front panel features and how to acquire and measure signals with the DSA.

Launching VirtualBench-DSA

You can launch VirtualBench-DSA by selecting **Start»Programs» VirtualBench»VirtualBench-DSA** or by clicking on the **DSA** button on the toolbar.

Front Panel Features

This section explains the features of the VirtualBench-DSA front panel, shown in Figure 3-1.
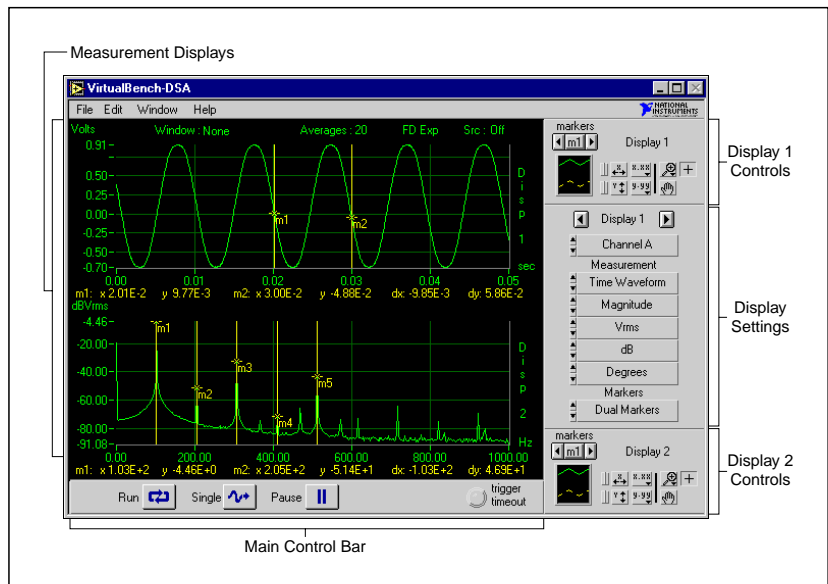
Figure 3-1. Front Panel of VirtualBench-DSA

The front panel of VirtualBench-DSA has the following features:

- **Display Settings Control**—provides individual control of the measurements VirtualBench-DSA performs on Display 1 and 2. You can switch between Display 1 and 2 by clicking on the left and right arrow buttons above the display settings control. You can select the channels, function, magnitude/phase mode, magnitude unit, log/linear mode, phase unit, and markers in this control. The *VirtualBench-DSA Online Help* includes detailed descriptions of each component.

- **Display 1/Display 2 Controls**—changes the marker positions and display attributes of the respective displays.

- **Main Control Bar Buttons**—contains the **Run**, **Single**, and **Pause** controls.

  - **Run**—acquires data continuously. Deselecting this button places VirtualBench-DSA in idle mode.

  - **Single**—acquires a single frame of data.

  - **Pause**—pauses the acquisition. Pausing does not clear the averaging buffers.

  - **Trigger Timeout**—turns yellow when a trigger does not occur within the time period the trigger timeout specifies in the Trigger Configuration dialog box.

- **Measurement Displays**—displays measurements, reference waveforms, and markers for marker measurements.

☞ **Note:** *Refer to the VirtualBench-DSA Online Help for additional help on the front panel items.*

Acquiring and Measuring Signals

You can start acquiring and measuring signals with VirtualBench-DSA by following these steps:

1. Connect a signal to the Channel 0 or 1 input of your DAQ device. Refer to the user manual of your DAQ device for details.

2. Configure the DSA.

    a. Select **Settings** from the **Edit** menu on the front panel.

    b. Select the Hardware tab from the DSA Settings dialog box, shown in Figure 3-2.
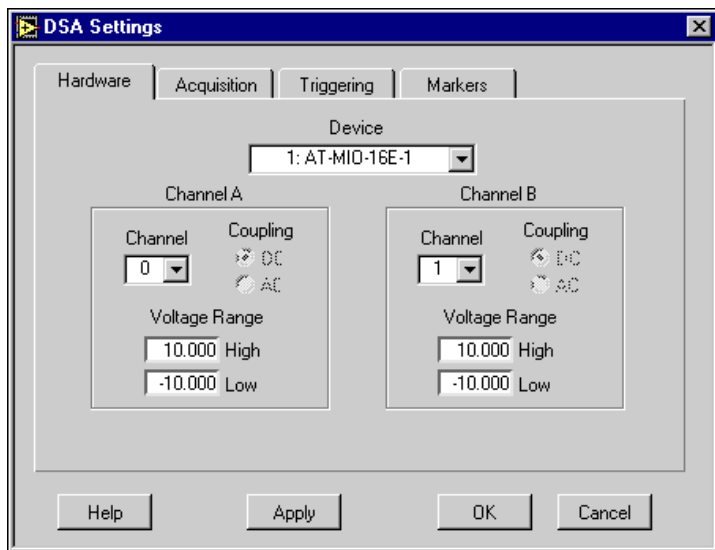
Figure 3-2. Hardware Tab of DSA Settings Dialog Box

    c. Select the device that you want to use for the data acquisition. The device must be successfully configured in the NI-DAQ Configuration Utility to appear in the Device list.

    d. Set Channel A or B to Channel 0 or 1, depending on where you connected the signal in step 1.

    e. Change the input Voltage Range to reflect the upper and lower limits of your signal (in volts).

f. Click on the Acquisition tab in the DSA Settings dialog box, shown in Figure 3-3.
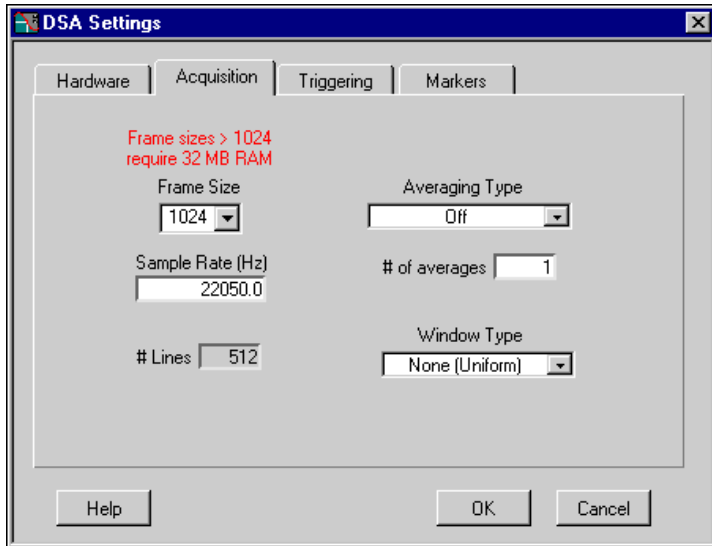
Figure 3-3. Acquisition Tab of DSA Settings Dialog Box

g. Set the Frame Size control to 1024 for VirtualBench-DSA to analyze data in blocks of 1024 points.

h. Select a Sample Rate that is at least twice the maximum frequency that you are trying to measure.

i. Select the Averaging Type as Off and Window Type as None (Uniform).

j. Click on the Triggering tab in the DSA Settings dialog box, shown in Figure 3-4.
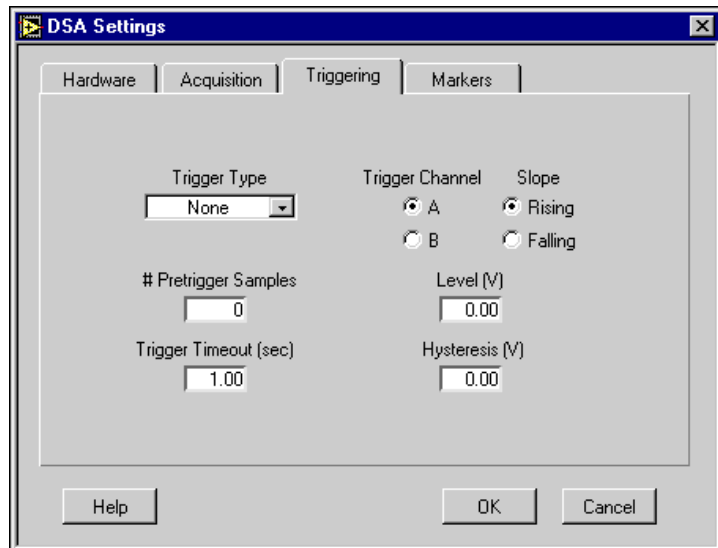
Figure 3-4. Triggering Tab of DSA Settings Dialog Box

k. Set the Trigger Type to none. This setting puts the acquisition in free-run mode.

l. Click on **OK**.

3. Use the left or right arrow buttons to change the display indicator to Display 1 in the display settings control.

4. Select Channel A or B (depending on where you connected your signal) in the channel selector of the display settings control.

5. On the front panel, select Time Waveform in the function selector of the display settings control. Set the mode to magnitude, the units to vrms, and the scale to linear.

6. Select Markers Off in the Markers section.

7. Use the left or right arrow buttons to change the display indicator to Display 2 in the Display Settings control.

8. Set the Channel Selector to the same channel you used in step 4.

9. On the front panel, select Pwr Spectrum. Set the mode to magnitude, the units to vrms, and the scale to dB.

10. Click on the **Single** button. VirtualBench-DSA displays a single frame of data. The Time Waveform is on Display 1, and the Power Spectrum on Display 2. If no data is visible, click on the Autoscale Y Axis button (the button with the y and up/down arrows) in the display control. Check your signal connections if data is still not visible.

11. Click on **Run**. VirtualBench-DSA continuously acquires and displays frames of data.

12. Click on **Run** again to stop acquisition.

☞ **Note:** *Refer to the VirtualBench-DSA Online Help for additional help on configuring VirtualBench-DSA for your specific application.*

VirtualBench-Logger
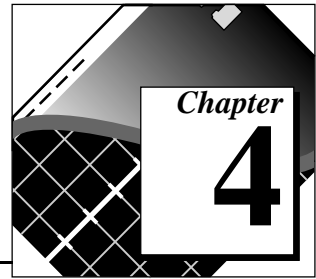
This chapter explains the VirtualBench-Logger front panel features and how to acquire data with the logger.

Launching VirtualBench-Logger

You can launch VirtualBench-Logger by selecting **Start»Programs» VirtualBench»VirtualBench-Logger** or by clicking on the **Logger** button on the VirtualBench toolbar.

Front Panel Features

This section explains the features of the VirtualBench-Logger front panel, shown in Figure 4-1.
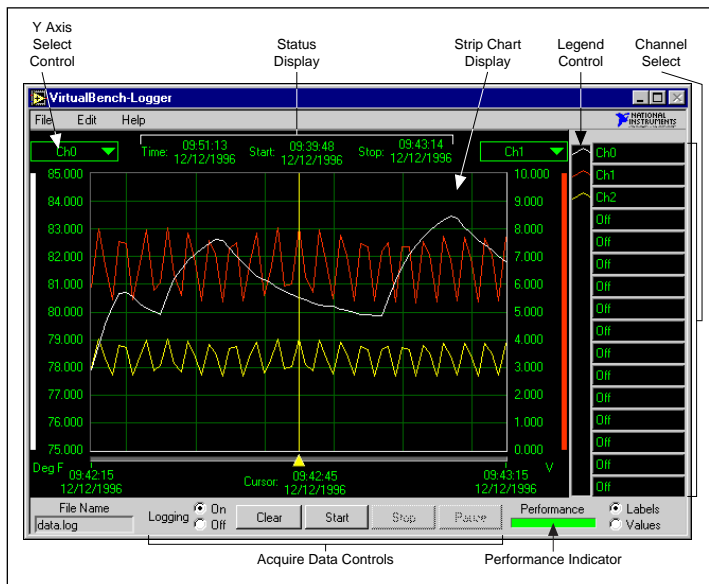
Figure 4-1. Front Panel of VirtualBench-Logger

The front panel of VirtualBench-Logger has the following features:

- **Strip Chart Display**—displays the logged data.
- **Y Axis Select Controls**—selects which channel's Y scale to display on either the left or right Y axis of the strip chart display.
- **Status Display**—shows the current time, start time, and stop time of the current data acquisition.
- **Channel Select Control**—selects which channels to display on the strip chart display. You can use the Labels/Values radio buttons below the channel select control to switch between the channel labels and the channel values.
- **Legend Control**—changes the trace attributes of each display channel. Clicking on a trace in the legend control brings up a menu that allows you to make changes to the point style, line style, interpolation method, and color of the trace.
- **Acquire Data Controls**
  - **Logging On/Off**—starts or stops logging of data to disk when you run the instruments.
  - **Clear Chart**—clears the strip chart display. Clicking on this button does not affect the acquisition of data.
  - **Start**—starts the acquisition of data using the current logger configuration.
  - **Stop**—stops the acquisition of data and data logging when enabled.
  - **Pause**—temporarily stops the flow of data to the strip chart and log file when enabled.
- **Performance Indicator**—shows how efficiently VirtualBench-Logger runs when acquiring data. You should strive to keep VirtualBench-Logger running as efficiently as possible. As the performance decreases, the indicator turns red to indicate poor performance. When the performance reaches zero, an error message pops up, and the Logger stops collecting data.

☞ **Note:**   *Refer to the VirtualBench-Logger Online Help **for additional help on the front panel items.***

Acquiring Data

You can start acquiring data with VirtualBench-Logger by following
these steps:

1. Connect several known voltage signals to the input channels
   of your DAQ device. Refer to the user manual of your DAQ
   device for details. National Instruments recommends that
   you use known reference signals to verify proper operation
   of VirtualBench-Logger and your DAQ device.

2. Configure VirtualBench-Logger.

   a. Select **Settings** from the **Edit** menu on the front panel.

   b. Select the device and SCXI Module that you want to use
      in the Logger Settings dialog box, shown in Figure 4-2.
      VirtualBench-Logger disables the SCXI Module list when
      no SCXI modules are configured for the selected device.
      If a device does not appear in the Device list, make sure
      you have properly configured the device in the NI-DAQ
      Configuration Utility.

Figure 4-2. Logger Settings Dialog Box

☞   **Note:**   *The options on the Logger Settings dialog box vary slightly if you use a*
4350 Series board. Refer to the VirtualBench-Logger Online Help for more
information.

    c.   Set the Start and End Channel appropriately for the channels
that you connected signals to in step 1.

    d.   Set the channel attributes for each channel from the Start
Channel to the End Channel. Give each channel an appropriate
label for easy identification on the strip chart display.

    e.   Click on the **File Config…** button. In the File Configuration
dialog box, shown in Figure 4-3, specify the name of the log
file where VirtualBench-Logger stores the logged data on disk.
Specify the location of this file by using the **Browse** button.
Select **Enable Logging** and **Begin Logging on Start**. Click
on **OK**.

☞   **Note:**   *If you have not previously specified a log file, VirtualBench-Logger*
automatically calls a File dialog box.
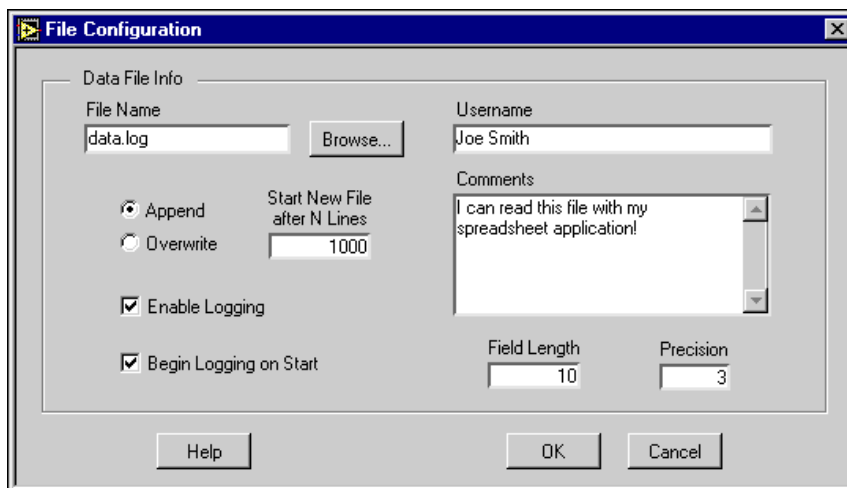
Figure 4-3. File Configuration Dialog Box

    f.   Click on the **Timing Config** button. In the Timing
Configuration dialog box, shown in Figure 4-4, set the Start
Timing and Stop Timing to start and stop manually. Set the
Time Interval to 1.00 seconds. Set the Display Length to

1 minute. Set Log to Disk Every *n* Time Intervals to 1. Click on **OK**.
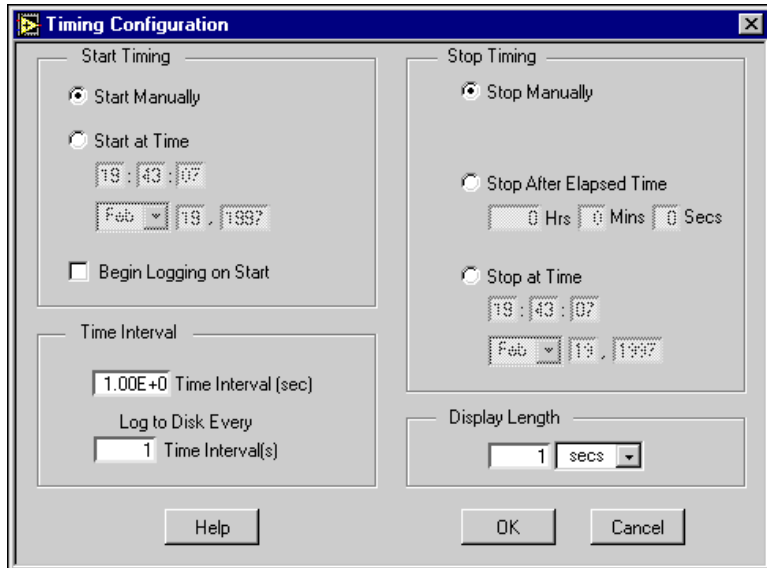
Figure 4-4. Timing Configuration Dialog Box

    g.   Click on **OK** in the Logger Settings dialog box to return to the front panel.

3.   Select the channels that you want to display on the strip chart using the channel select control.

4.   Use the right and left Y axis Controls to select which channel's Y scales to display on the strip chart.

5.   Click on **Start** in the acquire data controls area. VirtualBench-Logger begins acquiring and logging data to disk at one-second intervals and displays it on the strip chart. If no data appears, check the signal connections to your DAQ device or check the Range limits for the channels you selected in the Logger Settings dialog box.

6.   Click on the **Stop** button to stop the acquisition.

☞   **Note:**   *Refer to the VirtualBench-Logger Online Help for additional help on configuring VirtualBench-Logger for your specific application.*

VirtualBench-FG
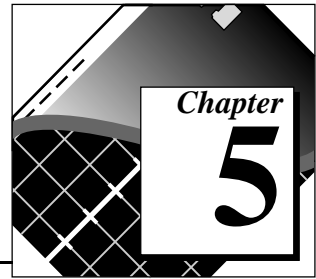
This chapter explains the VirtualBench function generator (FG) front panel features and how to generate a waveform.

Launching VirtualBench-FG

You can launch VirtualBench-FG by selecting **Start»Programs» VirtualBench»VirtualBench-FG** or by clicking on the **FG** button on the VirtualBench toolbar.

Front Panel Features

This section explains the features of the VirtualBench-FG front panel, shown in Figure 5-1.
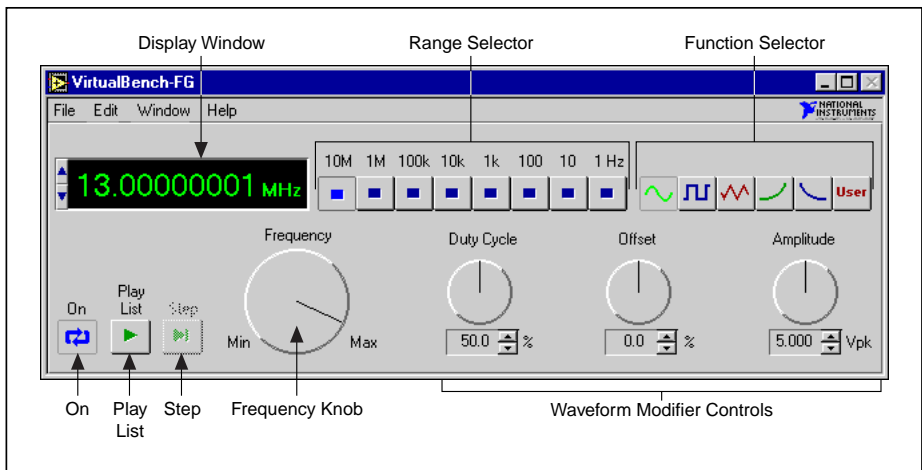
Figure 5-1. Front Panel of VirtualBench-FG

The front panel of VirtualBench-FG has the following features:

*   **Display Window**—shows the actual waveform frequency VirtualBench-FG generates.

*   **Range Selector**—selects the frequency range of VirtualBench-FG.

*   **Function Selector**—selects which type of waveform VirtualBench-FG generates.

*   **Frequency Knob**—controls the frequency of the waveform within the range range selector specifies.

*   **Waveform Modifier Controls**—modifies some of the properties of the waveform.

    –   **Duty Cycle**—adjusts the duty cycles of the sine wave, square wave, and triangle wave.

    –   **Offset**—adjusts the DC offset of the waveform.

    –   **Amplitude**—adjusts the peak amplitude of the generated waveform.

*   **On**—starts or stops waveform generation.

*   **Play List**—outputs waveforms as specified in the frequency list. The **Play List** button appears only with 5411 devices.

*   **Step**—steps through the frequency list. The **Step** button appears only with 5411 devices.

Note: *Refer to the* VirtualBench-FG Online Help *for additional help on the front panel items.*

Generating a Waveform

You can configure VirtualBench-FG to generate a waveform by performing the following steps.

1. Configure the output.

    a. Select **Settings** from the **Edit** menu on the front panel**.**

    b. Select the device that you want to use for waveform generation in the VirtualBench-FG Settings dialog box, shown in Figure 5-2. The device must be successfully configured in the NI-DAQ Configuration Utility to appear in the Device list.
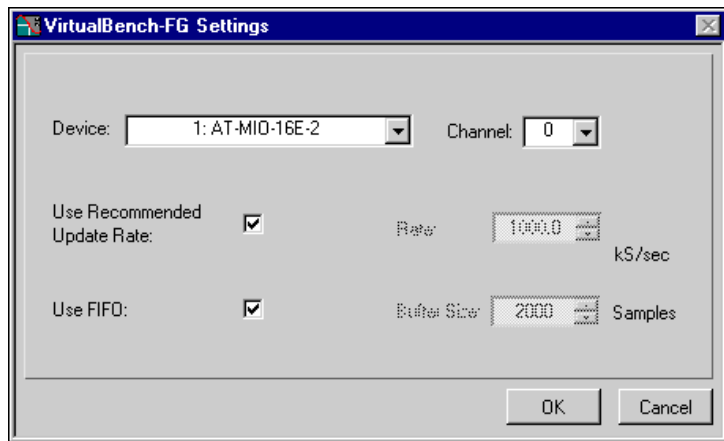
Figure 5-2. VirtualBench-FG Settings Dialog Box

    c. Set the Channel to 0 or 1.

    d. Click on **OK**.

2. Connect a device or scope to the output of the analog output device that you specified in step 1. Refer to your DAQ device user manual for details.

3. Click on **Run**. VirtualBench-FG continuously generates an analog waveform at the output pin.

4. Click on **Run** again to stop the waveform generation.

☞ **Note:** *Refer to the VirtualBench-FG Online Help **for additional help on configuring VirtualBench-FG for your specific application.***

VirtualBench-DMM
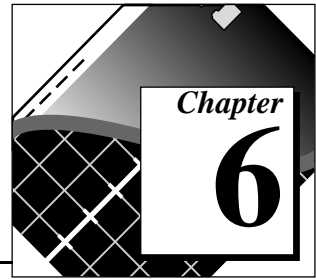
Chapter
6

This chapter explains the VirtualBench digital multimeter (DMM) and how to measure a signal with the DMM.

Launching VirtualBench-DMM

You can launch VirtualBench-DMM by selecting **Start»Programs» VirtualBench»VirtualBench-DMM** or by clicking on the **DMM** button on the VirtualBench toolbar.

Front Panel Features

This section explains the features of the VirtualBench-DMM front panel, shown in Figure 6-1.
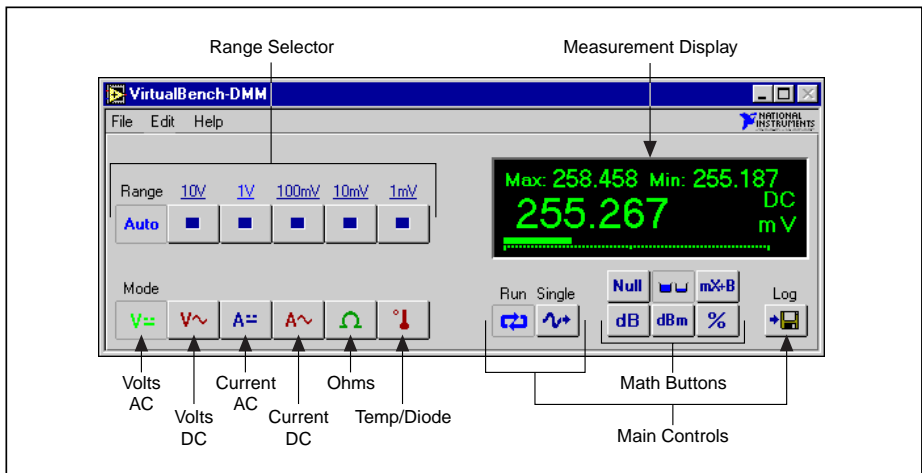
Figure 6-1. Front Panel of VirtualBench-DMM

The front panel of VirtualBench-DMM has the following features:

- **Measurement Display**—displays measurements.
- **Mode Selector**—selects which measurement mode you want to use. The modes, from left to right, are as follows:
  - **Volts AC**—measures the AC component of a voltage signal.
  - **Volts DC**—measures the DC component of a voltage signal.
  - **Current AC**—measures the AC component of a current source.
  - **Current DC**—measures the DC component of a current source.
  - **Ohms**—measures resistance.
  - **Temperature/Diode**—measures temperature and measures the voltage drop across a diode.

☞ **Note:** *Diode mode is available only when you are using the DAQCard-4050. Otherwise, only temperature mode is available.*

- **Range Selector**—determines the measurement range. This range is different for each measurement mode. AutoRange mode selects the best range to fit the input signal.
- **Main Control Buttons**
  - **Run**—starts or stops the DMM acquisition.
  - **Single**—acquires a single measurement.
  - **Log**—enables logging.
- **Math Control Buttons**
  - **Null**—selects relative mode. When you click on this button, all subsequent measurements become relative to the measurement made when this button was pressed.
  - **Max/Min**—displays the maximum and minimum values since you first clicked on the button.
  - **mX+B**—manipulates normal display readings (X) according to the calculation mX+B.
  - **dB**—displays the decibel value of your signal.
  - **dBm**—displays the decibel power level with respect to one mW.
  - **%**—displays the current value as a percentage of a reference.

☞ **Note:** *Refer to the* VirtualBench-DMM Online Help *for additional help on the front panel items.*

Measuring a Signal

You can start measuring signals with VirtualBench-DMM by following these steps:

1. Configure VirtualBench-DMM.

    a. Select **Settings** from the **Edit** menu on the front panel.

    b. Select the General tab, shown in Figure 6-2.
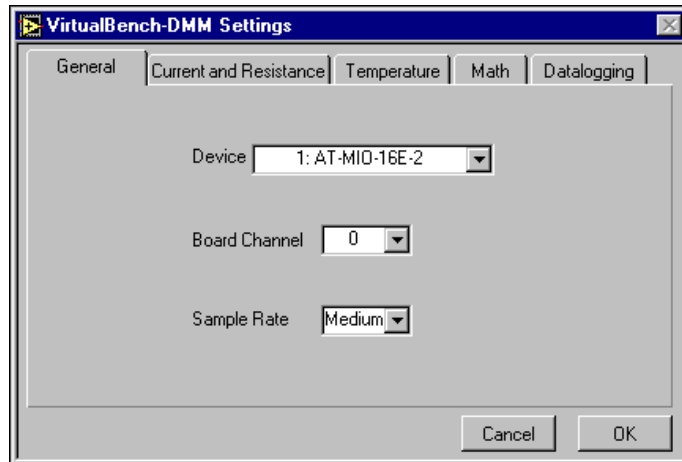
Figure 6-2. General Tab of VirtualBench-DMM Settings Dialog Box

    c. Select the Device and SCXI Module that you want to use. VirtualBench-DMM disables the SCXI Module list when no SCXI modules are configured for the selected device. If a device does not appear in the Device list, make sure you have properly configured the device in the NI-DAQ Configuration Utility.

    d. Set the channel to the source of your signal.

    e. Set the Sample Rate to Medium.

    f. Click on **OK**.

2. Measure voltage. VirtualBench-DMM measures AC and DC voltage without any external hardware.

    a. Connect a signal (AC or DC) to the Channel input that you specified in step 1. Refer to the user manual of your DAQ device for details.

   b.   Click on the **Volts AC** or **Volts DC** button in the Mode selector, depending on which type of voltage you connected in step 2a. VirtualBench-DMM continuously acquires and displays voltage measurements in the display window.

   c.   If the DMM display shows +CLIP or -CLIP, confirm that the input signal does not exceed the range of your DAQ device and that the input signal does not exceed the selected range.

   d.   Click on **Run** to stop the measurement.

3.   Measure current. VirtualBench-DMM requires a precision external shunt resistor to measure current.

   a.   Connect a precision shunt resistor across the input of the Channel that you specified in step 1. Refer to the user manual of your DAQ device for details.

   b.   Connect your current signal to the same terminals.

   c.   Select **Settings** from the **Edit** menu on the front panel.

   d.   Select the Current and Resistance tab, shown in Figure 6-3.

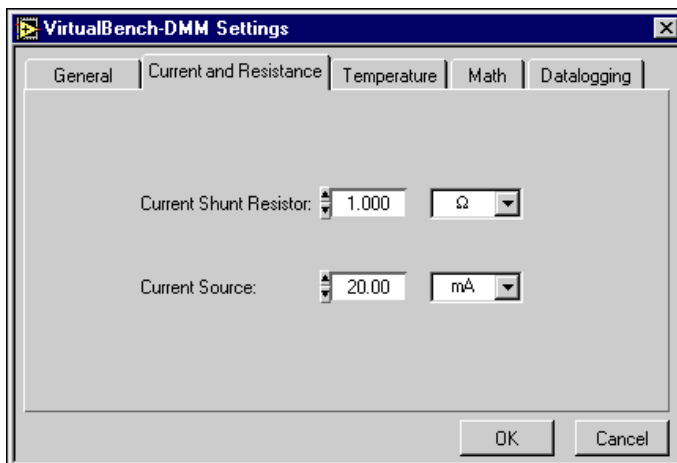**Figure 6-3.** Current and Resistance Tab of VirtualBench-DMM Settings Dialog Box

   e.   Enter the value of the shunt resistor that you placed across the channel specified in step 1.

   f.   Click on **OK**.

   g.   Click on the **Current AC** or **Current DC** button in the Mode selector, depending on which type of voltage you connected in step 3b.

   h.   Click on **Run**. VirtualBench-DMM continuously acquires and displays current measurements in the display window.

   i.   If the DMM display shows +CLIP or -CLIP, confirm that the input signal does not exceed the range of your DAQ device and that the input signal does not exceed the selected range.

   j.   Click on **Run** again to stop the measurement.

4.   Measure resistance. If you are not using a DAQCard-4050 device, VirtualBench-DMM requires a precision external current source to measure resistance.

   a.   If you are not using the DAQCard-4050, go to step 4b. If you are using a DAQCard-4050, connect the resistor you want to measure to the terminals of the device and go to step 4g.

   b.   Connect a precision current source to the channel that you specified in step 1. Refer to the user manual of your DAQ device for details.

   c.   Connect the resistor you want to measure across the same terminals.

   d.   Select **Settings** from the **Edit** menu on the front panel.

   e.   Select the Current and Resistance tab.

   f.   Enter the value of the current source that you placed at the Channel specified in step 1.

   g.   Click on **OK**.

   h.   Click on the **Ohms** button in the Mode selector.

   i.   Click on **Run**. VirtualBench-DMM continuously acquires and displays resistance measurements in the display window.

   j.   If the DMM display shows +CLIP or -CLIP, confirm that the input signal does not exceed the range of your DAQ device and that the input signal does not exceed the selected range.

   k.   Click on **Run** again to stop the measurement.

5.   Measure temperature. VirtualBench-DMM requires a thermistor, IC sensor, or thermocouple to make precise temperature measurements. If you are using a DAQCard-4050, you cannot use VirtualBench-DMM to make temperature measurements.

   a.   Connect a precision temperature sensor to the channel that you specified in step 1. Refer to the user manual of your DAQ device for details.

   b.   Select **Settings** from the **Edit** menu on the front panel.

c.   Select the Temperature tab, shown in Figure 6-4.
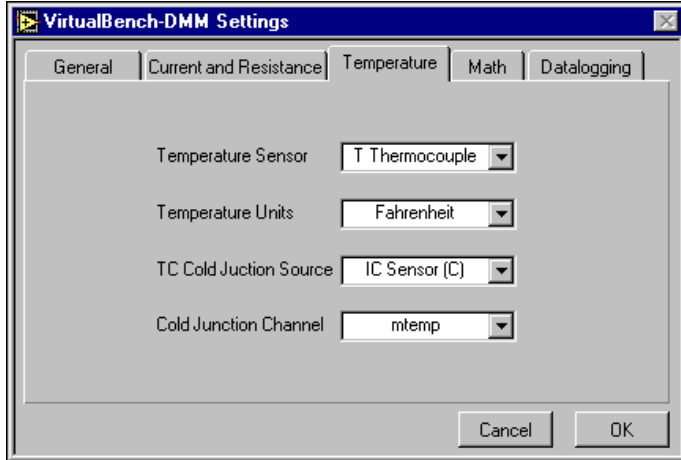
Figure 6-4. Temperature Tab of VirtualBench-DMM Settings Dialog Box

d.   Select the type of sensor from the Temperature Sensor list that you connected to the channel specified in step 1a.

e.   Select the Temperature Units you want the temperature to display.

f.   Select the cold junction sensor type from the TC Cold Junction Source list when you use a thermocouple. Select the channel to which the cold junction sensor is connected.

g.   Click on **OK**.

h.   Click on the **Temp/Diod**e button in the Mode selector.

i.   Click on **Run**. VirtualBench-DMM continuously acquires and displays temperature measurements in the display window.

j.   If the DMM display shows +CLIP or -CLIP, confirm that the input signal does not exceed the range of your DAQ device and that the input signal does not exceed the selected range.

k.   Click on **Run** again to stop the measurement.

6. Measure a diode. If you are using a DAQCard-4050 device, you can measure the voltage drop across a diode, up to two volts.

    a. Connect the diode to the terminals of the DAQCard-4050.

    b. Click on the **Temp/Diode** button in the Mode selector.

    c. Click on **Run**.

    d. Click on **Run** again to stop the measurement.

☞ **Note:**   *Refer to the VirtualBench-DMM Online Help for additional help on configuring VirtualBench-DMM for your specific application.*

VirtualBench-Arb

Chapter
7

This chapter explains the VirtualBench arbitrary Waveform Generator front panel features, the Waveform Editor front panel features, and how to generate a waveform.

Launching VirtualBench-Arb

You can launch VirtualBench-Arb, which contains the Waveform Generator and Waveform Editor, by selecting **Start»Programs» VirtualBench»VirtualBench-Arb** or by clicking on the **Arb** button on the VirtualBench toolbar.

Waveform Generator Front Panel Features

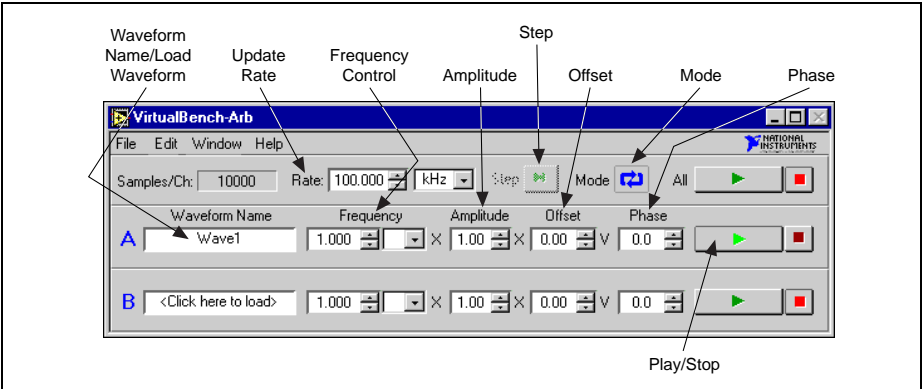This section explains the features of the VirtualBench-Arb Waveform Generator front panel, shown in Figure 7-1.

Figure 7-1. Front Panel of VirtualBench-Arb Waveform Generator

The key features of the Waveform Generator front panel of
VirtualBench-Arb are:

- **Waveform Name/Load Waveform Control**—shows the name of
  the waveform file, if any, for VirtualBench-Arb to generate. Select
  this window to load a waveform from a file.

- **Mode**—plays the waveform continuously. Deselecting this button
  plays the waveform only once.

- **Update Rate**—controls the update rate of the waveform. This
  control does not affect the play speed of waveform files (`.wfm`) but
  does affect waveform quality. With text, binary, and sound (`.wav`)
  files, the update rate determines the play speed by controlling the
  number of samples of the waveform that VirtualBench-Arb plays
  per second.

- **Frequency Control**—modifies the rate at which VirtualBench-Arb
  plays waveform files (`.wfm`). VirtualBench-Arb multiplies the
  waveform rate by this value to determine the actual play speed.
  This control does not affect text, binary, and sound (`.wav`) files.

- **Amplitude Control**—scales the waveform by the specified
  amount.

- **Step**—steps through the stages in a waveform sequence.
  VirtualBench-Arb enables this button only for 5411 devices.

- **Offset Control**—adds a voltage offset to the waveform.

- **Phase Control**—shifts the waveform buffer by a certain phase,
  specified in degrees.

- **Play/Stop Control**—starts or stops waveform generation for one
  channel.

Waveform Editor Front Panel Features

This section explains the features of the VirtualBench-Arb Waveform Editor front panel, shown in Figure 7-2.
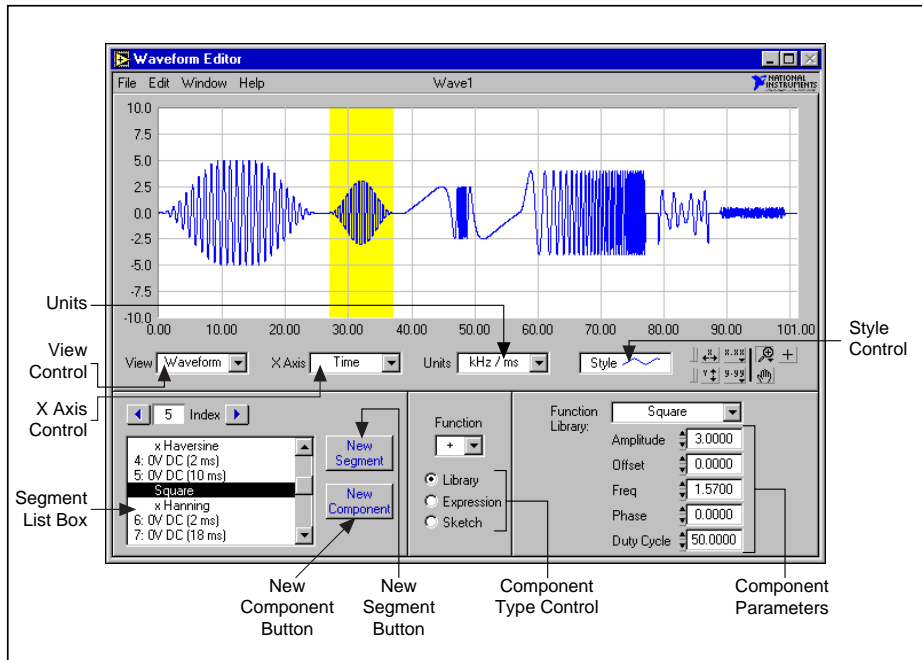
Figure 7-2. Front Panel of VirtualBench-Arb Waveform Editor

The Waveform Editor front panel of VirtualBench-Arb has the following features:

- **View Control**—selects the waveform view to display on the graph. **Waveform** displays the entire waveform. **Segment** displays the selected segment. **Component** displays the selected component.

- **X Axis Control**—selects the X axis units. **Time** displays the waveform as a function of time. **Frequency** displays the power spectrum of the waveform.

- **Units Control**—selects the active units you are currently using for the display and control values.

- **Style Control**—changes the graph attributes.

- **Segment List Box Control**—selects the segment or component you want to edit. A number precedes a segment and indicates a unique

section of the waveform. The value in parentheses indicates the segment length. Indented text in the list box represents a waveform component.

- • **New Segment Button**—inserts a new waveform segment immediately after the current selection.

- • **New Component Button**—inserts a new component immediately after the current selection.

- • **Component Type Control**—selects the type of component. A waveform Library function is one of 20 predefined waveform patterns. An Expression is a single-variable function evaluated over an interval. A Sketch is a waveform you draw with a mouse.

☞ **Note:**   *Refer to the* VirtualBench-Arb Online Help *for additional help on the front panel items.*

Generating a Waveform

You can start generating waveforms with VirtualBench-Arb by following these steps:

1. Configure VirtualBench-Arb.

   a. Select **Settings** from the **Edit** menu on the front panel.

   b. Select the Channels tab, shown in Figure 7-3.
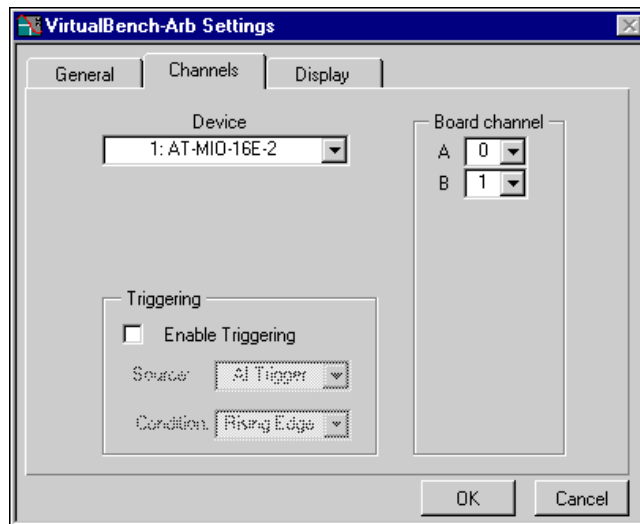

Figure 7-3. Channels Tab of VirtualBench-Arb Settings Dialog Box

    c.   Select the device that you want to use for waveform generation. To appear in the Device list, the device must be successfully configured in the NI-DAQ Configuration Utility.

    d.   Select the corresponding DAQ device channels to map to the VirtualBench-Arb alphabetical channel names.

    e.   Click on **OK**.

2.   Create a new waveform.

    a.   Select **Window»Waveform Editor**.

    b.   Enter the duration of the waveform in the Duration control to set the duration of the first segment.

    c.   Click on **New Component**. By default, every time you click on **New Component**, VirtualBench-Arb adds a new library component to any existing waveform.

    d.   Select the type of component: Library, Expression, or Sketch. The following steps further describe how to use these options.

3.   Create a waveform using the library functions.

    a.   Confirm that you selected **Library** in the Component Type control.

    b.   Select a waveform from the library and modify the parameters if necessary.

    c.   Click on **New Component** again to add a new component. This component adds to the first to produce the final segment. Change the Function selector to perform subtraction, multiplication, division, or frequency modulation.

    d.   Click on **New Segment** to add additional waveform segments to the end of the waveform.

4.   Create a waveform from a mathematical expression.

    a.   Create a new segment by clicking on **New Segment**.

    b.   Create a new component in the segment by clicking on **New Component**.

    c.   Select **Expression** from the component type control.

    d.   Enter an expression in terms of variable x in the **f(x)=** box. VirtualBench-Arb indicates any error in red, with the character position of the error in parentheses.

      e.   Enter the range for x in the From: and To: input boxes. VirtualBench-Arb evaluates the expression over this range.

      f.   You can change the number of cycles of the waveform by changing the **Cycles** control.

5.   Create a waveform from a freehand sketch.

      a.   Create a new segment by clicking on **New Segment**.

      b.   Create a new component in the segment by clicking on **New Component**.

      c.   Select **Sketch** from the component type control.

      d.   Click on **Draw**. Notice that this changes from **View** to **Component** mode so that VirtualBench-Arb displays only the current component.

      e.   Click and drag over the graph using the mouse to create a waveform. Change the mode to line by clicking on the **Mode** button. This mode allows you to draw straight lines.

      f.   Click on **Draw** again to finish editing.

6.   Save your waveform by selecting **File»Save**.

7.   Close the Waveform Editor front panel.

8.   In the front panel of the Waveform Generator, click on the Waveform Name/Load Waveform control to bring up the file dialog box. Select the waveform file that you saved in step 6.

9.   Adjust the Rate control to an appropriate update rate. Select a rate that is at least twice the maximum frequency component of your signal.

10. Click on the **Play** button (the button containing a green triangle) to begin waveform generation.

11. Click on the **Stop** button (the button containing a red square) to end signal generation.

    Note: ***Refer to the*** *VirtualBench-Arb Online Help* ***for additional help on configuring VirtualBench-Arb for your specific application.***

VirtualBench-DIO

This chapter explains the VirtualBench digital input/output controller (DIO) and how to read from and write to digital ports.

Launching VirtualBench-DIO

You can launch VirtualBench-DIO by selecting **Start»Programs» VirtualBench»VirtualBench DIO** or by clicking on the **DIO** button on the VirtualBench toolbar.

Front Panel Features

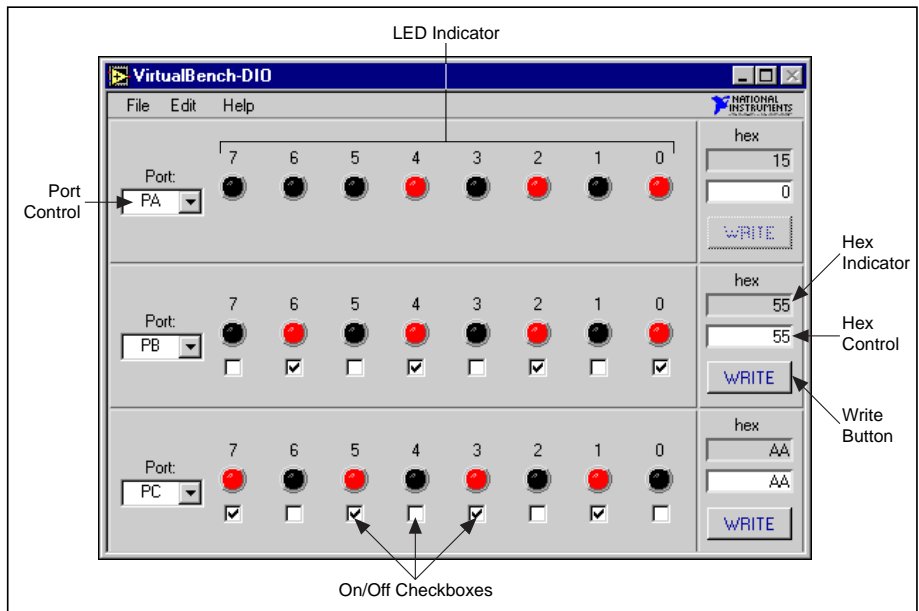This section explains the features of the VirtualBench-DIO front panel, shown in Figure 8-1.

Figure 8-1. Front Panel of VirtualBench-DIO

The front panel of VirtualBench-DIO has the following features:

- **Port Control**—allows you to independently assign the selected digital port control group to any of your device digital ports.

- **LED Indicator**— shows the current state of the assigned digital port.

- **On/Off Checkboxes**—sets the digital state of the assigned digital port. VirtualBench-DIO does not change the state of the digital port until you click on the **Write** button. These checkboxes appear only for ports or lines configured for output.

- **Hex Control**—sets the digital state, in hexadecimal form, of the assigned digital port. VirtualBench-DIO does not change the state of the digital port until you click on the **Write** button.

- **Hex Indicator**—shows the current state, in hexadecimal form, of the assigned digital port.

- **Write Button**—sets the assigned digital port to the state shown on the On/Off checkboxes or Hex control. VirtualBench-DIO disables the **Write** button if the digital port is configured for read mode.

Note: *Refer to the VirtualBench-DIO Online Help for additional help on the front panel items.*

Reading from and Writing to Digital Ports

You can start reading from and writing to the digital ports of your National Instruments device with VirtualBench-DIO by following these steps:

1. Configure VirtualBench-DIO.

    a. Select **Settings** from the **Edit** menu on the front panel.

    b. Click on the **General** tab in the DIO Settings dialog box, shown in Figure 8-2.
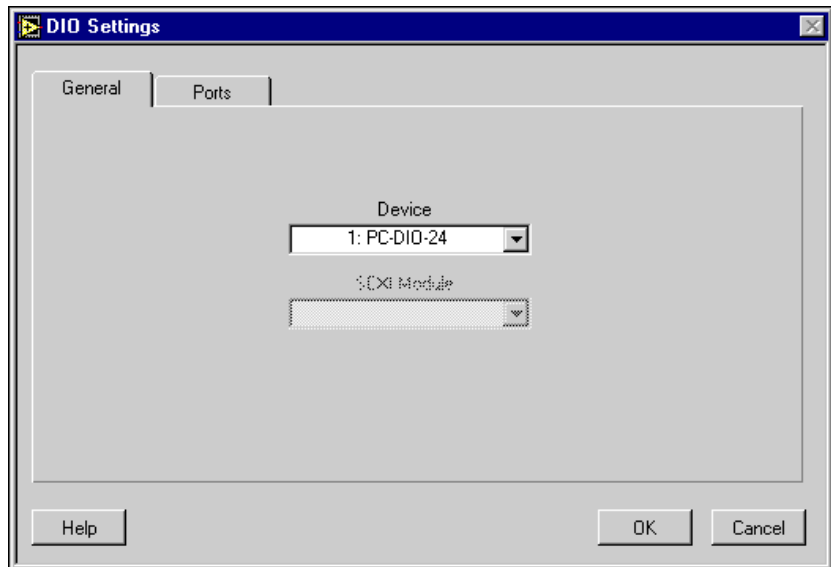

Figure 8-2. General Tab of DIO Settings Dialog Box

    c. Select the device and SCXI Module that you want to use. VirtualBench-DIO disables the SCXI Module list if no SCXI modules are configured for the selected device. The device must be successfully configured in the NI-DAQ Configuration Utility to appear in this list.

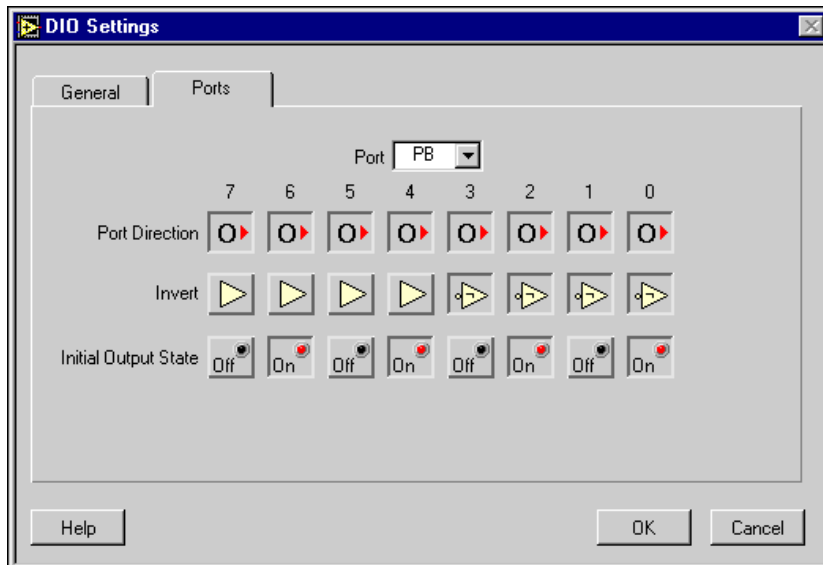   d.   Click on the **Ports** tab in the DIO Settings dialog box, shown
        in Figure 8-3.

Figure 8-3. Ports Tab of DIO Settings Dialog Box

   e.   Select the preferred Port Direction, Inversion, and Initial
        Output State for every port in the Port list.

   f.   Click on **OK** to use these settings.

2. Use the Port control to assign a digital port from your DAQ device
   to that particular port control group.

3. Change the output state of a particular port by selecting or
   deselecting the **On/Off** checkboxes or Hex control to the preferred
   state and finally clicking on the **Write** button to change the port to
   the new state.

4. Read the states displayed on the LEDs. If you configured the port
   as input, no additional settings are needed.

☞ **Note:**   *Refer to the* VirtualBench-DIO Online Help *for additional help on
                 configuring VirtualBench-DIO for your specific application.*

VirtualBench-AODC

This chapter explains the VirtualBench DC analog output controller (AODC) front panel features and how to control analog output.

Launching VirtualBench-AODC

You can launch VirtualBench-AODC by selecting **Start»Programs» VirtualBench»VirtualBench AODC** or by clicking on the AODC button on the VirtualBench toolbar.

Front Panel Features

This section explains the features of the VirtualBench-AODC front panel, shown in Figure 9-1.
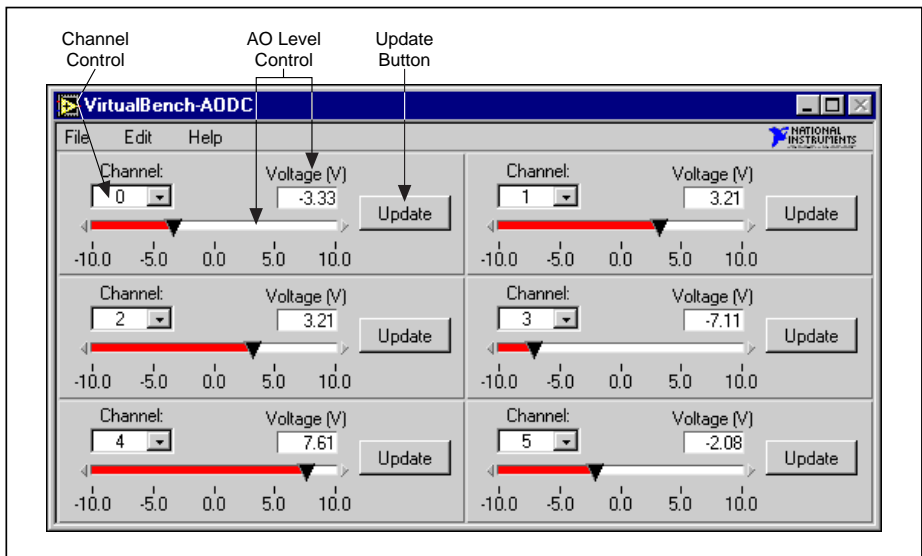

Figure 9-1. Front Panel of VirtualBench-AODC

The front panel of VirtualBench-AODC has the following features:

- **Channel Control**—allows you to independently assign the selected analog output control to any of your device's analog output channels.

- **AO Level Control**—manipulates the analog output level of the assigned analog output channel. VirtualBench-AODC does not change the analog output channel until you click on the **Update** button.

- **Update Button**—updates the channel selected in the **Channel** control to the voltage/current specified in the **AO Level** control.

☞ **Note:** *Refer to the VirtualBench-AODC Online Help for additional help on the front panel items.*

Controlling Analog Output

You can start controlling analog output with VirtualBench-AODC by following these steps:

1. Configure VirtualBench-AODC.

   a. Select **Settings** from the **Edit** menu on the front panel.

   b. Click on the General tab in the AODC Settings dialog box shown in Figure 9-2.

Figure 9-2. General Tab of AODC Settings Dialog Box

c. Select the device and SCXI Module that you want to use. VirtualBench-AODC disables the SCXI Module list if no SCXI modules are configured for the selected device. The device must be successfully configured in the NI-DAQ Configuration Utility to appear in the Device list.

d. Click on the AO Channels tab on the AODC Settings dialog box, shown in Figure 9-3.
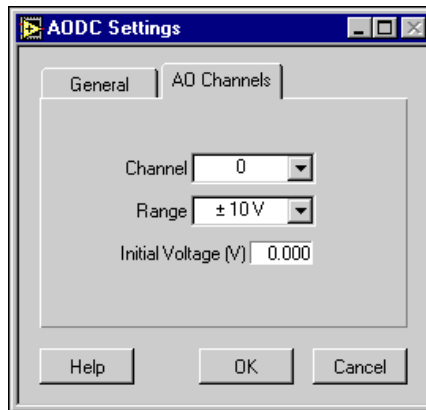
Figure 9-3. Channels Tab of AODC Settings Dialog Box

e. Select the Range and Initial Voltage (V) or Current (mA) for each channel in the Channel list.

f. Click on **OK** to use these settings.

2. Use the Channel control to assign an analog output channel from your DAQ device to that particular AO Level control.

3. Use the slider or digital controls in the AO Level control to set the output level.

4. Click on **Update** to update the analog output channel with the new value you specified in AO Level control.

☞ **Note:** *Refer to the VirtualBench-AODC Online Help **for additional help on configuring VirtualBench-AODC for your specific application.***

VirtualBench-
Device Calibrator
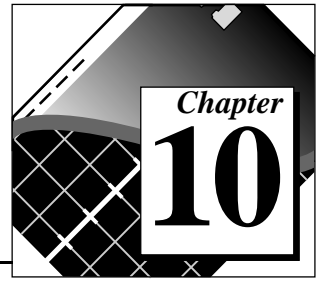
This chapter explains the VirtualBench-Device Calibrator front panel features and how to calibrate a DAQ device.

Launching VirtualBench-Device Calibrator

You can launch the VirtualBench-Device Calibrator by selecting **Start»Programs»VirtualBench»VirtualBench Cal** or by clicking on the **Cal** button on the VirtualBench toolbar.

Front Panel Features

This section explains the front panel features of the VirtualBench-Device Calibrator, shown in Figure 10-1.
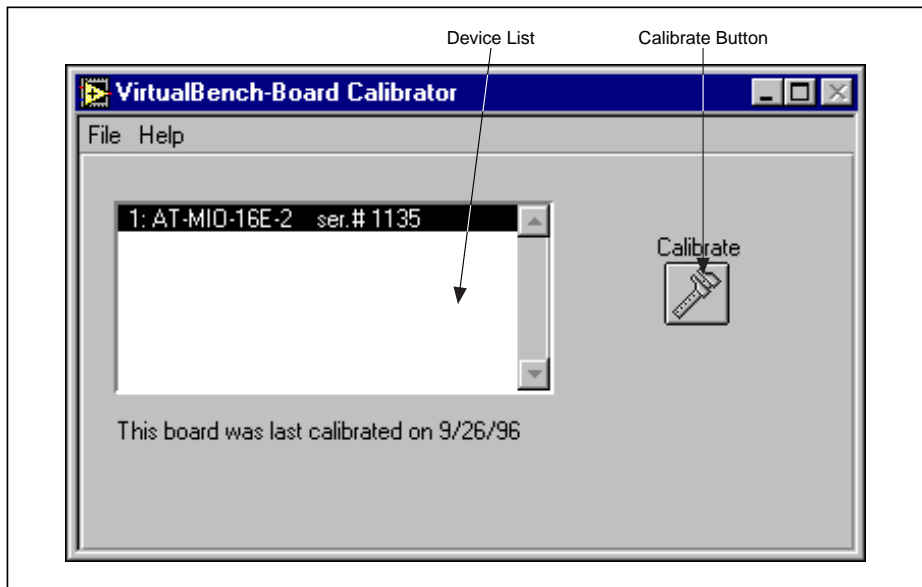

Figure 10-1. Front Panel of VirtualBench-Device Calibrator

The front panel of the VirtualBench-Device Calibrator has the following features:

- **Device List**—shows all the devices installed in your computer that are self-calibrating and the last calibrated date. The device must be successfully configured in the NI-DAQ Configuration Utility to appear in this list.

- **Calibrate Button**—begins the calibration process.

You can use the VirtualBench-Device Calibrator to calibrate the analog input circuitry of the following DAQ devices: E-series, AT-MIO-16F-5, AT-MIO-64F-5, AT-MIO-16X, and PC-LPM-16. Special connections are not necessary; VirtualBench-Device Calibrator automatically accesses the calibration features of these devices.

Calibrating a DAQ Device

You can calibrate your device with VirtualBench-Device Calibrator by following these steps:

1. Wait at least 15 minutes after you turn on both your computer and device before calibrating your device.

2. Select the device you want to calibrate from the Device list.

3. Click on **Calibrate**. Calibration of your device may take up to 20 seconds.

4. Wait for calibration to complete before using any other VirtualBench instrument.

☞ **Note:**   *Refer to the VirtualBench-Device Calibrator Online Help for additional help on configuring VirtualBench-Device Calibrator for your specific application.*

Customer Communication
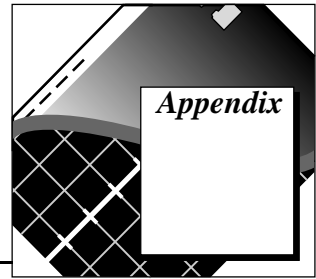
For your convenience, this appendix contains forms to help you gather the information necessary to help us solve your technical problems and a form you can use to comment on the product documentation. When you contact us, we need the information on the Technical Support Form and the configuration form, if your manual contains one, about your system configuration to answer your questions as quickly as possible.

National Instruments has technical assistance through electronic, fax, and telephone systems to quickly provide the information you need. Our electronic services include a bulletin board service, an FTP site, a fax-on-demand system, and e-mail support. If you have a hardware or software problem, first try the electronic support systems. If the information available on these systems does not answer your questions, we offer fax and telephone support through our technical support centers, which are staffed by applications engineers.

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United States: (512) 794-5422
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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

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National Instruments has branch offices all over the world. Use the list below to find the technical support number for your country. If there is no National Instruments office in your country, contact the source from which you purchased your software to obtain support.
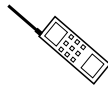
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Austria	0662 45 79 90 0	0662 45 79 90 19
Belgium	02 757 00 20	02 757 03 11
Canada (Ontario)	905 785 0085	905 785 0086
Canada (Quebec)	514 694 8521	514 694 4399
Denmark	45 76 26 00	45 76 26 02
Finland	09 725 725 11	09 725 725 55
France	01 48 14 24 24	01 48 14 24 14
Germany	089 741 31 30	089 714 60 35
Hong Kong	2645 3186	2686 8505
Israel	03 573 4815	03 573 4816
Italy	02 413091	02 41309215
Japan	03 5472 2970	03 5472 2977
Korea	02 596 7456	02 596 7455
Mexico	5 520 2635	5 520 3282
Netherlands	0348 433466	0348 430673
Norway	32 84 84 00	32 84 86 00
Singapore	2265886	2265887
Spain	91 640 0085	91 640 0533
Sweden	08 730 49 70	08 730 43 70
Switzerland	056 200 51 51	056 200 51 55
Taiwan	02 377 1200	02 737 4644
United Kingdom	01635 523545	01635 523154
United States	512 795 8248	512 794 5678

Technical Support Form

Photocopy this form and update it each time you make changes to your software or hardware, and use the completed copy of this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

If you are using any National Instruments hardware or software products related to this problem, include the configuration forms from their user manuals. Include additional pages if necessary.

Name _____

Company _____

Address _____

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Fax (___)_____ Phone (___) _____

Computer brand _____ Model _____ Processor_____

Operating system (include version number) _____

Clock speed _____MHz RAM _____MB   Display adapter _____

Mouse ___yes ___no   Other adapters installed _____

Hard disk capacity _____MB   Brand _____

Instruments used _____

_____

National Instruments hardware product model _____ Revision _____

Configuration _____

National Instruments software product _____Version _____

Configuration _____

The problem is: _____

_____

_____

_____

_____

List any error messages: _____

_____

_____

The following steps reproduce the problem:_____

_____

_____

_____

_____

VirtualBench Hardware and Software Configuration Form

Record the settings and revisions of your hardware and software on the line to the right of each item. Complete a new copy of this form each time you revise your software or hardware configuration, and use this form as a reference for your current configuration. Completing this form accurately before contacting National Instruments for technical support helps our applications engineers answer your questions more efficiently.

National Instruments Products

DAQ hardware _____

Interrupt level of hardware _____

DMA channels of hardware _____

Base I/O address of hardware _____

Programming choice _____

VirtualBench and NI-DAQ version_____

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Base I/O address of other boards_____

DMA channels of other boards _____

Interrupt level of other boards_____

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Microprocessor _____

Clock frequency or speed _____

Type of video board installed _____

Operating system version _____

Operating system mode_____

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Programming language version_____

Other boards in system _____

Base I/O address of other boards_____

DMA channels of other boards _____

Interrupt level of other boards_____

Documentation Comment Form

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Title: *Getting Started with VirtualBench*™

Edition Date: August 1997

Part Number: 321518B-01

Please comment on the completeness, clarity, and organization of the manual.

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