

VIRTUALBENCH™

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# Getting Started with VirtualBench

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For further support information, see the *Technical Support Resources* appendix. To comment on the documentation, send e-mail to [techpubs@natinst.com](mailto:techpubs@natinst.com).

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# Conventions

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The following conventions appear in this manual:

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



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

**bold**

Bold text denotes items that you must select or click on in the software, such as menu items and dialog box options. Bold text also denotes parameter names.

*italic*

Italic text denotes variables, emphasis, a cross reference, or an introduction to a key concept. This font also denotes text that is a placeholder for a word or value that you must supply.

monospace

Text in this font denotes text or characters that you should enter from the keyboard, sections of code, programming examples, and syntax examples. This font is also used for the proper names of disk drives, paths, directories, programs, subprograms, subroutines, device names, functions, operations, variables, filenames and extensions, and code excerpts.

*monospace italic*

Italic text in this font denotes text that is a placeholder for a word or value that you must supply.

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# Welcome to VirtualBench

The VirtualBench suite of tools is a high-performance, easy-to-use virtual instruments application program for Windows NT/98/95. *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.

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

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## VirtualBench Installation for Windows

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You must install VirtualBench along with NI-DAQ driver software.

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## Minimum System Requirements

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To run VirtualBench, you must have the following:

- Microsoft Windows NT 4.0 or higher, Microsoft Windows 98, or Windows 95
- Personal computer using at least a 66 MHz 486 or higher microprocessor with floating-point capability (National Instruments recommends a Pentium 60 or higher microprocessor with floating-point capability)
- VGA resolution (or higher) video adapter
- Minimum of 16 MB of RAM
- 30 MB free hard disk space
- Microsoft-compatible mouse
- NI-DAQ 6.5 or later

You cannot use the current version of VirtualBench in either of these cases:

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



In these cases, you must use VirtualBench 2.0, located in the vbench20 folder on the VirtualBench 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

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

To install VirtualBench, perform the following steps:

1. Insert your VirtualBench Installation CD into your CD-ROM drive.
2. Wait several seconds. On most computers, the AutoRun utility on the CD automatically launches the VirtualBench Installation CD dialog box.
3. If the VirtualBench Installation CD dialog box does not appear, use the **Start** button in the Windows taskbar to select **Run**, and type `d:\setup` in the input box, where *d* is your CD-ROM drive. Click on **OK**.
4. Click on **Install VirtualBench** in the VirtualBench Installation CD dialog box.

## What the Setup Program Installs

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The VirtualBench setup program installs the following virtual instruments, with online help for each instrument:

- Oscilloscope (Scope)
- Dynamic signal analyzer (DSA)
- Function generator (FG)
- Logger
- Arbitrary waveform generator (Arb)
- Waveform editor (Arb)
- Device calibrator (CAL)

## Installing on a Network

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Contact National Instruments for licensing information if you plan to run VirtualBench on a network.



**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

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

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# VirtualBench-Scope

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

## Launching VirtualBench-Scope

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To launch VirtualBench-Scope, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-Scope**.

## Front Panel Features

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

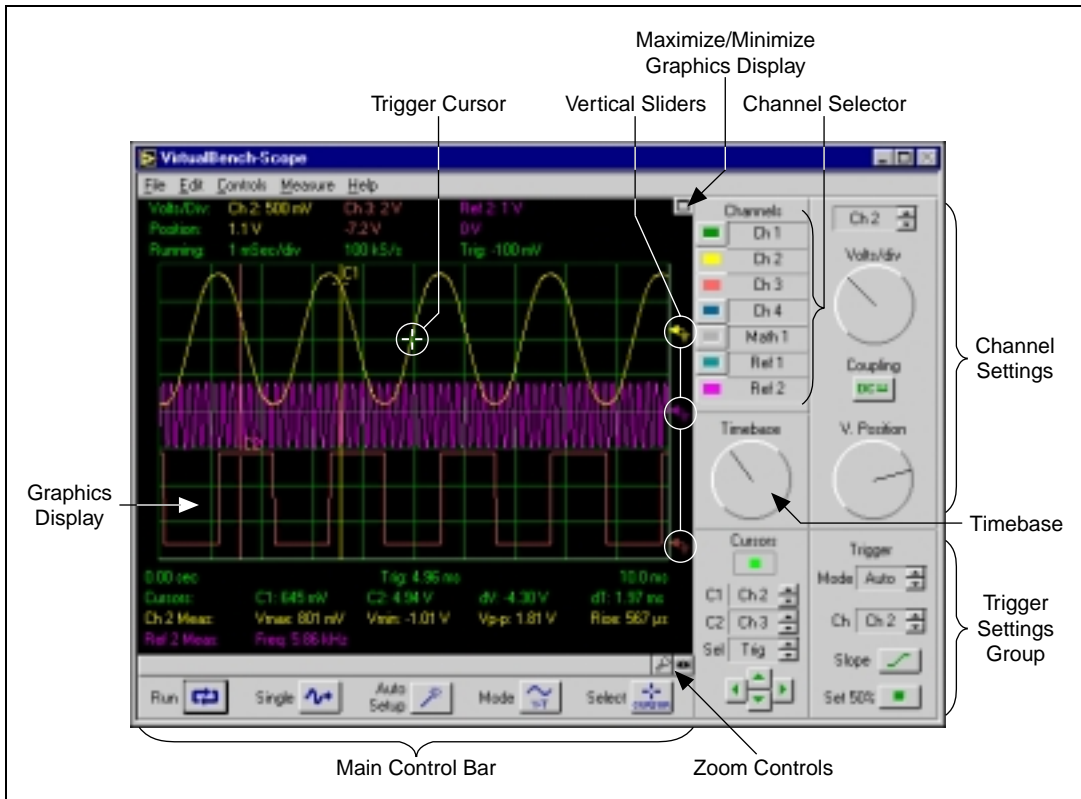


Figure 2-1. Front Panel of VirtualBench-Scope

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

- **Channel Selector**—Selects a waveform for display on the graphics display.
- **Channel Settings**
  - **Channel**—Selects the active channel.
  - **Volts/div**—Adjusts the vertical sensitivity of the active channel.
  - **Coupling**—Selects AC or CD input coupling.
  - **V. Position**—Moves the active channel vertically on the graph.
- **Timebase**—Controls the timebase setting. Turning the knob clockwise reduces the time period that appears in the graphics display. Each horizontal division represents one time period.
- **Trigger Cursor**—Changes the trigger level and position. Move the trigger cursor by clicking and dragging the cursor on the display.

- **Graphics Display**—Displays waveforms, channel information, cursor, and waveform measurements.
- **Maximize/Minimize Graphics Display**—Maximizes the graphics display so that it fills the entire window.
- **Vertical Sliders**—Adjust voltage offset for each channel. Use a 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. Deselection of this button places the VirtualBench-Scope in idle mode.
  - **Single**—Instructs VirtualBench-Scope to perform a single 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.
  - **Select**—Selects a subset of the waveform for further analysis or for saving to disk.
- **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 *VirtualBench-Scope Online Reference* for additional help on the front panel items.

## Acquiring Data

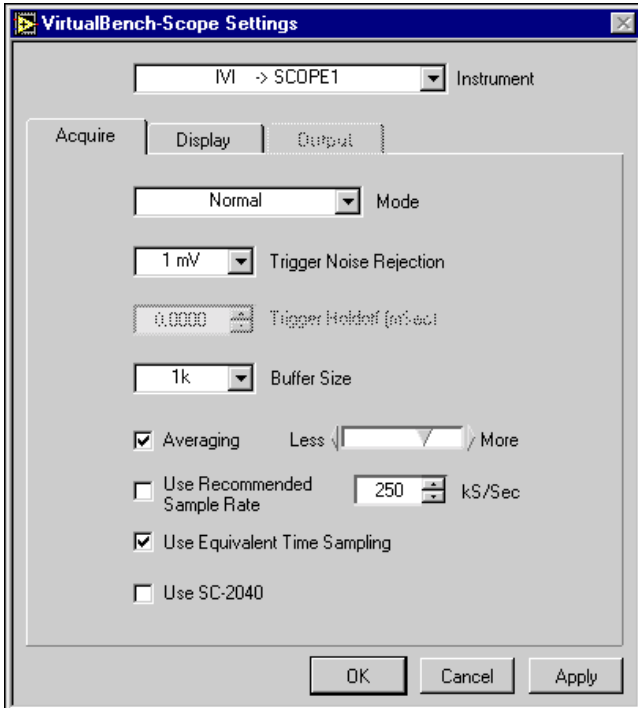
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When you launch VirtualBench-Scope, it operates in continuous run mode. To start acquiring signals with VirtualBench-Scope, complete the following steps:

1. If you are using a DAQ device, connect a signal to the Channel 0 input of your 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.

If you are using an IVI device, connect a signal to the appropriate channel of your device.

2. Configure VirtualBench-Scope.
  - a. Select **General Settings** from the **Edit** menu on the front panel.
  - b. Select the National Instruments DAQ or IVI instrument you want to use from the **Acquire** tab of the Scope Settings dialog box, shown in Figure 2-2. If a device does not appear in the Instrument list, make sure you have properly configured the instrument using the Measurement & Automation Explorer, or that you have configured an IVIScope virtual instrument in the Measurement & Automation Explorer. Please refer to Chapter 4, *Configuring Your System*, in the *IVI Driver Library User Manual* for more information on configuring your IVI virtual instrument.



**Figure 2-2.** General Tab of VirtualBench-Scope Settings Dialog Box

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



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

3. Enable the button for the connected channel in the Channel Selector group. Disable all other channels.
4. Click on **AutoSetup** on the main control bar.
5. To change the trigger position, drag the trigger cursor (the small green cursor in the center of the graph).
6. Click on **Run** to stop the acquisition.



**Note** Refer to *VirtualBench-Scope Online Reference* for additional help on configuring VirtualBench-Scope for your specific application.

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# VirtualBench-DSA

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

## Launching VirtualBench-DSA

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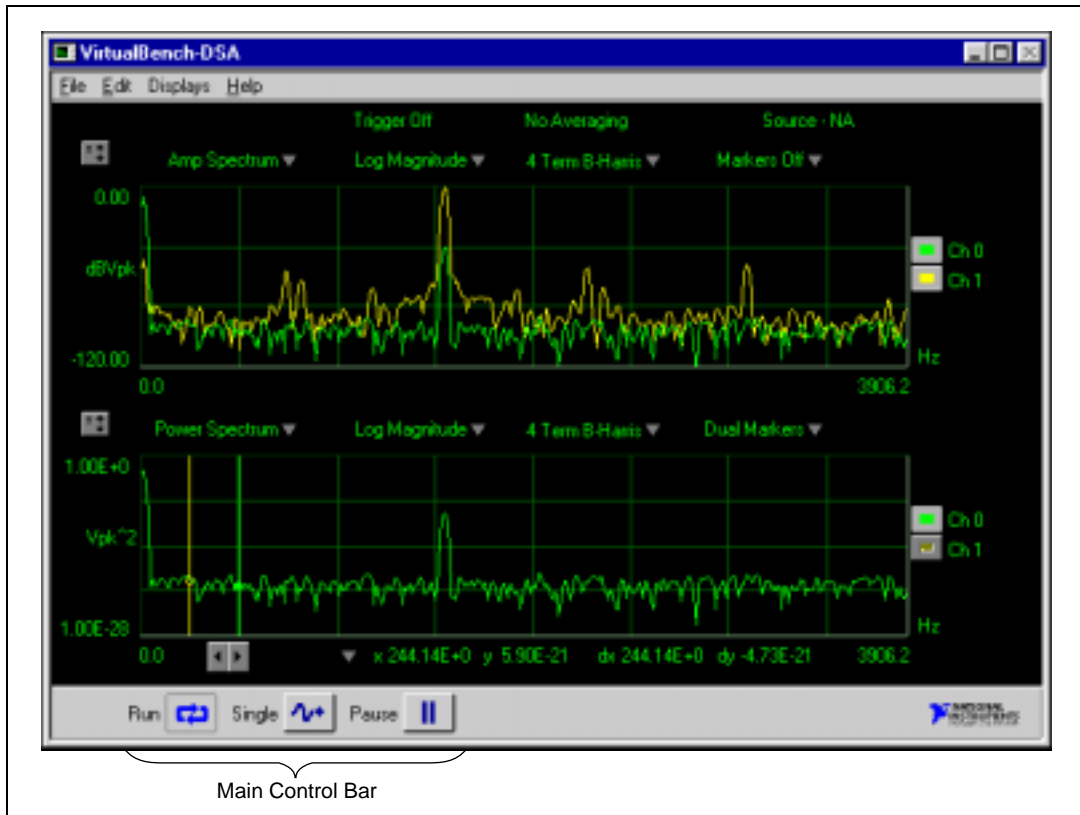
To launch VirtualBench-DSA, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-DSA** or click on the **DSA** button on the VirtualBench toolbar.

## Front Panel Features

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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 each display. You can select the channels, function, magnitude/phase mode, magnitude unit, log/linear mode, phase unit, and markers for a display.
- **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.
- **Measurement Displays**—Displays measurements, reference waveforms, and markers for marker measurements.

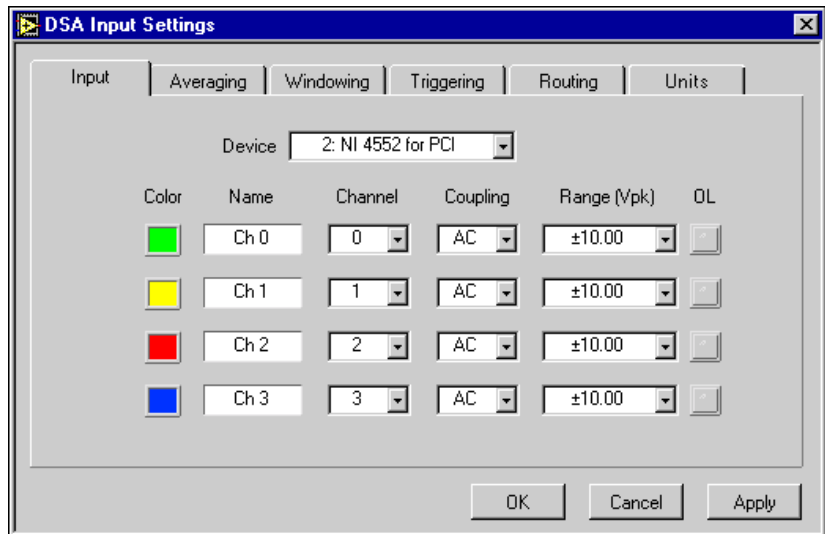


**Note** *VirtualBench-DSA Online Reference* provides additional help on the front panel items.

## Acquiring and Measuring Signals

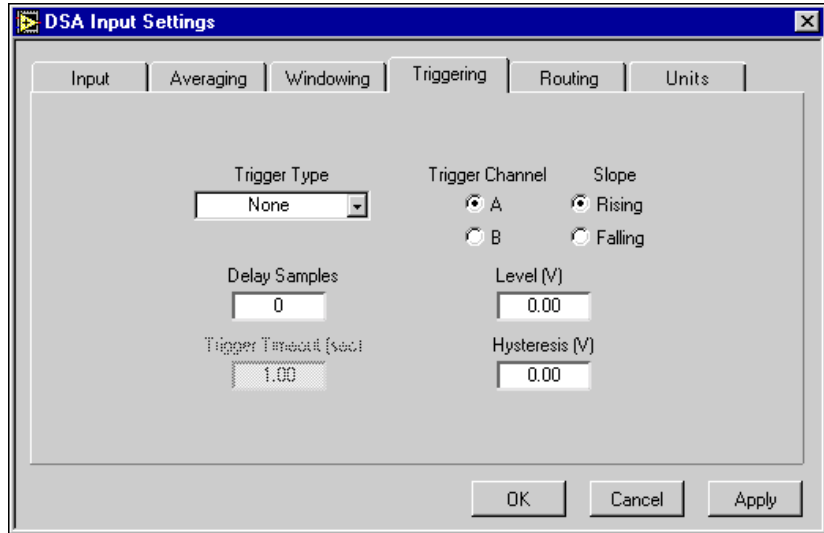
To start acquiring and measuring signals with VirtualBench-DSA, follow these steps:

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 **Input Settings** from the **Edit** menu on the front panel.
  - b. Select the Input tab from the DSA Settings dialog box, shown in Figure 3-2.



**Figure 3-2.** Input Tab of DSA Input Settings Dialog Box

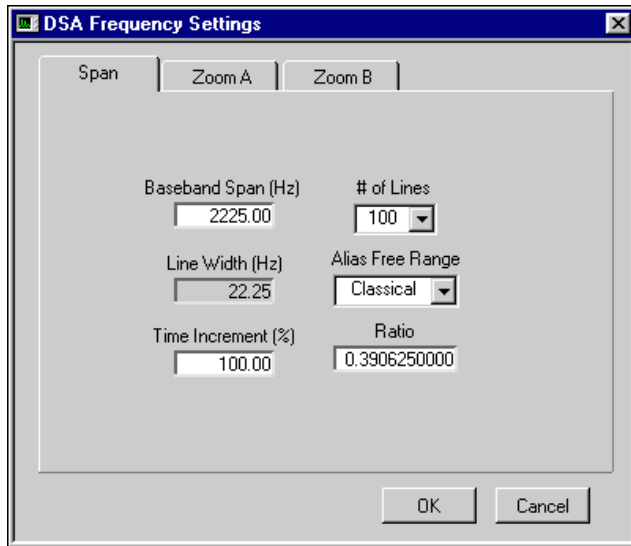
- c. Select the device that you want to use for the data acquisition. The Device list displays only devices that you have configured successfully in the Measurement & Automation Explorer.
- d. Click on the Triggering tab in the DSA Settings dialog box, shown in Figure 3-3.



**Figure 3-3.** Triggers Tab of DSA Input Settings Dialog Box

- e. Set the Trigger Type to none. This setting puts the acquisition in free-run mode.
- f. Click on **OK**.

- g. Select **Frequency Settings** in the **Edit** menu on the front panel.
- h. Select the Span tab in the Frequency Settings dialog box.



**Figure 3-4.** Span Tab of DSA Frequency Settings Dialog Box

3. Select a Baseband Span that is appropriate to the signal that you are trying to measure. Then click on **OK**.
4. In the upper display on the front panel, select **Time Waveform** in the Waveform Type pop-up menu. Choose **Linear Magnitude** in the Scale pop-up menu.
5. Select Markers None in the Markers pop-up menu.
6. In the lower display on the front panel, select **Power Spectrum** in the Waveform Type pop-up menu. Choose **Log Magnitude** in the Scale pop-up menu.
7. Click on the **Single** button. VirtualBench-DSA displays a single frame of data. If no data is visible, click on the Autoscale Y Axis button (the button that contains a “y” and up/down arrows) in the display control. Check your signal connections if data still does not appear.
8. Click on **Run**. VirtualBench-DSA continuously acquires and displays frames of data.
9. Click on **Run** again to stop acquisition.



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

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# VirtualBench-Logger

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

## Launching VirtualBench-Logger

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To launch VirtualBench-Logger, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-Logger** or click on the **Logger** button on the VirtualBench toolbar.

## Front Panel Features

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

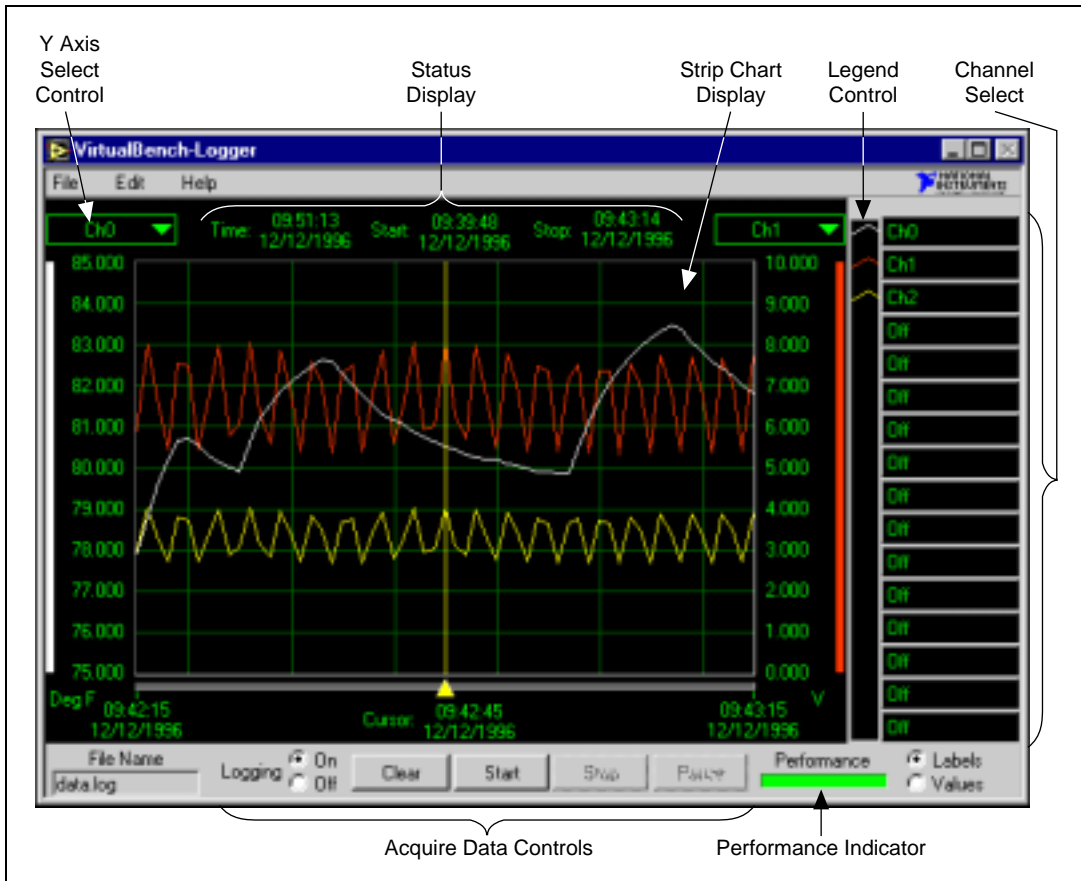


Figure 4-1. Front Panel of VirtualBench-Logger

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. Try 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 *VirtualBench-Logger Online Reference* for additional help on the front panel items.

## Acquiring Data

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To start acquiring data with VirtualBench-Logger, follow 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. The Device list displays only devices that you have configured successfully in the Measurement & Automation Explorer.

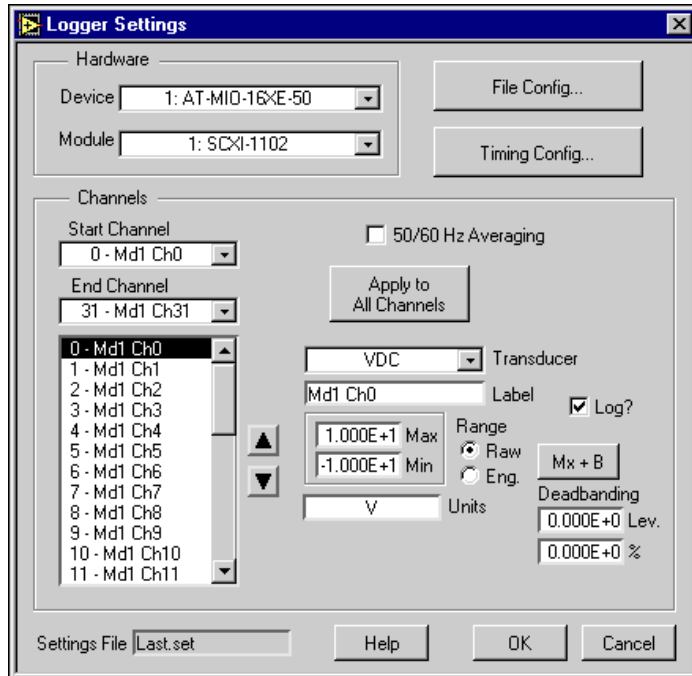


Figure 4-2. Logger Settings Dialog Box



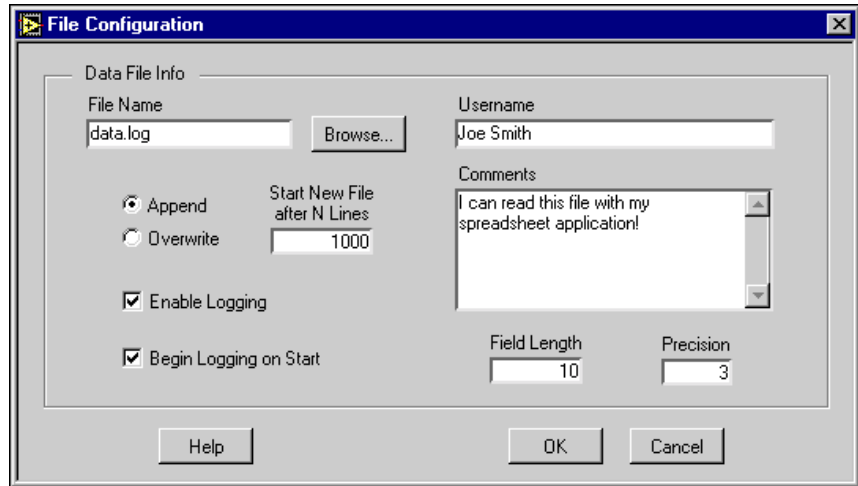
**Note** The options on the Logger Settings dialog box vary slightly if you use a 4350 Series board. Refer to *VirtualBench-Logger Online Reference* for more information.

- 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. To specify the location of this file, use the **Browse** button. Select **Enable Logging** and **Begin Logging on Start**. Click on **OK**.



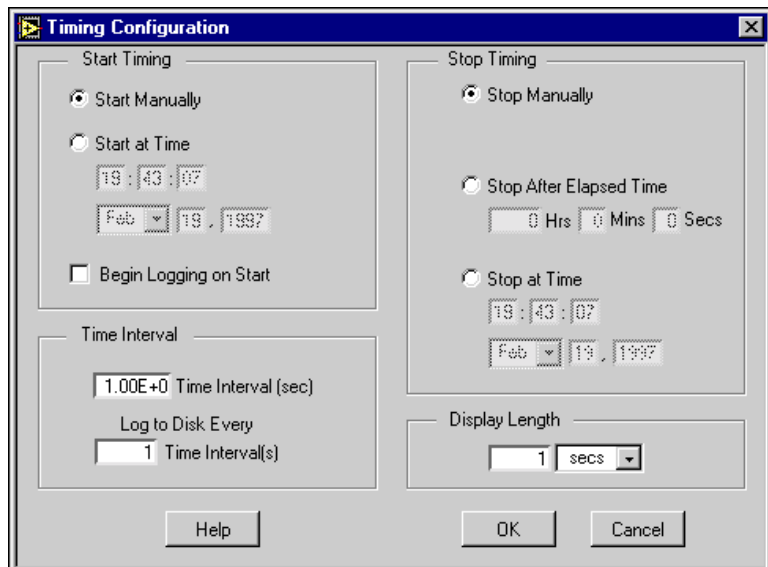
**Note** If you have not previously specified a log file, VirtualBench-Logger automatically displays a File dialog box.





**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. Click on the right or left y-axis controls to select which channel's y-scale you want 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 *VirtualBench-Logger Online Reference* for additional help on configuring VirtualBench-Logger for your specific application.

# VirtualBench-FG

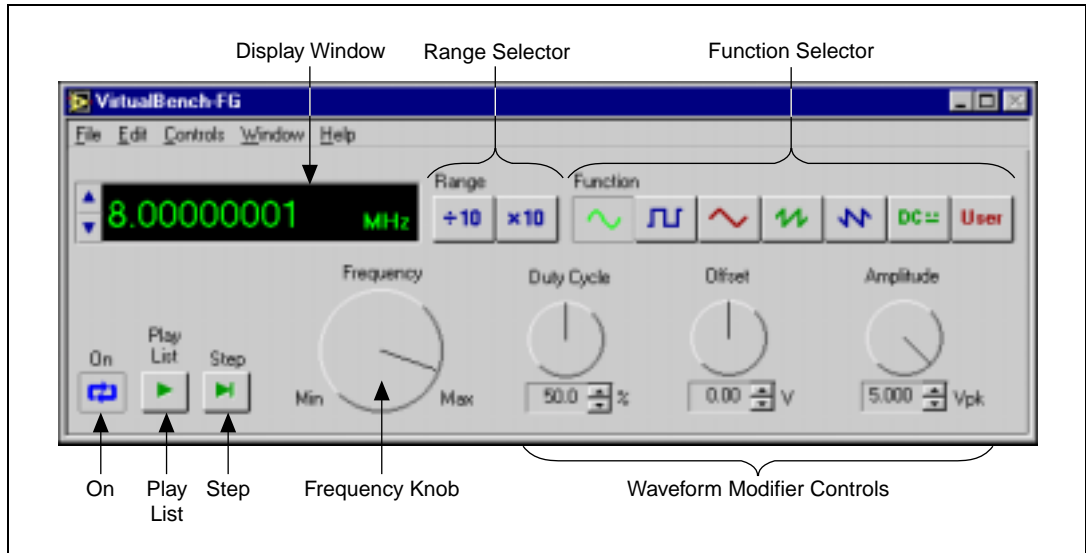
This chapter explains the VirtualBench function generator (FG) front panel features and how to generate a waveform.

## Launching VirtualBench-FG

To launch VirtualBench-FG, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-FG** or click 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 54xx devices.
- **Step**—Steps through the frequency list. The **Step** button appears only with 54xx devices.



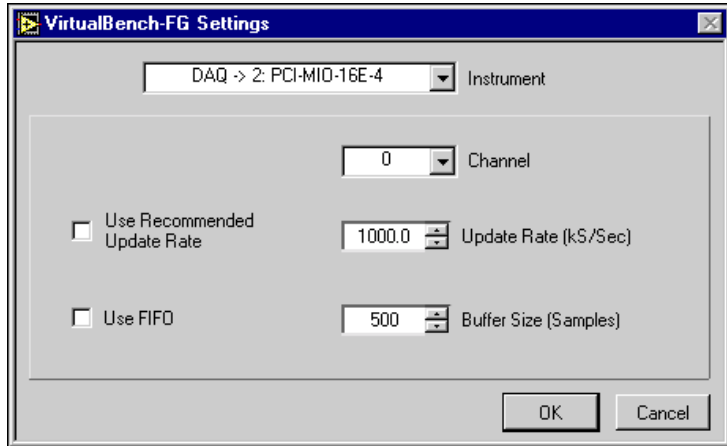
**Note** Refer to *VirtualBench-FG Online Reference* for additional help on the front panel items.

## Generating a Waveform

---

To configure VirtualBench-FG to generate a waveform, perform the following steps.

1. Configure the output.
  - a. Select **Settings** from the **Edit** menu on the front panel.
  - b. Select the instrument that you want to use for waveform generation in the VirtualBench-FG Settings dialog box, shown in Figure 5-2. The Device list displays only devices that you have configured successfully in the Measurement & Automation Explorer. Please refer to Chapter 4, *Configuring Your System*, in the *IVI Driver Library User Manual* for more information on configuring your IVI virtual instrument.



**Figure 5-2.** VirtualBench-FG Settings Dialog Box

- c. Set the channel.
- 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 or instrument manual for details.
3. Click on **On**. VirtualBench-FG continuously generates an analog waveform at the output pin.
4. Click on **On** again to stop the waveform generation.



**Note** Refer to *VirtualBench-FG Online Reference* for additional help on configuring VirtualBench-FG for your specific application.

# VirtualBench-DMM

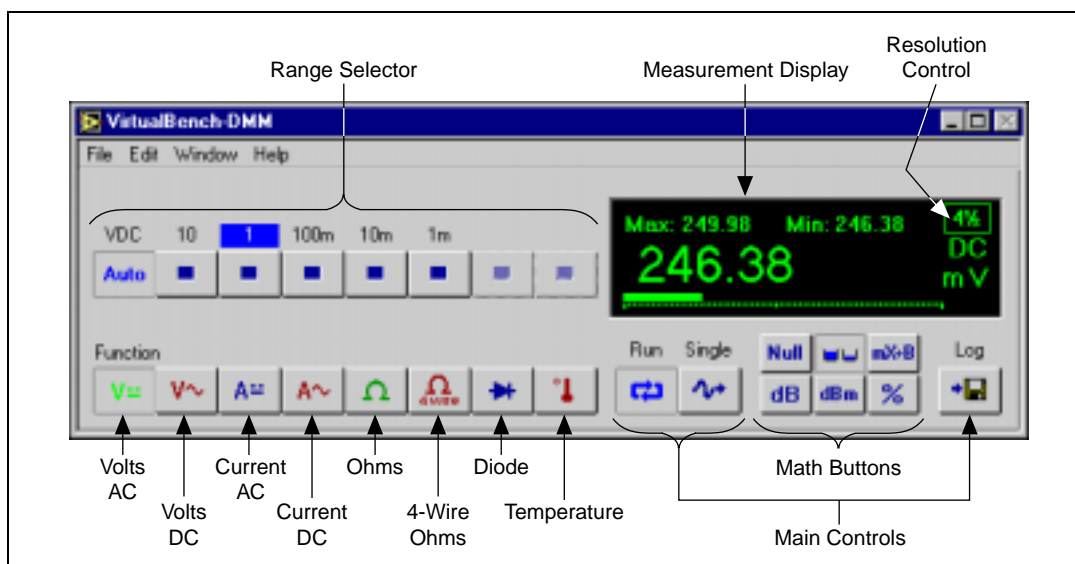
This chapter explains the VirtualBench digital multimeter (DMM) and how to measure a signal with the DMM.

## Launching VirtualBench-DMM

To launch VirtualBench-DMM, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-DMM**.

## 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.
  - **4-Wire Ohms**—Measures resistance using four-wire method.
  - **Diode**—Measures the voltage drop across a diode.
  - **Temperature**—Measures temperature.
- **Resolution Control**—Selects the number of digits of resolution.
- **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 you pressed this button.
  - **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.

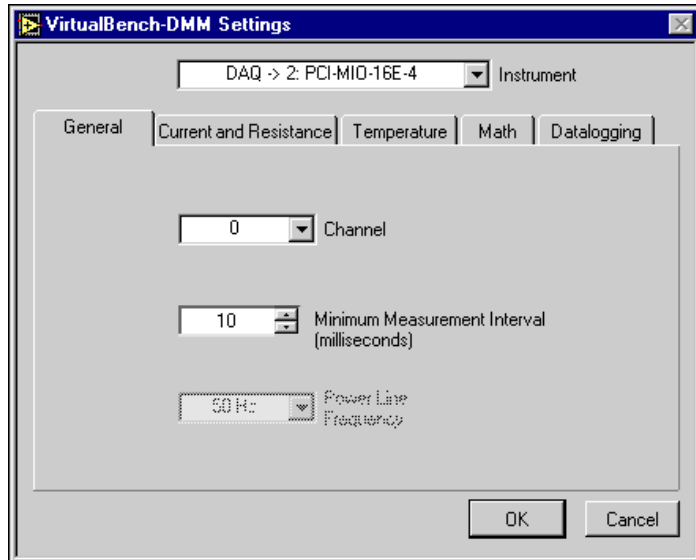


**Note** Refer to *VirtualBench-DMM Online Reference* for additional help on the front panel items.

# Measuring a Signal

To start measuring signals with VirtualBench-DMM, follow 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.

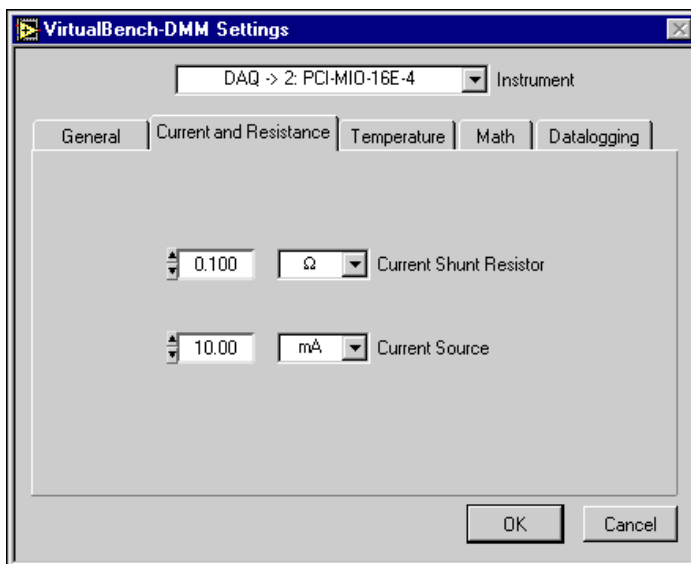


**Figure 6-2.** General Tab of VirtualBench-DMM Settings Dialog Box

- c. Select the instrument that you want to use. VirtualBench-DMM hides the SCXI Module list when no SCXI modules are configured for the selected device. The Device list displays only devices that you have configured successfully in the Measurement & Automation Explorer.
  - d. Set the channel to the source of your signal.
  - e. Click on **OK**.
2. Measure voltage. VirtualBench-DMM measures AC and DC voltage without any external hardware.
  - a. Connect a signal 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. 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. If you are using an NI 4060 PCI/PXI-based multimeter or an IVI instrument, skip to Step 3g.
- If you are using any other device, VirtualBench-DMM requires a precision external shunt resistor to measure current. To configure your precision external shunt, follow these steps:
- 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

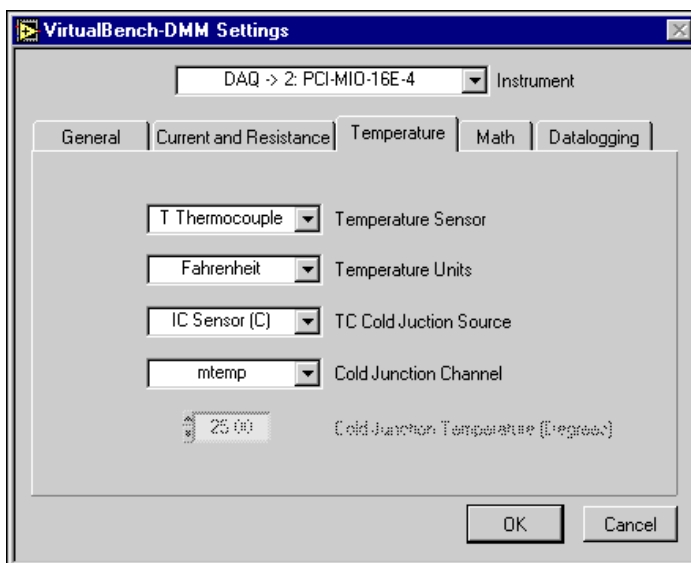
- e. Enter the value of the shunt resistor in the Current Shunt Resistor Control.
- f. Click on **OK**.

- 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 or IVI instrument 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 using an NI 4060 PCI/PXI-based multimeter, a DAQMeter DAQCard-4050, or an IVI device, skip to Step 4g.

If you are using any other device, you must use a precision external current source to measure resistance. To configure your current source, follow these steps:

- a. 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.
- b. Connect the resistor you want to measure across the same terminals.
- c. Select **Edit>Settings** on the front panel.
- d. Select the **Current and Resistance** tab.
- e. Enter the value of the current source in the Current Source Control.
- f. Click on **OK**.
- g. Click on the **Ohms** button in the Mode selector.
- h. Click on **Run**. VirtualBench-DMM continuously acquires and displays resistance 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 or IVI instrument and that the input signal does not exceed the selected range.
- j. 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 DAQMeter DAQCard-4050 or an NI 4060 PCI/PXI-based multimeter, 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 for the temperature 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 **Temperature** 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 DAQMeter DAQCard-4050 or an NI 4060 PCI/PXI-based multimeter, you can measure the voltage drop across a diode, up to 2 V. If you are using an IVI instrument, you can also measure diode voltage if the instrument supports this.
    - a. Connect the diode to the terminals of the DAQCard-4050.
    - b. Click on the **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 Reference* for additional help on configuring VirtualBench-DMM for your specific application.

# VirtualBench-Power Supply

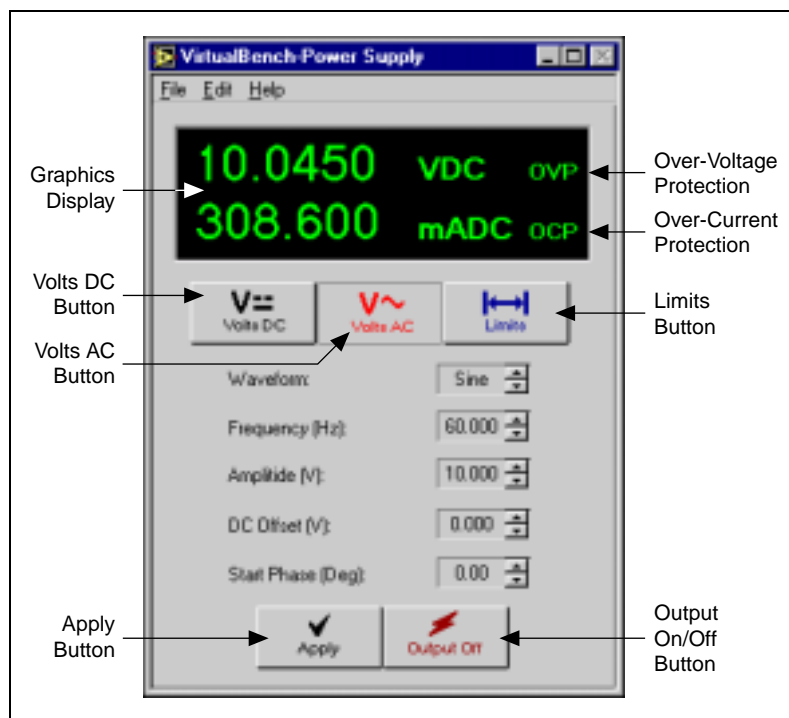
This chapter explains the front panel features of the VirtualBench-Power Supply and how to turn on VirtualBench-Power Supply.

## Launching VirtualBench-Power Supply

To launch VirtualBench-Power Supply, select **Programs»VirtualBench»VirtualBench-Power Supply** in the **Start** button of the Windows taskbar.

## Front Panel Features

This section describes the VirtualBench-Power Supply front panel.



**Figure 7-1.** Front Panel of VirtualBench-Power Supply

The front panel of VirtualBench-Power Supply has the following features:

- **Graphics Display**—Shows real-time voltage and current measurements, if your instrument supports these measurements. If your device does not support these measurements, the display shows your current settings. “OVP” indicates that the over-voltage protection circuitry has tripped. “OCP” indicates that the over-current protection circuitry has tripped.
- **Volts DC**—Allows you to set the power supply to a specified DC voltage.
- **Volts AC**—Allows you to set the power supply to a specified AC voltage, with optional settings such as waveform shape, frequency, amplitude, DC offset, and start phase.
- **Limits**—Allows you to specify upper and lower voltage limits and a current limit, and enable over-voltage or over-current protection circuitry.
- **Apply**—Commits changes you have made to front panel controls.
- **Output On/Off**—Enables output of the Power Supply.

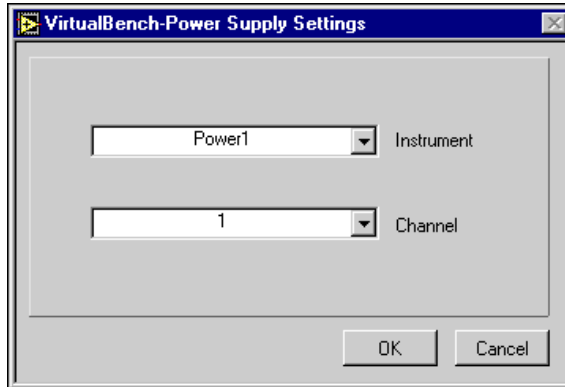


**Note** Refer to *VirtualBench-Power Supply Online Reference* for additional help on the front panel items.

## Turning on the Power Supply

When you launch VirtualBench-Power Supply, it always launches in a power off state. You must configure VirtualBench-Power Supply before using it:

1. Connect a load to one of the output channels of your power supply.
2. Configure VirtualBench-Power Supply.
  - a. Select **Settings** from the **Edit** menu on the front panel.
  - b. Select the IVI instrument’s logical name that you want to use. If you have not already configured a logical name for your instrument, VirtualBench-Power Supply has already created one for you with the same name as the virtual instrument installed in your system. For details, see the *Changing the Items to which Another Item Refers* section in Chapter 4, *Configuring Your System*, of the *IVI Driver Library User Manual*.
  - c. Select the channel you want to use.



**Figure 7-2.** Power Supply Settings Configuration

- d. Click on **OK** to use these settings.

To generate a DC power signal, complete these steps:

1. Click on the **Volts DC** button to select DC volts mode.

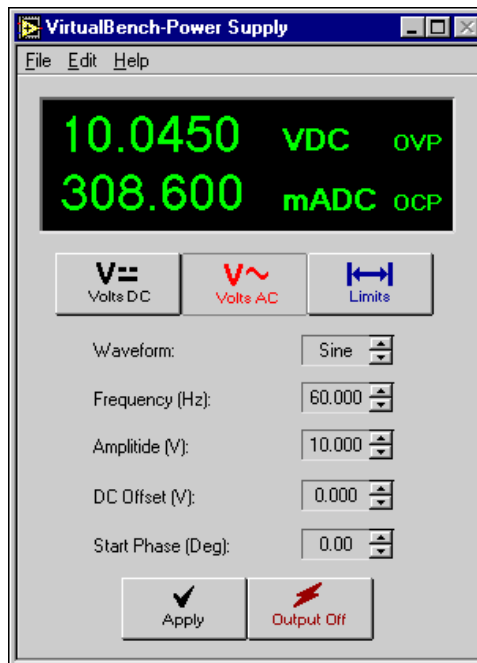


**Figure 7-3.** Front Panel with Volts DC Button Selected

2. Enter a voltage in the **Voltage** control.
3. Click on **Apply** to commit to the change. If a red error button appears in the display window, click on the button to display the cause of the error. Adjust the voltage level if necessary.
4. Click on **Output** to enable the power supply.

To generate an AC power signal, complete these steps:

1. Click on the **Volts AC** button to select AC volts mode.



**Figure 7-4.** Front Panel with Volts AC Button Selected

2. Enter the appropriate settings for your AC signal.
3. Click on **Apply** to commit to the change. If a red error button appears in the display window, click on the button to display the cause of the error. Adjust the settings if necessary.
4. Click on **Output** to enable the power supply.

To exit VirtualBench-Power Supply, select **Exit** from the **File** menu. VirtualBench-Power Supply saves your current settings for the next session.



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# VirtualBench-Switch

This chapter explains the VirtualBench-Switch front panel features and how to make signal connections.

## Launching VirtualBench-Switch

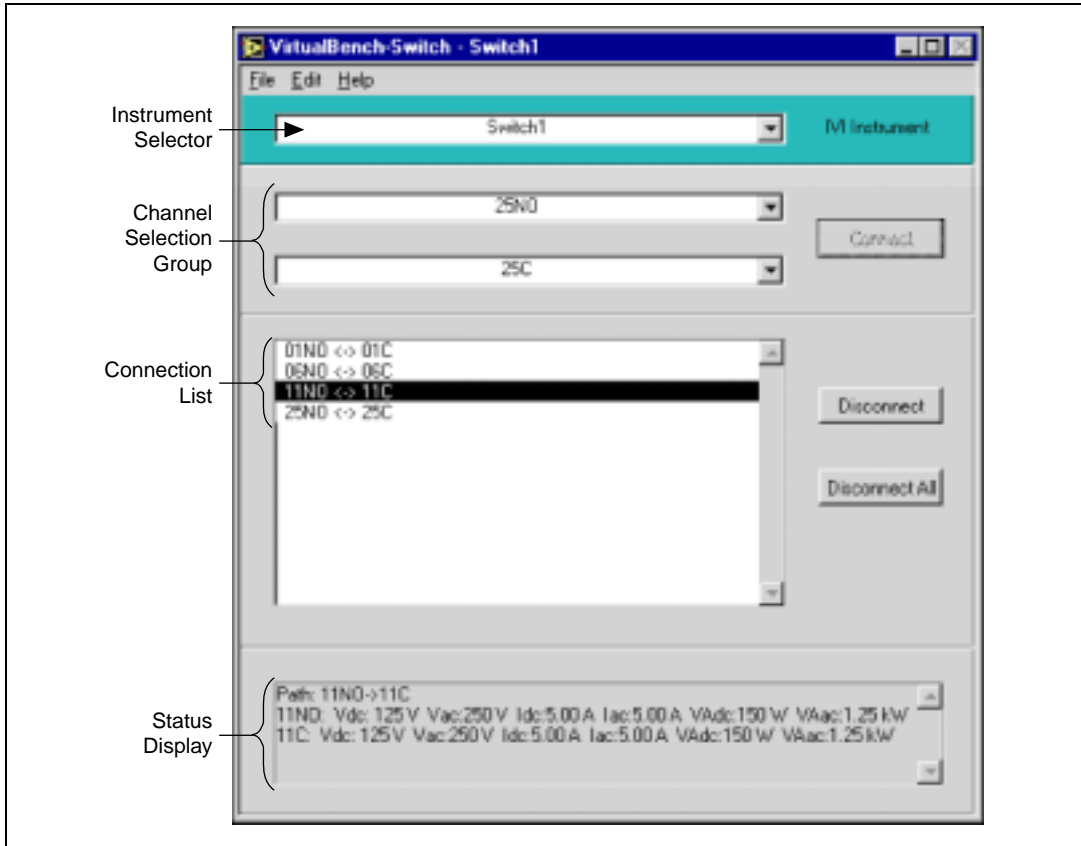
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To launch VirtualBench-Switch, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-Switch**.

## Front Panel Features

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



**Figure 8-1.** Front Panel of VirtualBench-Switch

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

- **Instrument Selector**—Allows you to select the IVI instrument you want to use.
- **Channel Selection Group**—Allows you to choose two channels to connect.
- **Connection List**—Allows you to view details and disconnect any existing connection.
- **Status Display**—Displays the connection path of the selected connection, channel information such as maximum current, voltage, and power capacity, information on why two channels cannot be connected, and any error information.



**Note** Refer to *VirtualBench-Switch Online Reference* for additional help on the front panel items.

## Making Connections

When you launch VirtualBench-Switch, it automatically assumes the settings of your previous VirtualBench-Switch session. To make signal connections, complete the following steps:

1. Connect signals to two or more channels on your switch instrument.
2. Select the IVI instrument's logical name that you want to use. If you have not already configured a logical name for your instrument, VirtualBench-Switch has already created one for you with the same name as the virtual instrument installed in your system. For details, see the *Changing the Items to which Another Item Refers* section in Chapter 4, *Configuring Your System*, of the *IVI Driver Library User Manual*.
3. Select two channels that you want to connect in the **Channel Selection Group**.
4. Click on **Connect** to connect the two channels.
5. Click on the connection in the connection list to view information about the connection.

To disconnect a signal connection, click on the connection in the connection list and then click on **Disconnect**.

To save a group of connections, select **Save Settings** from the **Edit** menu. Enter the name of the file you want to save, such as `MySetup.swh`.

To exit VirtualBench-Switch, select **Exit** from the **File** menu. VirtualBench-Switch saves your current settings for the next session.

# VirtualBench-Arb

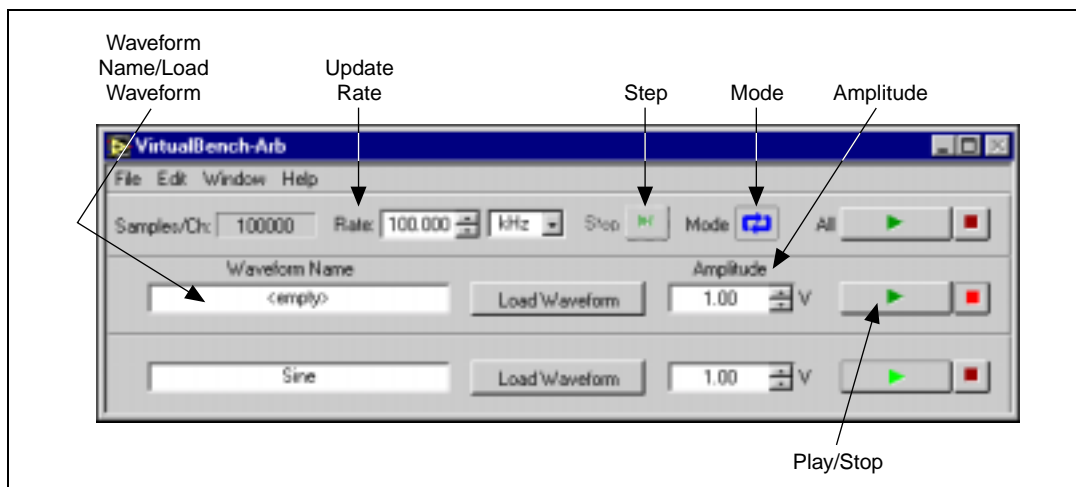
This chapter explains the VirtualBench Arbitrary Waveform Generator front panel features, the Waveform Editor front panel features, and how to generate a waveform.

## Launching VirtualBench-Arb

To launch VirtualBench-Arb, which contains the Waveform Generator and Waveform Editor, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench-Arb** or click 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 9-1.



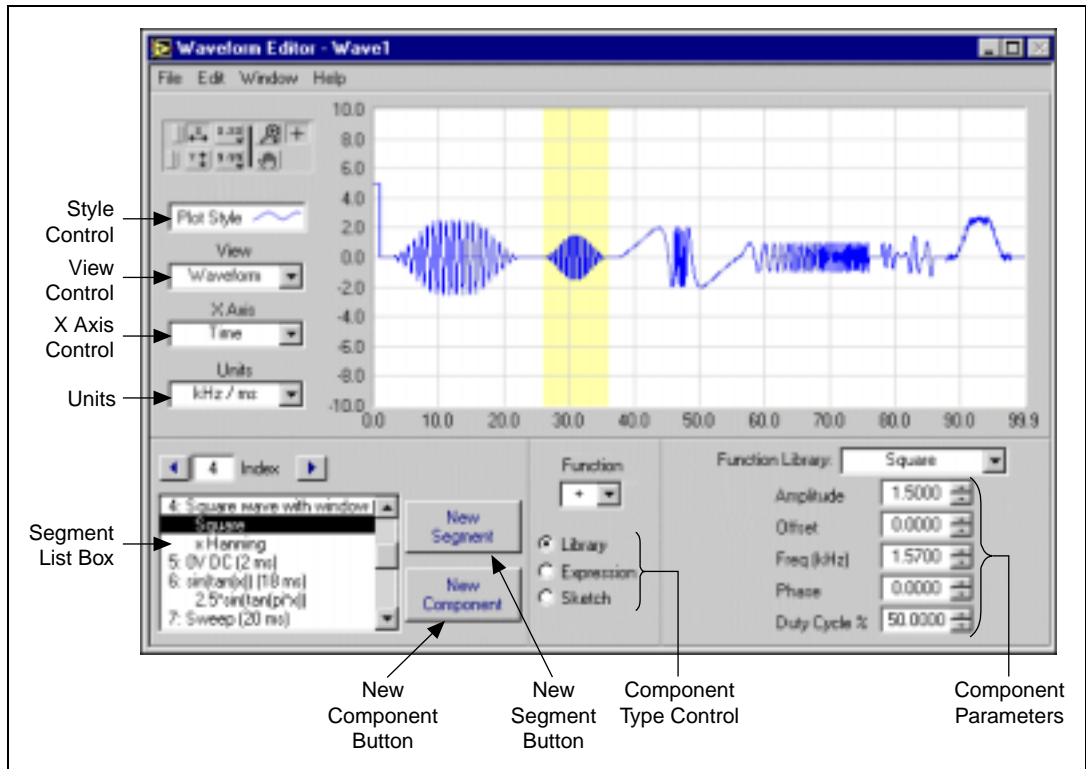
**Figure 9-1.** Front Panel of VirtualBench-Arb Waveform Generator

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

- **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.
- **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.
- **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 9-2.



**Figure 9-2.** 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**—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.

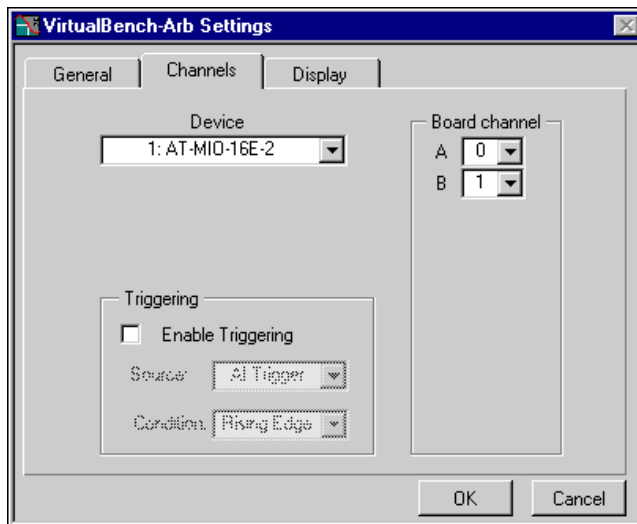


**Note** *VirtualBench-Arb Online Reference* provides additional help for the front panel items.

## Generating a Waveform

To start generating waveforms with VirtualBench-Arb, follow 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 9-3.



**Figure 9-3.** Channels Tab of VirtualBench-Arb Settings Dialog Box

- c. Select the device that you want to use for waveform generation. The Device list displays only devices that you have configured successfully in the Measurement & Automation Explorer.
  - 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. Click on **New Segment** to create a new segment.
    - b. Click on **New Component** to create a new component in the segment.
    - 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. To change the number of cycles of the waveform, change the **Cycles** control.
5. Create a waveform from a freehand sketch.
  - a. Click on **New Segment** to create a new segment.
  - b. Click on **New Component** to create a new component in the segment.
  - 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. Click on the **Mode** button to change the mode to line. This mode allows you to draw straight lines.
  - f. Click on **Draw** again to finish editing.
6. Select **File»Save** to save your waveform.
7. Close the Waveform Editor front panel.
8. In the front panel of the Waveform Generator, click on the **Load Waveform** button to invoke the file selection 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 *VirtualBench-Arb Online Reference* for additional help on configuring VirtualBench-Arb for your specific application.

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# VirtualBench-Device Calibrator

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

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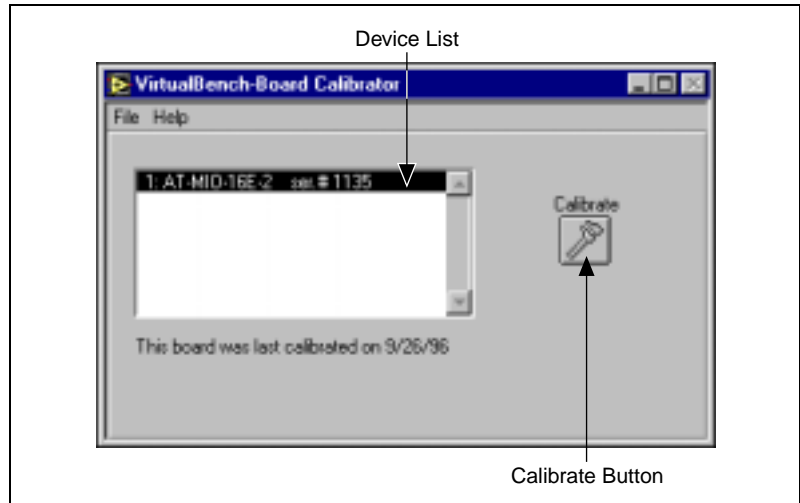
## Launching VirtualBench-Device Calibrator

To launch the VirtualBench-Device Calibrator, use the **Start** button in the Windows taskbar to select **Programs»VirtualBench»VirtualBench Cal** or click on the **Cal** button on the VirtualBench toolbar.

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## Front Panel Features

This section explains the front panel features of the VirtualBench-Device Calibrator, shown in Figure 12-1.



**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 list displays only devices that you have configured successfully in the Measurement & Automation Explorer.
- **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

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To calibrate your device with VirtualBench-Device Calibrator, follow 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 *VirtualBench-Device Calibrator Online Reference* for additional help on configuring VirtualBench-Device Calibrator for your specific application.



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# Technical Support Resources

This appendix describes the comprehensive resources available to you in the Technical Support section of the National Instruments Web site and provides technical support telephone numbers for you to use if you have trouble connecting to our Web site or if you do not have internet access.

## NI Web Support

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To provide you with immediate answers and solutions 24 hours a day, 365 days a year, National Instruments maintains extensive online technical support resources. They are available to you at no cost, are updated daily, and can be found in the Technical Support section of our Web site at [www.natinst.com/support](http://www.natinst.com/support).

### Online Problem-Solving and Diagnostic Resources

- **KnowledgeBase**—A searchable database containing thousands of frequently asked questions (FAQs) and their corresponding answers or solutions, including special sections devoted to our newest products. The database is updated daily in response to new customer experiences and feedback.
- **Troubleshooting Wizards**—Step-by-step guides lead you through common problems and answer questions about our entire product line. Wizards include screen shots that illustrate the steps being described and provide detailed information ranging from simple getting started instructions to advanced topics.
- **Product Manuals**—A comprehensive, searchable library of the latest editions of National Instruments hardware and software product manuals.
- **Hardware Reference Database**—A searchable database containing brief hardware descriptions, mechanical drawings, and helpful images of jumper settings and connector pinouts.
- **Application Notes**—A library with more than 100 short papers addressing specific topics such as creating and calling DLLs, developing your own instrument driver software, and porting applications between platforms and operating systems.

## Software-Related Resources

- **Instrument Driver Network**—A library with hundreds of instrument drivers for control of standalone instruments via GPIB, VXI, or serial interfaces. You also can submit a request for a particular instrument driver if it does not already appear in the library.
- **Example Programs Database**—A database with numerous, non-shipping example programs for National Instruments programming environments. You can use them to complement the example programs that are already included with National Instruments products.
- **Software Library**—A library with updates and patches to application software, links to the latest versions of driver software for National Instruments hardware products, and utility routines.

## Worldwide Support

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National Instruments has offices located around the globe. Many branch offices maintain a Web site to provide information on local services. You can access these Web sites from [www.natinst.com/worldwide](http://www.natinst.com/worldwide).

If you have trouble connecting to our Web site, please contact your local National Instruments office or the source from which you purchased your National Instruments product(s) to obtain support.

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