

# WHERE TO START WITH YOUR NI 45XX FOR PCI DYNAMIC SIGNAL ANALYZER

This document explains how to install, test, and begin using your NI 45XX (NI 4551 or NI 4552) for PCI dynamic signal analyzer (DSA) instrument. These procedures can also be used for troubleshooting.

You can control the NI 45XX interactively with the VirtualBench-DSA soft front panels or programmatically with an application development environment (ADE) using the supplied NI-DSA Instrument Driver. The supported ADEs include LabVIEW, LabWindows/CVI, Visual Basic, and other C or C++ environments. You can find more information for programmers in the [Programming Your NI 45XX](#) section of this document.



**Note** Install your software before you install your NI 45XX instrument.

## Install Your Software

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The NI-DSA software CD includes the software you need to configure, test, and program your NI 45XX. If you do not have an NI-DSA CD, want to get the latest version of NI-DSA, or have any problems while installing or testing your NI 45XX, refer to the [Technical Support](#) section of this document.

Follow these steps to install your NI-DSA software:

1. If you are using an ADE such as LabVIEW or LabWindows/CVI, or a third-party development tool such as Visual Basic, install it before you install the NI-DSA software.
2. Insert your NI-DSA software CD into your CD-ROM drive. Click the **Install Software** option in the installation window. If the installation window does not appear after you insert the CD, click **Start>Run** from the Windows taskbar, then type `x:\autorun.exe` (where *x* is the letter of your CD-ROM drive) and click **OK**.
3. To install the instrument driver, ADE examples (programming examples for LabVIEW, LabWindows/CVI, Visual C++, and Visual

Basic), and VirtualBench-DSA, choose the **Programmatic and Interactive Support** option. To install only VirtualBench-DSA, choose the **Interactive Support Only** option.

4. If you choose the **Programmatic and Interactive Support** option, select the development environments you will use. If the installer detects supported ADEs on your system, they will be selected automatically.



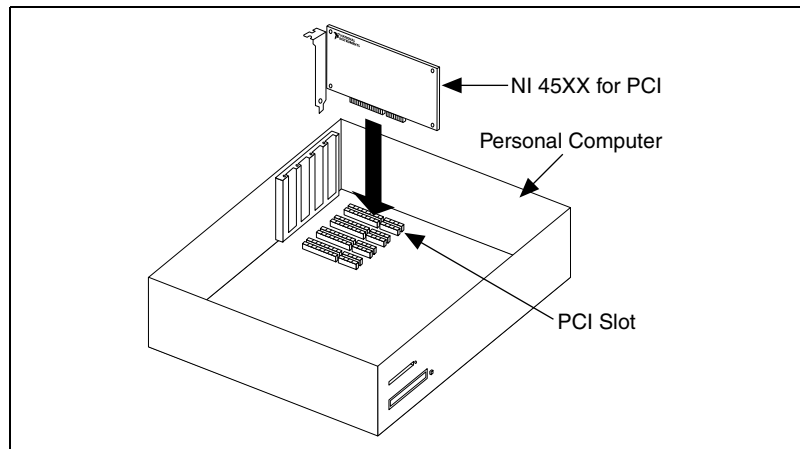
**Note** The NI-DAQ driver software controls the communication between your NI 45XX and your computer, and is necessary for the NI-DSA software to work. The installer will automatically install the latest version of NI-DAQ if it is not already present on your system.

## Install Your Hardware

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You can install the NI 45XX in any available PCI expansion slot in your computer. The following are general installation instructions; consult the documentation for your computer for specific instructions and warnings:

1. Turn off your computer.
2. Remove the top cover of the computer, then remove the expansion slot cover from the back panel of the computer.
3. To prevent damage from electrostatic discharge, touch a metal part of the computer chassis with your hand and with the antistatic bag containing your NI 45XX.
4. Locate an empty 5 V PCI slot in your computer. PCI slots are typically white in color. Insert the NI 45XX into the slot as shown in Figure 1. It should fit snugly, but do not force the board into place.



**Figure 1.** Install Your NI 45XX for PCI

5. Screw the mounting bracket of the NI 45XX to the back panel rail of the computer.
6. Check the installation. Make sure the board is completely inserted in the slot and not touching other boards or components.
7. Replace the cover.
8. Turn on your computer.

When you have installed the software and hardware, you are ready to run the functionality tests and begin controlling the instrument using the soft front panels.

The NI 45XX instrument is completely software configurable and is fully compatible with the industry-standard *PCI Local Bus Specification Revision 2.0*. The PCI system will perform all bus-related configuration and requires no interaction from you. Bus-related configuration includes setting the instrument base memory address and interrupt channel. Data acquisition-related configuration steps, such as setting analog I/O mode, polarity, and range, are described in the [Perform a Basic I/O Functionality Test](#) section.

## Test Your NI 45XX

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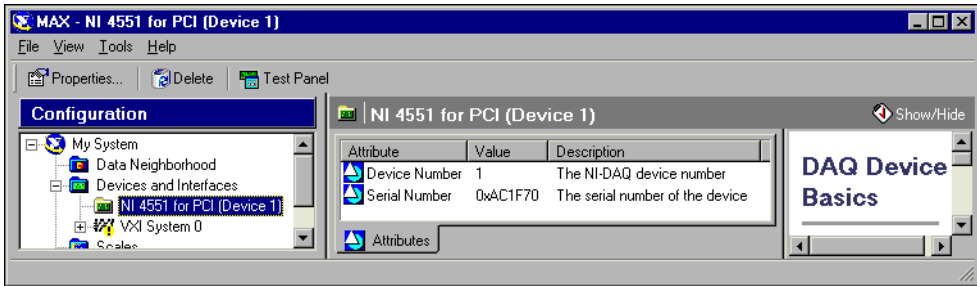
The resources test described here will verify the communication between your computer and the NI 45XX. To test the resource assignments for your NI 45XX, follow these instructions:

1. Double-click the Measurement & Automation Explorer (MAX) icon, shown in Figure 2, on your desktop.



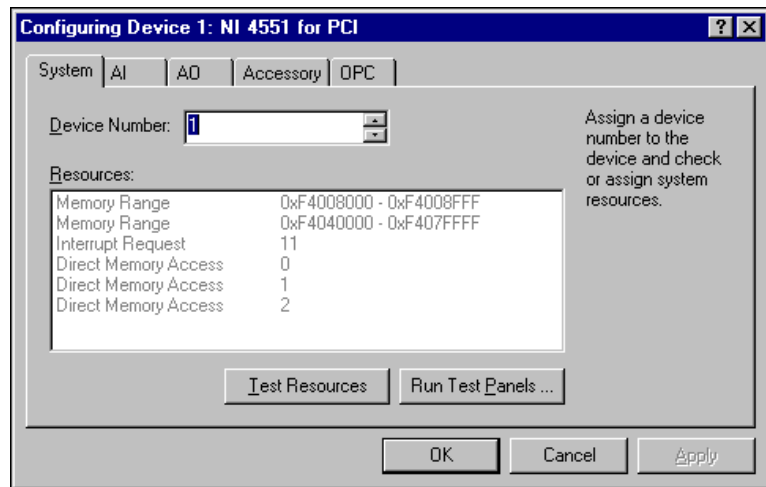
**Figure 2.** Measurement & Automation Explorer Icon

2. In MAX, shown in Figure 3, double-click **Devices and Interfaces** to open the folder, then double-click the icon for the NI 45XX for PCI device you want to test.



**Figure 3.** Measurement & Automation Explorer Window

3. Right-click the **NI 45XX for PCI (Device *n*)** folder and select **Properties** from the pop-up menu to open the Configuring Device dialog box shown in Figure 4.



**Figure 4.** Device Configuration Dialog Box



**Note** The device number and resources assigned to your device may differ from those shown in Figure 4.

4. Click **Test Resources** to test the resource assignments. This test verifies that the PCI system has allocated resources correctly and that your NI 45XX can communicate with your computer. If there are no resource conflicts, a dialog box with the message **The device has passed the test** appears. Click **OK** to continue. If your device

does not pass the test, refer to the [Technical Support](#) section of this document.

## Set Up Your Hardware for Signal Acquisition

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To use your NI 45XX, you must input an analog signal. These instructions assume you will connect your signal to Analog Input Channel 0 (ACH0), but are applicable to any input channel.



**Caution** If you are using the BNC-2140 accessory, and your transducer does not require Integrated Circuit Piezoelectric (ICP®)-type current excitation, be sure the ICP Power switch is in the OFF position to avoid inducing noise on your signal and possibly damaging your transducer. National Instruments is *not* liable for damage caused by incorrect use of ICP power.

To connect a signal source to your instrument, attach a BNC-214X accessory to your NI 45XX with an SHC68-C68-A1 cable (included in your NI 45XX kit), and use a 50  $\Omega$  or 75  $\Omega$  BNC cable to attach the output of your signal source to the ACH0 connector on the BNC-214X; alternatively, you can use custom cables or accessories to attach your signal source. Refer to the *NI 4551/4552 User Manual* for more information on using custom cables and accessories.

### ◆ NI 4551 for PCI

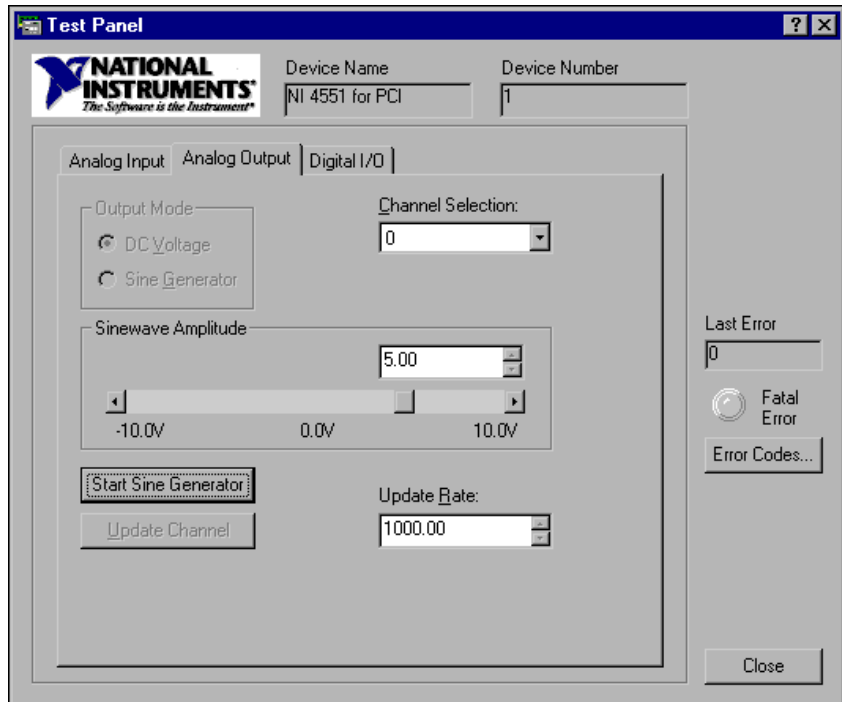
The NI 4551 can generate signals through two analog output channels. You can take advantage of this feature to perform the procedures in this document by generating a signal through an analog output channel, then using that signal as your input. This is useful for testing or familiarizing yourself with the operation of your NI 4551. If you are using another signal source for these procedures, skip to the [Perform a Basic I/O Functionality Test](#) section.

Attach a BNC-214X accessory to your NI 4551 with an SHC68-C68-A1 cable, and use a 50  $\Omega$  or 75  $\Omega$  BNC cable to connect the analog output of Digital-to-Analog Converter 0 (DAC0 OUT) to ACH0 on the BNC-214X; alternatively, you can use custom cables or accessories to connect the signal from DAC0 OUT to ACH0. Refer to the *NI 4551/4552 User Manual* for more information on using custom cables and accessories.

# Perform a Basic I/O Functionality Test

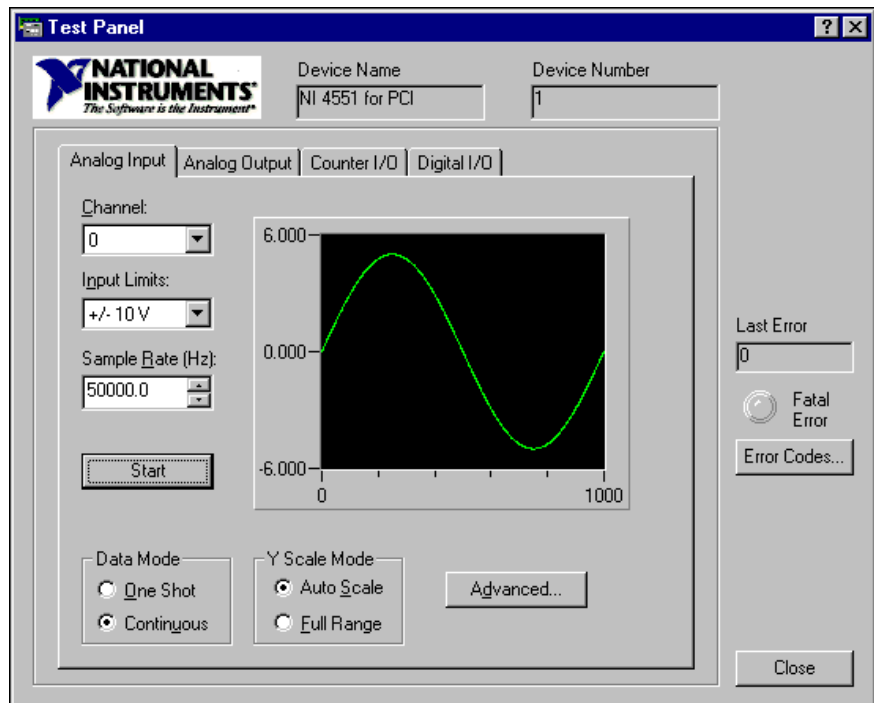
This procedure is a test of the analog I/O circuitry. Follow these instructions to test your NI 45XX:

1. Launch the Test Panel—either click **Run Test Panels** from the Configuring Device dialog box, or right-click your device icon in Measurement & Automation Explorer and select **Test Panel** from the pop-up menu. If you are using an external signal source, go to Step 3.
2. If you have an NI 4551 and will be using its analog output to provide your test signal, click the **Analog Output** tab. Make sure your settings are like those shown in Figure 5. Start the signal output by clicking the **Start Sine Generator** button.



**Figure 5.** Analog Output Test Panel

3. Select the **Analog Input** tab to open the Analog Input Test Panel shown in Figure 6 and set your parameters as follows:
  - **Channel**—Select Channel 0.
  - **Input Limits**—Select the limits value to be large enough to include the entire voltage range of your input signal, but no larger. The **Input Limits** setting determines the gain that is applied to the input signal to ensure maximum use of the entire 16 bits of ADC resolution of the delta sigma converters. In the NI 45XX, the limits correspond to gains from -20 to 60 dB in 10 dB increments.
  - **Sample Rate (Hz)**—Enter a sampling rate that is at least twice the frequency of the highest frequency of your input signal.
  - **Data Mode**—Select **Continuous**.
4. Click **Start** to begin a continuous signal acquisition.



**Figure 6.** Analog Input Test Panel

The Test Panel window displays a graph of the signal you input to the ACH0. Your settings and the waveform displayed may be different from those shown in Figure 6.

# Perform an FFT Analysis Using VirtualBench-DSA

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This section shows you how to use VirtualBench-DSA soft front panels to perform an FFT analysis using the onboard processor and the NI-DSA instrument driver. You can use VirtualBench-DSA to control your NI 45XX without the need to write a program. For more information on using VirtualBench-DSA, refer to the *VirtualBench-DSA Online Reference*, which you can access by selecting **Start»Programs»National Instruments»NI-DSA»VirtualBench-DSA Help** from the Windows taskbar.

These instructions also serve as a test to confirm that the NI-DSA driver is working correctly with the hardware and that the onboard instrument engine is running and communicating with the host.

Set up your hardware as described in the [Set Up Your Hardware for Signal Acquisition](#) section. Then follow these steps:

1. Input a signal to ACH0. For this example we are using a sine wave with a frequency in the 0–20 kHz range.

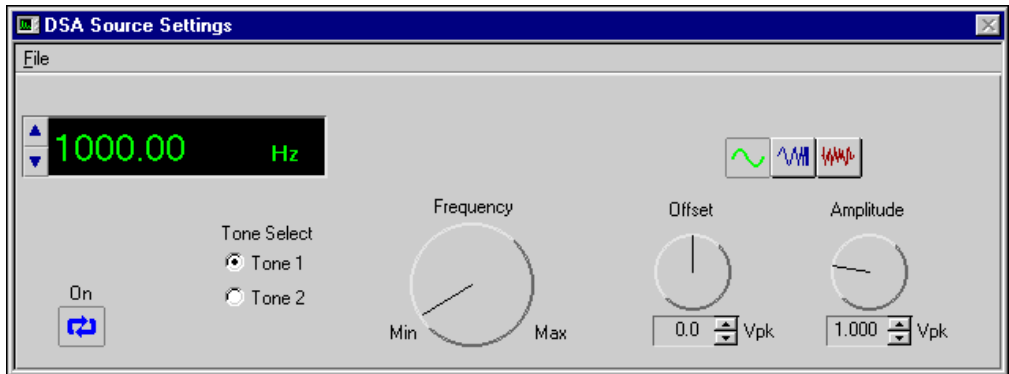


**Caution** Close Measurement & Automation Explorer before running VirtualBench-DSA. Failure to do so will result in a system crash.

2. Launch VirtualBench-DSA from the Windows taskbar by clicking **Start»Programs»National Instruments»NI-DSA»VirtualBench-DSA**.
3. Choose **Edit»Reset Settings** from the VirtualBench-DSA menu bar to restore the default settings for your instrument.
4. If you are using an external signal source, go to Step 7. If you have an NI 4551 and will be using it to provide your signal, choose **Edit»Source Settings** to open the DSA Source Settings instrument panel.

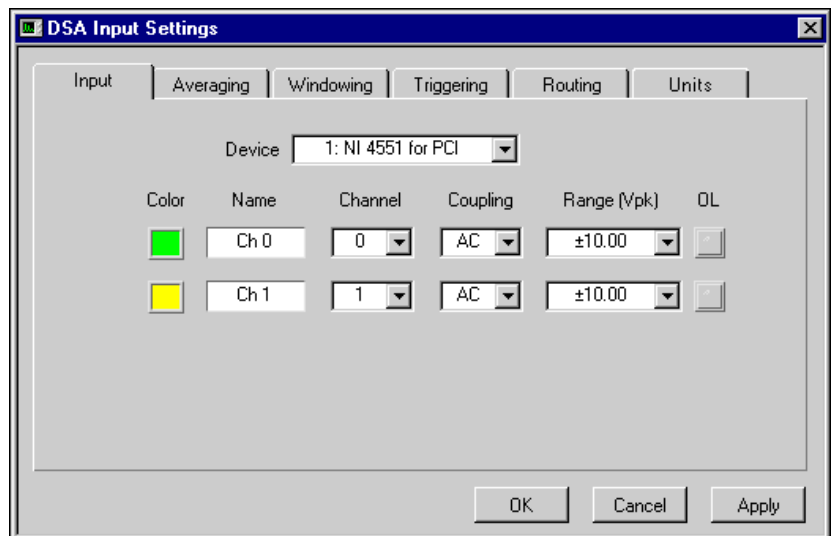


5. Click **On** to generate a sine wave with the default settings, shown in Figure 7, or choose a different frequency and amplitude. Make sure the amplitude is not 0 Vpk.



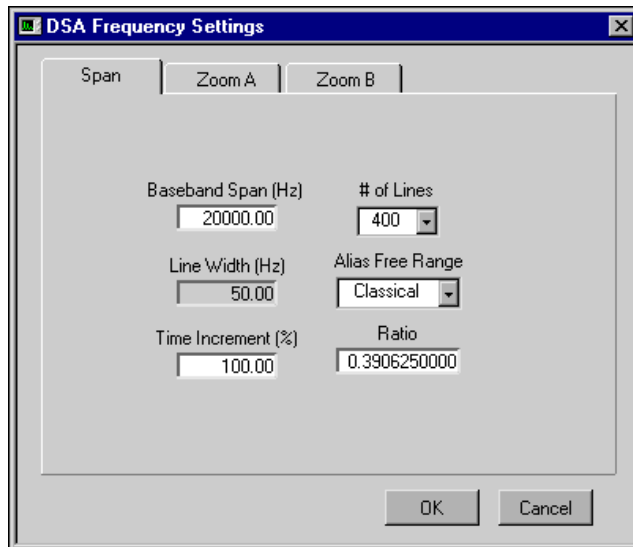
**Figure 7.** DSA Source Settings Panel

6. Return to the main VirtualBench-DSA window.
7. Choose **Edit>Input Settings** to open the DSA Input Settings panel.
8. Click the **Input** tab. Be sure that an NI 45XX for PCI is selected in the **Device** list box. Check that your settings are the same as those shown in Figure 8, with a **Range (Vpk)** value selected that is large enough to include your input signal, but not larger.



**Figure 8.** Virtual Bench-DSA Input Settings Panel

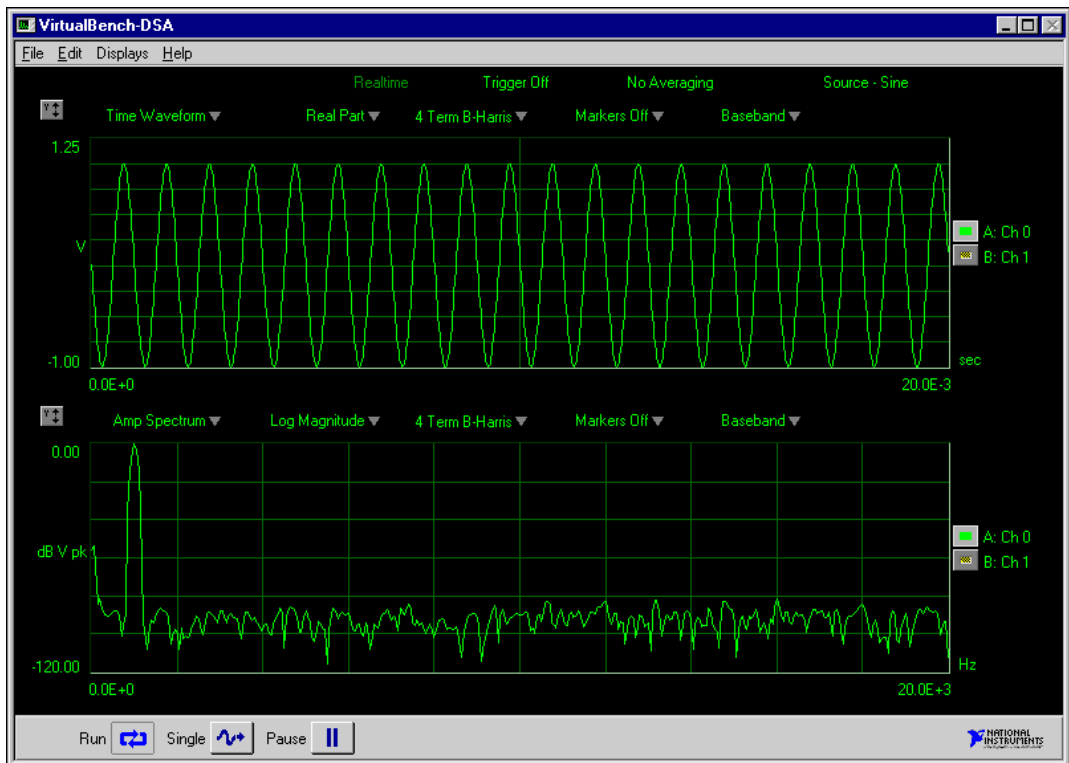
9. Click **OK** to return to the main VirtualBench-DSA window.
10. If your input signal contains no frequencies above 20 kHz, go to step 13. If your input signal contains frequencies of interest above 20 kHz, select **Edit»Frequency Settings** to open the DSA Frequency Settings panel, shown in Figure 9.



**Figure 9.** VirtualBench-DSA Frequency Settings Panel

11. Enter the highest frequency you want to analyze in the **Baseband Span (Hz)** text box.
12. Click **OK** to return to the main VirtualBench-DSA window.

- Click **Run**. The upper graph displays the time-domain waveform, and the lower graph displays the amplitude spectrum for a 400-lines FFT analysis of your input signal with peaks at the frequencies contained in the signal. In this example, the FFT analysis graph has a peak at the fundamental frequency of the input sine wave, as shown in Figure 10.



**Figure 10.** VirtualBench-DSA Main Window

You have now successfully installed, configured, and tested the hardware and software necessary to begin using NI-DSA and your NI 45XX DSA instrument. Now you have the option of continuing to use the ready-to-run VirtualBench-DSA soft front panels to interactively control your instrument, or creating your own programs using an ADE.

# Programming Your NI 45XX

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Unless you chose a different location while installing the NI-DSA software, you will find programming examples for your ADE in one of the following locations:

- LabVIEW—Program Files\National Instruments\LabVIEW\INSTR.LIB\nidsa\
- C, C++, or LabWindows/CVI—Nidsa\examples\cvi\
- Visual Basic—Nidsa\examples\vbasic\

## Technical Support

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If you have questions or encounter problems while installing, testing, or using your NI 45XX digital signal analyzer, you can find answers by clicking **Start»Programs»National Instruments»NI-DSA»DSA Resources** from the Windows taskbar to connect to the National Instruments DSA Resources Web pages.

The DSA Resources Web pages have the latest versions of DSA software, documentation, troubleshooting instructions, product information, and programming examples for the National Instruments NI 45XX DSA instruments.

