USER GUIDE AND SPECIFICATIONS

NI myDAQ

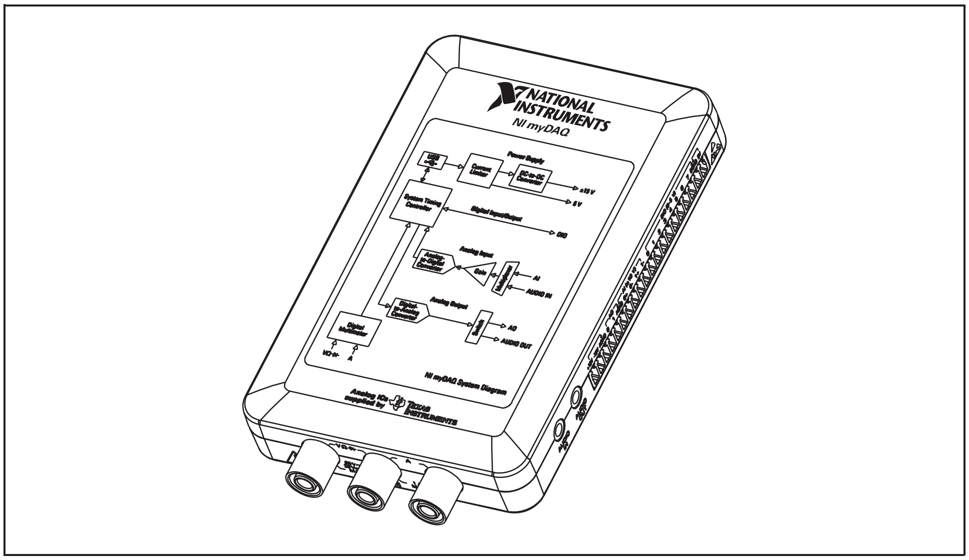


Figure 1. NI myDAQ

NI myDAQ is a low-cost portable data acquisition (DAQ) device that uses NI LabVIEW-based software instruments, allowing students to measure and analyze real-world signals. NI myDAQ is ideal for exploring electronics and taking sensor measurements. Combined with NI LabVIEW on the PC, students can analyze and process acquired signals and control simple processes anytime, anywhere.

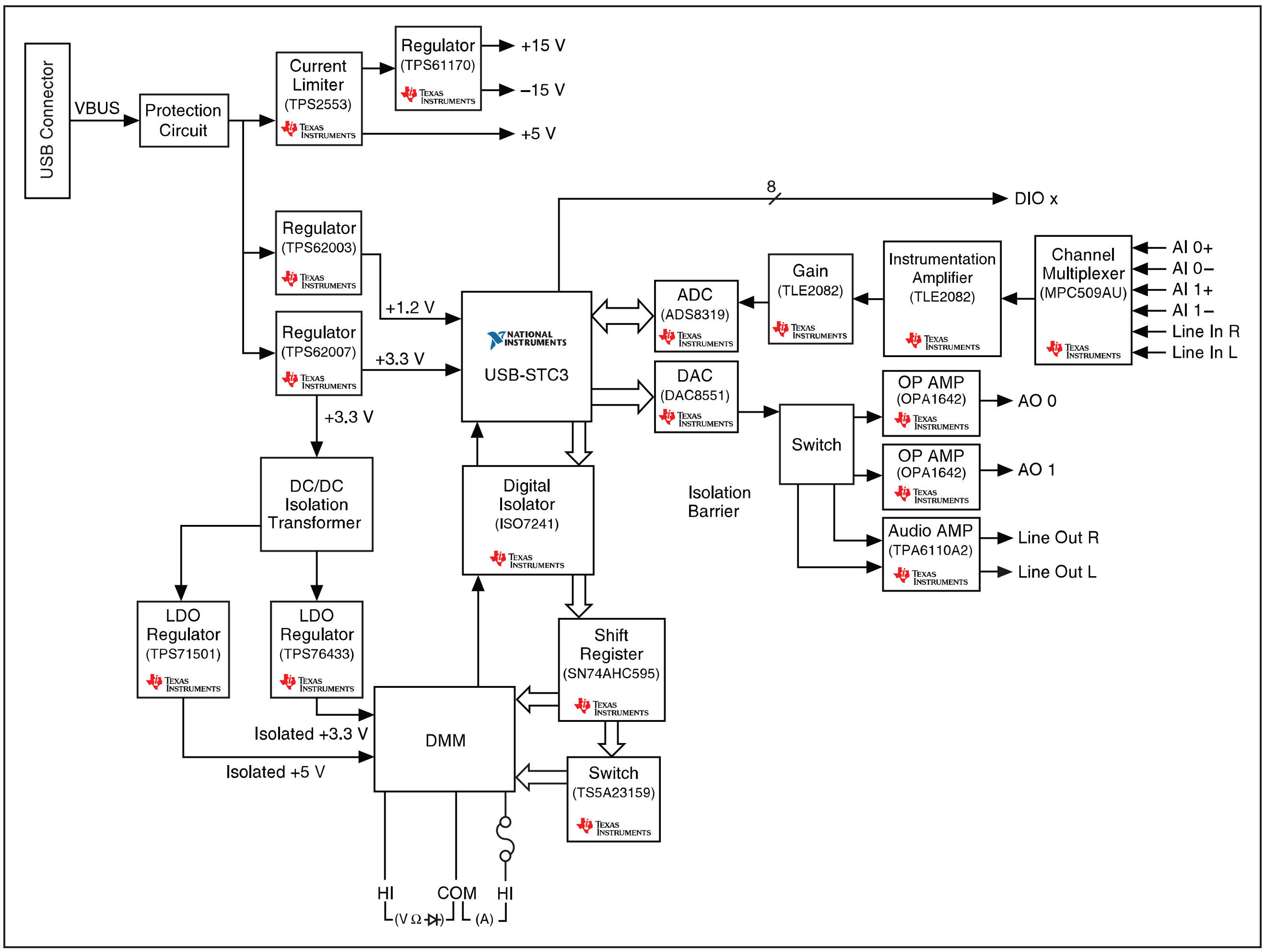
NATIONAL INSTRUMENTS™

NI myDAQ Hardware Overview

NI myDAQ provides analog input (AI), analog output (AO), digital input and output (DIO), audio, power supplies, and digital multimeter (DMM) functions in a compact USB device.

Tip The *Common Terms and Acronyms* section has a list of acronyms and terms that you will see in this manual, and in many engineering and measurement documents and websites.

Integrated circuits supplied by Texas Instruments form the power and analog I/O subsystems of NI myDAQ. Figure 2 depicts the arrangement and function of the NI myDAQ subsystems. Refer to Table 5 for more information on all of the Texas Instruments components used in NI myDAQ.



Note: NI myDAQ components may be changed or substituted without notice.

Figure 2. NI myDAQ Hardware Block Diagram

Analog Input (AI)

There are two analog input channels on NI myDAQ. These channels can be configured either as general-purpose high-impedance differential voltage input or audio input. The analog inputs are multiplexed, meaning a single analog-to-digital converter (ADC) is used to sample both channels. In general-purpose mode, you can measure up to ±10 V signals. In audio mode, the two channels represent left and right stereo line level inputs. Analog inputs can be measured at up to 200 kS/s per channel, so they are useful for waveform acquisition. Analog inputs are used in the NI ELVISmx Oscilloscope, Dynamic Signal Analyzer, and Bode Analyzer instruments.

Analog Output (AO)

There are two analog output channels on NI myDAQ. These channels can be configured as either general-purpose voltage output or audio output. Both channels have a dedicated digital-to-analog converter (DAC), so they can update simultaneously. In general-purpose mode, you can generate up to ±10 V signals. In audio mode, the two channels represent left and right stereo outputs.

Caution If using earphones to listen to the audio output of the NI myDAQ, ensure that the volume is set to a safe level. Listening to audio signals at a high volume may result in permanent hearing loss.

Analog outputs can be updated at up to 200 kS/s per channel, making them useful for waveform generation. Analog outputs are used in the NI ELVISmx Function Generator, Arbitrary Waveform Generator, and Bode Analyzer instruments.

Power Supplies

There are three power supplies available for use on NI myDAQ. +15 V and –15 V can be used to power analog components such as operational amplifiers and linear regulators. +5 V can be used to power digital components such as logic devices.

The total power available for the power supplies, analog outputs, and digital outputs is limited to 500 mW (typical)/100 mW (minimum). To calculate the total power consumption of the power supplies, multiply the output voltage by the load current for each rail and sum them together. For digital output power consumption, multiply 3.3 V by the load current. For analog output power consumption, multiply 15 V by the load current. Using audio output subtracts 100 mW from the total power budget.

For example, if you use 50 mA on +5 V, 2 mA on +15 V, 1 mA on –15 V, use four DIO lines to drive LEDs at 3 mA each, and have a 1 mA load on each AO channel, the total output power consumption is:

$5\ \text{V} \times 50\ \text{mA} = 250\ \text{mW}$

$|+15\ \text{V}| \times 2\ \text{mA} = 30\ \text{mW}$

$|-15\ \text{V}| \times 1\ \text{mA} = 15\ \text{mW}$

$3.3\ \text{V} \times 3\ \text{mA} \times 4 = 39.6\ \text{mW}$

$15\ \text{V} \times 1\ \text{mA} \times 2 = 30\ \text{mW}$

Total output power consumption = 250 mW + 30 mW + 15 mW + 39.6 mW + 30 mW = 364.6 mW

Digital Multimeter (DMM) Overview

The NI myDAQ DMM provides the functions for measuring voltage (DC and AC), current (DC and AC), resistance, and diode voltage drop.

DMM measurements are software-timed, so update rates are affected by the load on the computer and USB activity.

Getting Started

Caution For EMC compliance, the USB cable must be less than 2.0 m (6.6 ft) in length. Also, wires attached to the MIO screw terminal connector must be limited to 30.0 cm (11.8 in.) in length.

Getting started with NI myDAQ is a simple process, but it is important to ensure that you install the right components in the correct order. To get started with your NI myDAQ, complete the following steps:

1. Install the NI myDAQ Software Suite from the DVD shipped with your device.

   The NI myDAQ Software Suite installs application software (NI LabVIEW, NI Multisim) first, and then installs the NI ELVISmx driver software.

Note If you are not installing software from the NI myDAQ Software Suite media, make sure to install all application software before installing the driver software.

2. Connect the cable from the computer Hi-Speed USB port to the USB port on the device.

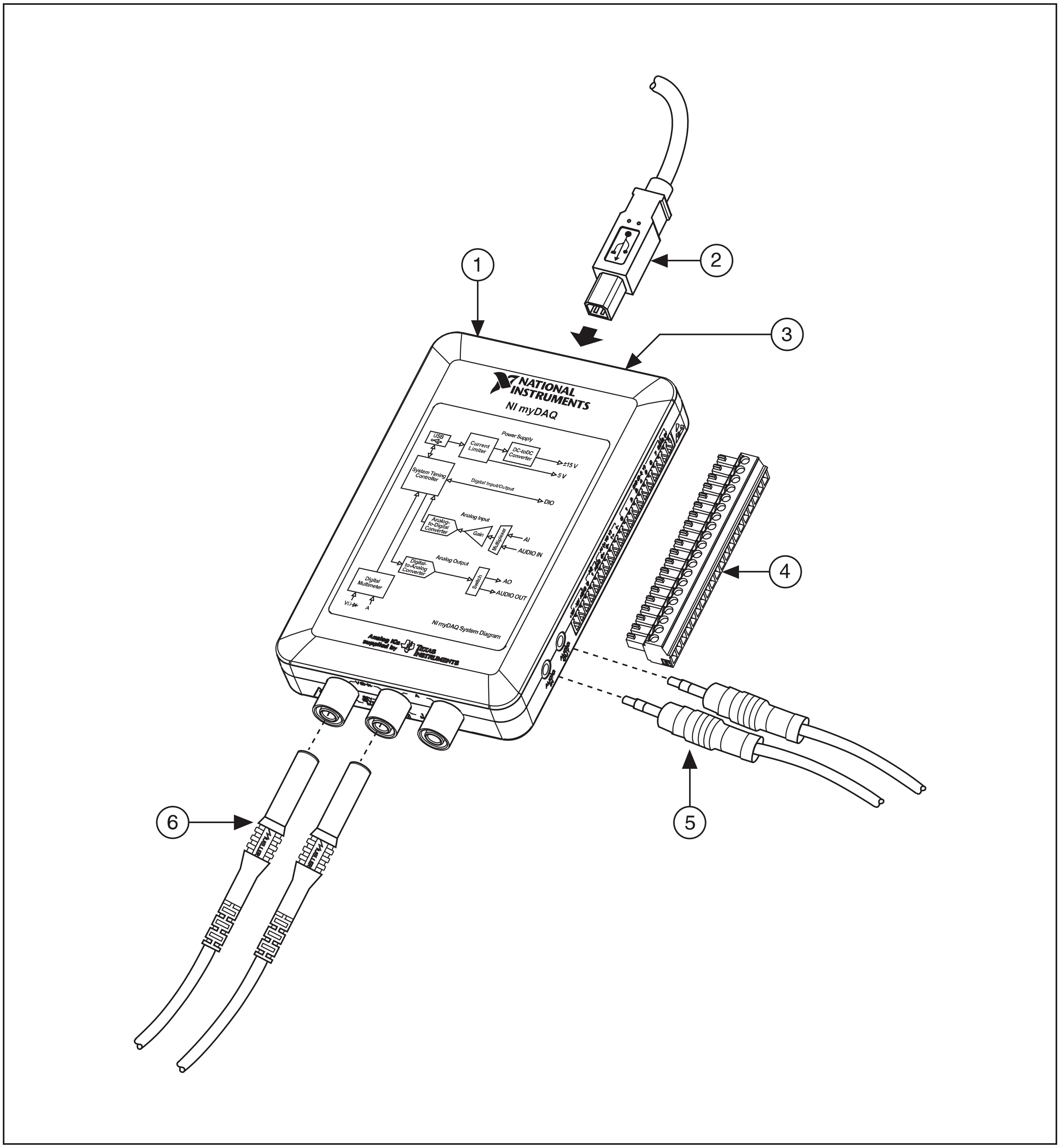
   The computer will recognize the NI myDAQ and the NI ELVISmx Instrument Launcher appears. You can also manually open NI ELVISmx Instrument Launcher by selecting **Start»All Programs» National Instruments»NI ELVISmx for NI ELVIS & NI myDAQ» NI ELVISmx Instrument Launcher**.

Making Signal Connections with NI myDAQ

Setting up Your NI myDAQ Device

Cautions Insert and remove the 20-position screw terminal connector aligned evenly to the NI myDAQ. Inserting the screw terminal connector at an angle to the NI myDAQ may cause damage to the connector.

The screw terminal connector *must* snap securely into place to ensure proper signal connection.



1	NI myDAQ	4	20-Position Screw Terminal Connector
2	USB Cable	5	Audio Cable
3	LED	6	DMM Banana Cable

Figure 3. NI myDAQ Connection Diagram

Connecting Signals

Figure 4 shows the available audio, AI, AO, DIO, GND, and power signals accessed through the 3.5 mm audio jacks and screw terminal connections. Refer to Table 1 for descriptions of these signals.

Caution Signal wires *must* be securely affixed and screwed down in the screw terminal connector to ensure proper connection.

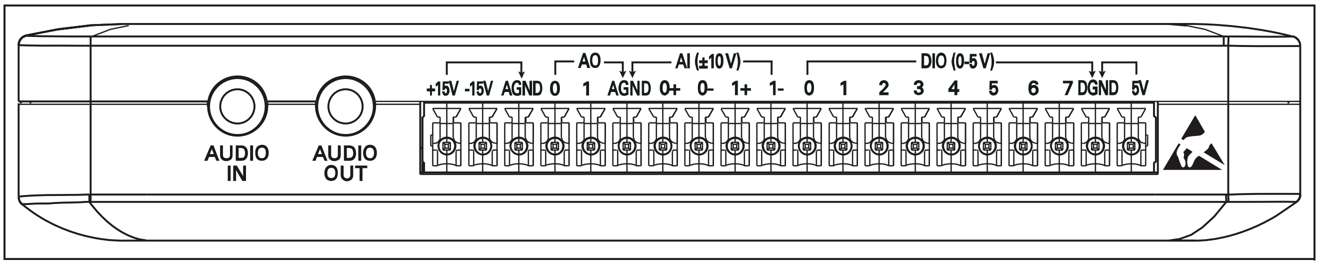


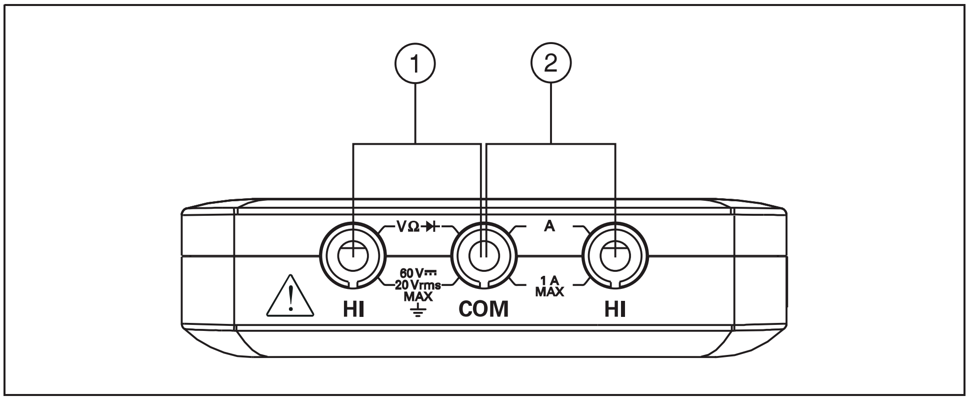
Figure 4. NI myDAQ 20-Position Screw Terminal I/O Connector

Table 1. Screw Terminal Signal Descriptions

Signal Name	Reference	Direction	Description
AUDIO IN	—	Input	**Audio Input**—Left and right audio inputs on a stereo connector
AUDIO OUT	—	Output	**Audio Output**—Left and right audio outputs on a stereo connector
+15V/–15V	AGND	Output	+15 V/–15 V power supplies
AGND	—	—	**Analog Ground**—Reference terminal for AI, AO, +15 V, and –15 V
AO 0/AO 1	AGND	Output	Analog Output Channels 0 and 1
AI 0+/AI 0–; AI 1+/AI 1–	AGND	Input	Analog Input Channels 0 and 1
DIO <0..7>	DGND	Input or Output	**Digital I/O Signals**—General-purpose digital lines or counter signals
DGND	—	—	**Digital Ground**—Reference for the DIO lines and the +5 V supply
5V	DGND	Output	5 V power supply

Figure 5 shows the DMM connections on the NI myDAQ. Table 2 describes these signals.

Caution 60 VDC/20 Vrms maximum. *Do not* plug digital multimeter probes into circuits with Hazardous Voltages, such as wall outlets.



1 Connectors for Voltage/Resistance/Diode/Continuity
2 Connectors for Current

Figure 5. Connections for DMM Measurements

Table 2. DMM Signal Descriptions

Signal Name	Reference	Direction	Description
HI (V)	COM	Input	Positive terminal for voltage, resistance, and diode measurements
COM	—	—	Reference for all DMM measurements
HI (A)	COM	Input	Positive terminal for current measurements (Fused: F 1.25 A 250 V Fast-Acting)

Connecting Analog Input Signals

When configuring the input channels and making signal connections, you must first determine whether the signal sources are floating or ground referenced. The following sections describe these two signal types.

Ground-Referenced Signal Sources

A ground-referenced signal source is connected to the building system ground, so it is already connected to a common ground point with respect to the NI myDAQ device, assuming that the computer is plugged into the same power system. Instruments or devices with nonisolated outputs that plug into the building power system are ground-referenced signal sources.

Note Most laptop computers have isolated power supplies, and are consequently not connected to the building ground system. In these cases, treat the analog input signal as floating with respect to NI myDAQ.

The difference in ground potential between two instruments connected to the same building power system is typically between 1 and 100 mV. This difference can be much higher if power distribution circuits are improperly connected. If a grounded signal source is improperly measured, this difference might appear as a measurement error. Connect the differential analog inputs across the signal source and do not connect the NI myDAQ AGND pin to the grounded source.

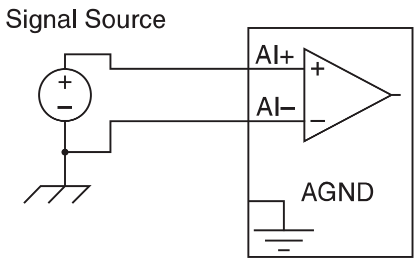


Figure 6. Ground-Referenced Differential Connection

Floating Signal Sources

A floating signal source is not connected to the same ground reference as NI myDAQ, but instead has an isolated reference point. Some examples of floating signal sources are battery-powered devices, outputs of transformers, thermocouples, optical isolator outputs, and isolation amplifiers. An instrument or device that has an isolated output is a floating signal source. You must connect the ground reference of a floating signal to an NI myDAQ AGND pin through a bias resistor or jumper wire to establish a local or onboard reference for the signal. Otherwise, the measured input signal varies as the source floats out of the common-mode input range.

The easiest way to reference the source to AGND is to connect the positive side of the signal to AI+ and connect the negative side of the signal to AGND as well as to AI– without using resistors. This connection works well for DC-coupled sources with low source impedance (less than 100 Ω).

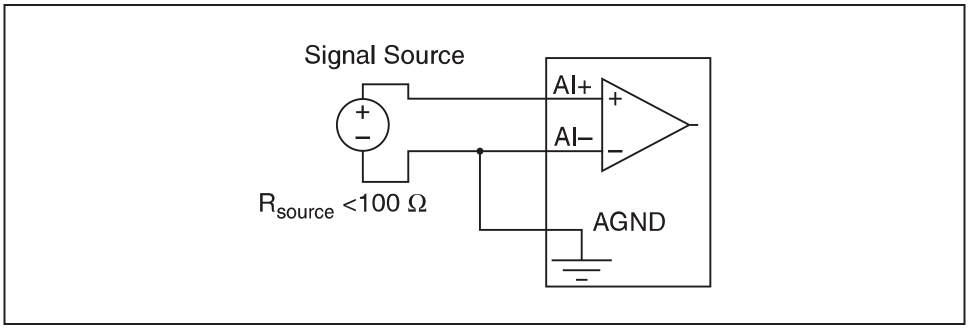


Figure 7. Differential Connections for Floating Signal Sources without Resistors

For larger source impedances, however, this connection leaves the differential signal path significantly off balance. Noise that couples electrostatically onto the positive line does not couple onto the negative line because it is connected to ground. This noise appears as a differential-mode signal instead of a common-mode signal, and thus appears in your data. In this case, instead of directly connecting the negative line to AGND, connect the negative line to AGND through a resistor that is about 100 times the equivalent source impedance. The resistor puts the signal path nearly in balance, so that about the same amount of noise couples onto both connections, yielding better rejection of electrostatically coupled noise. This configuration does not load down the source.

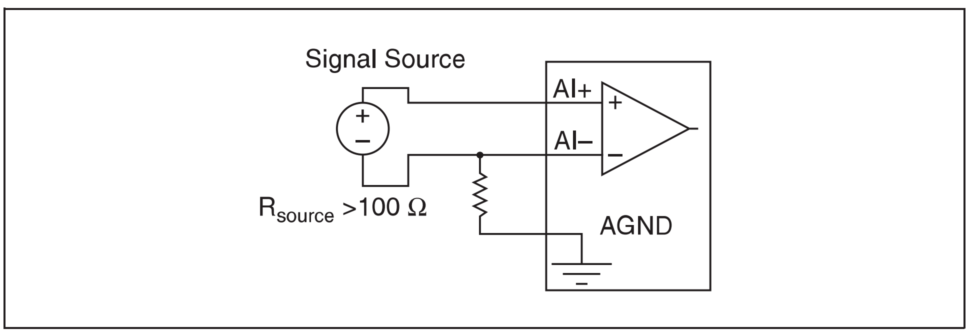


Figure 8. Differential Connections for Floating Signal Sources a Single Resistor

You can fully balance the signal path by connecting another resistor of the same value between the positive input and AGND, as shown in Figure 9. This fully balanced configuration offers slightly better noise rejection, but has the disadvantage of loading the source down with the series combination (sum) of the two resistors. If, for example, the source impedance is 2 kΩ and each of the two resistors is 100 kΩ, the resistors load down the source with 200 kΩ and produce a –1% gain error.

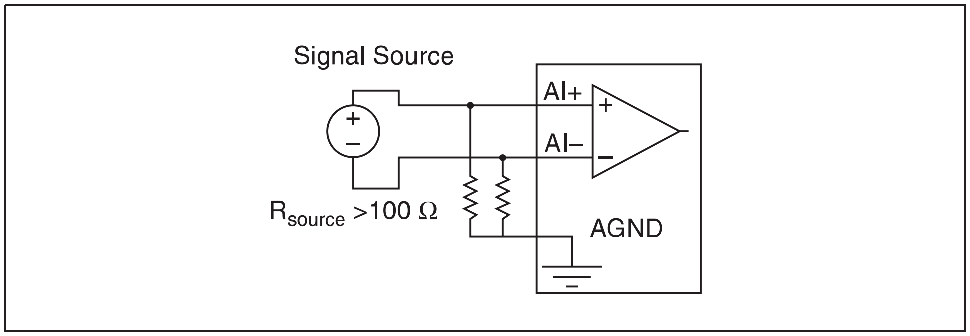


Figure 9. Differential Connections for Floating Signal Sources with Two Resistors

Both positive and negative analog input lines require a DC path to ground in order for the instrumentation amplifier to work. If the source is AC coupled (capacitively coupled), a resistor is needed between the positive input and AGND. If the source has low impedance, choose a resistor that is large enough not to significantly load the source but small enough not to produce significant input offset voltage as a result of input bias current (typically 100 kΩ to 1 MΩ). In this case, connect the negative input directly to AGND. If the source has high output impedance, balance the signal path as previously described using the same value resistor on both the positive and negative inputs.

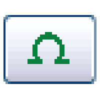
NI myDAQ DMM Fuse Replacement

NI myDAQ has a fuse to protect the device from overcurrent through HI (A) current measurement input on the DMM. If the DMM soft front panel (SFP) always reads 0 A current, the cause may be a blown fuse.

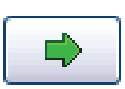
Testing Your Fuse

To test for a blown fuse, complete the following steps.

1. Using a banana cable, connect the **HI (V)** and **HI (A)** DMM terminals.
2. Launch the NI ELVISmx Digital Multimeter (DMM) Soft Front Panel instrument from the NI ELVISmx Instrument Launcher, located at **Start»All Programs»National Instruments»NI ELVISmx for NI ELVIS & NI myDAQ»NI ELVISmx Instrument Launcher**.



3. Select the **Resistance** mode.
4. Set the Range to **200** Ω.



5. Click **Run**.
6. If the fuse is blown, the display will show **`+Over`**, indicating a disconnected circuit path. Replace the fuse and complete the procedure again.

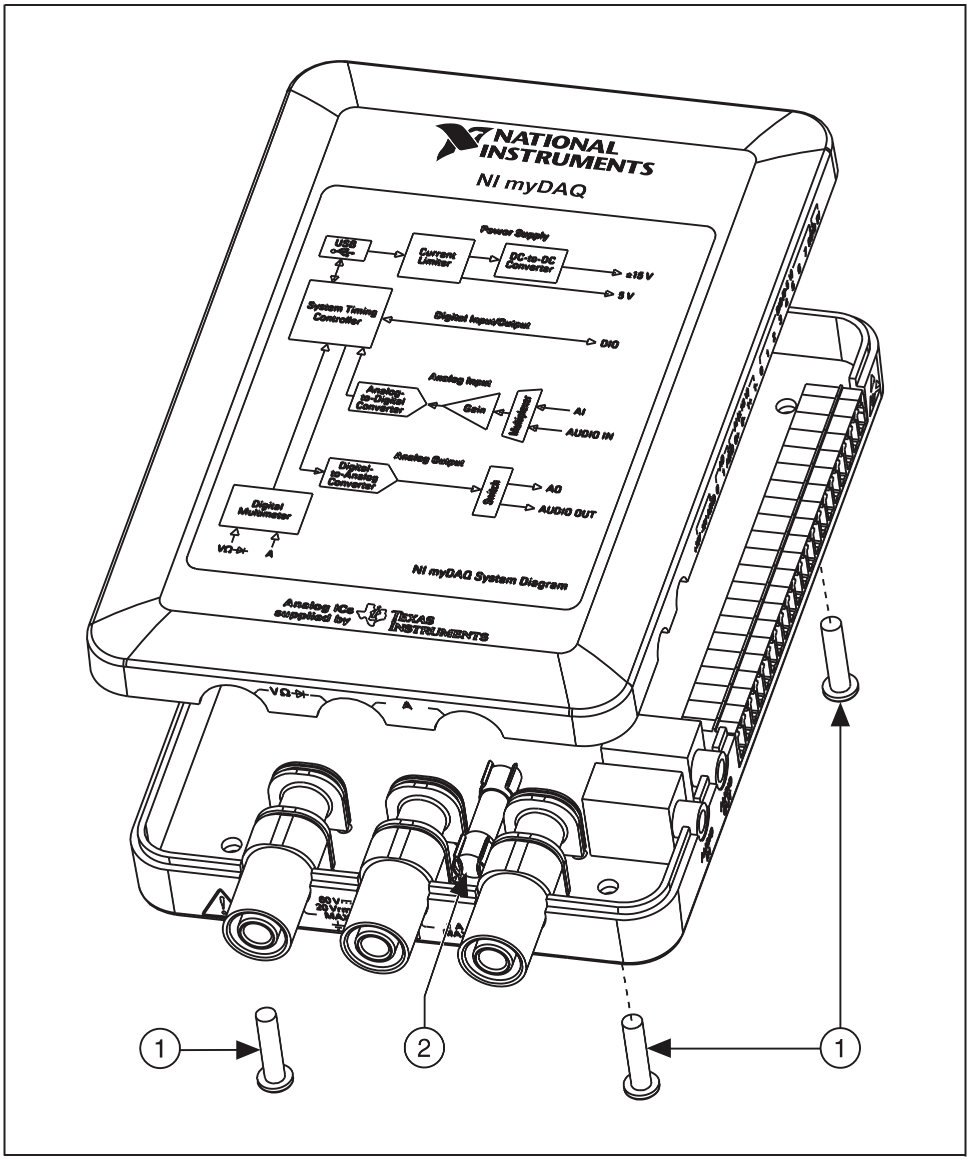
Replacing the Fuse

Replace broken fuses with a 1.25 A Fast-Acting 5X20 fuse (Littelfuse part number 02161.25 at `www.littelfuse.com`).

To replace a broken fuse, complete the following steps.

1. Power down the device by properly disconnecting it from the PC and removing the USB cable.
2. Remove the screw terminal connector and all other signal cables from the device.
3. Loosen the four Phillips screws that attach the bottom of the enclosure to the device, and remove the top lid of the enclosure.

4. Replace the broken fuse while referring to Figure 10 for the fuse location.



1 Enclosure Screws
2 Internal Fuse—1.25 A Fast-Acting (Littelfuse Part Number 02161.25)

Figure 10. NI myDAQ Fuse Location

5. Replace the lid and screws.

Digital Multimeter (DMM)

NI ELVISmx Digital Multimeter (DMM) is a stand-alone instrument that controls the basic DMM capabilities of NI myDAQ. This commonly used instrument can perform the following types of measurements:

- Voltage (DC and AC)
- Current (DC and AC)
- Resistance
- Diode test
- Audible continuity

Make connections for measurements to the DMM banana jacks on the device. This instrument has the following measurement parameters:

- DC voltage: 60 V, 20 V, 2 V, and 200 mV ranges
- AC voltage: 20 V, 2 V, and 200 mV ranges
- DC current: 1 A, 200 mA, and 20 mA ranges
- AC current: 1 A, 200 mA, and 20 mA ranges
- Resistance: 20 MΩ, 2 MΩ, 200 kΩ, 20 kΩ, 2 kΩ, and 200 Ω ranges
- Diode: 2 V range
- Resolution (number of significant digits for display): 3.5

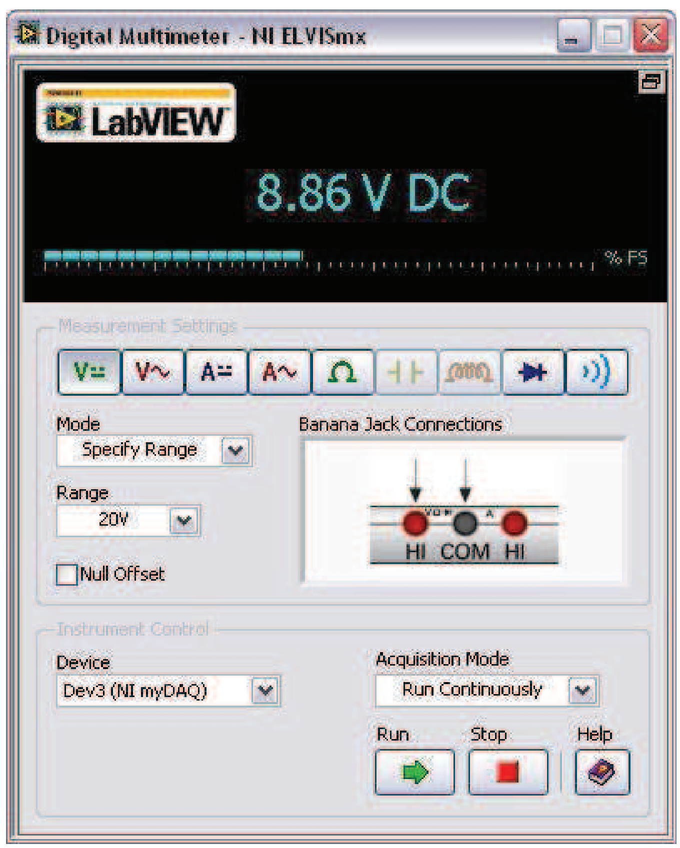


Figure 12. NI ELVISmx Digital Multimeter SFP

Oscilloscope (Scope)

The NI ELVISmx Oscilloscope (Scope) displays voltage data for analysis. This instrument provides the functionality of the standard desktop oscilloscope found in typical undergraduate laboratories. The NI ELVISmx Oscilloscope SFP has two channels and provides scaling and position adjustment knobs along with a modifiable timebase. The autoscale feature allows you to adjust the voltage display scale based on the peak-to-peak voltage of the AC signal for the best display of the signal.

The computer-based scope display has the ability to use cursors for accurate screen measurements. This instrument has the following measurement parameters:

- Channel Source: Channels AI 0 and AI 1; AudioInput Left, and AudioInput Right. You can use AI channels or AudioInput channels, but not a combination of both.
- Coupling: AI Channels support DC Coupling only. AudioInput Channels support AC Coupling only.
- Scale Volts/Div: AI channels—5 V, 2 V, 1 V, 500 mV, 200 mV, 100 mV, 50 mV, 20 mV, 10 mV and for AudioInput Channels—1 V, 500 mV, 200 mV, 100 mV, 50 mV, 20 mV, 10 mV.
- Sample Rate: The Max Sample Rate available for AI and AudioInput Channels: 200 kS/s when either one or both channels are configured.
- Timebase Time/Div: The available values for both AI and AudioInput channels: 200 ms to 5 µs.
- Trigger settings: Immediate and Edge Trigger Types are supported. When using Edge Trigger Type, you can specify a Horizontal Position of 0%–100%.

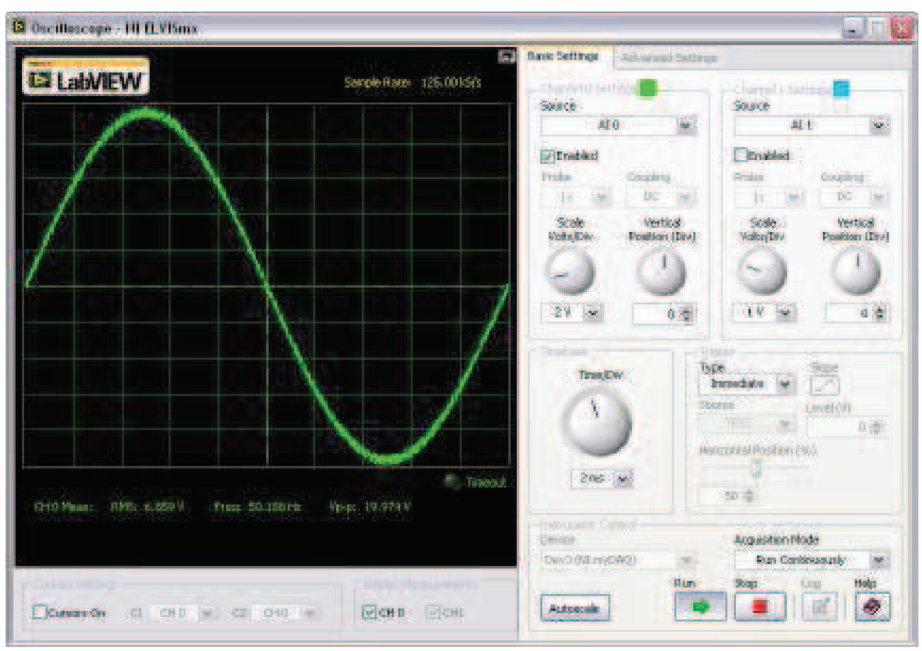


Figure 13. NI ELVISmx Oscilloscope SFP

Function Generator (FGEN)

The NI ELVISmx Function Generator (FGEN) generates standard waveforms with options for the type of output waveform (sine, square, or triangle), amplitude selection, and frequency settings. In addition, the instrument offers DC offset setting, frequency sweep capabilities, and amplitude and frequency modulation. The FGEN uses AO 0 on the screw terminal connector.

This instrument has the following measurement parameters:

- Output channel: AO 0
- Frequency range: 0.2 Hz to 20 kHz

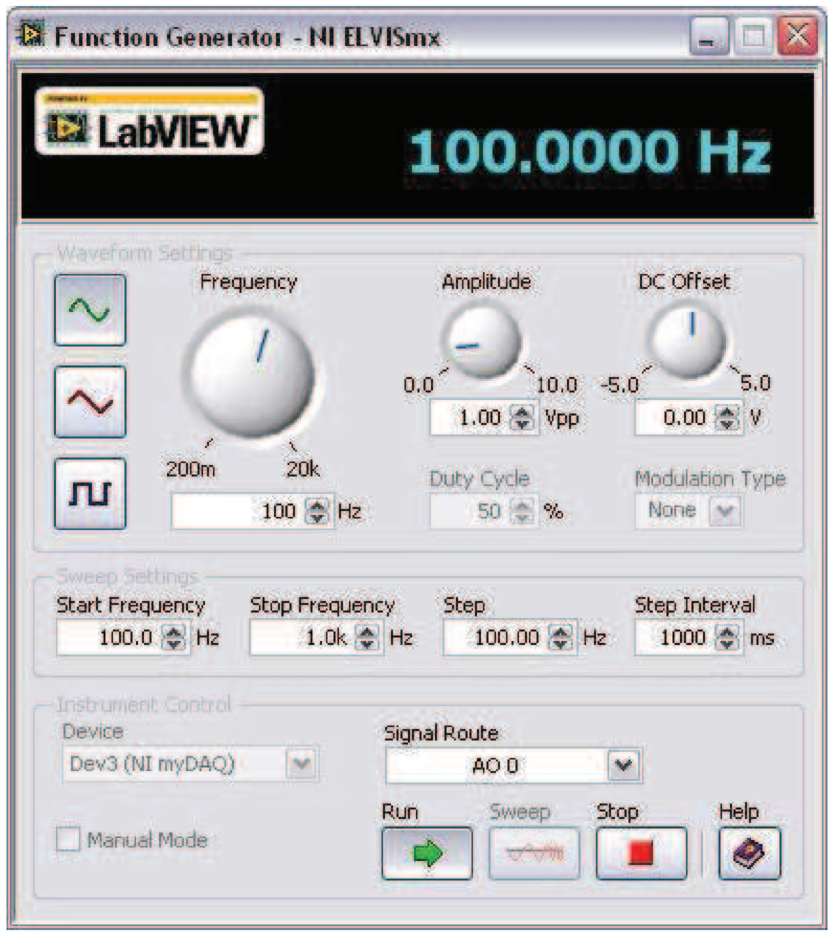


Figure 14. NI ELVISmx Function Generator SFP

Bode Analyzer

The NI ELVISmx Bode Analyzer produces a Bode plot for analysis. By combining the frequency sweep feature of the function generator and the analog input capability of the device, a full-function Bode Analyzer is available with NI ELVISmx. You can set the frequency range of the instrument and choose between linear and logarithmic display scales. You can also invert the measured values of the input signal during Bode analysis by inverting the Op-Amp signal polarity. Refer to the *NI ELVISmx Help* for required hardware connections. To access this help file, go to **Start» All Programs»National Instruments»NI ELVISmx for NI ELVIS & NI myDAQ»NI ELVISmx Help**.

This instrument has the following measurement parameters:

- Stimulus measurement channel: AI 0
- Response measurement channel: AI 1
- Stimulus signal source: AO 0
- Frequency range: 1 Hz to 20 kHz

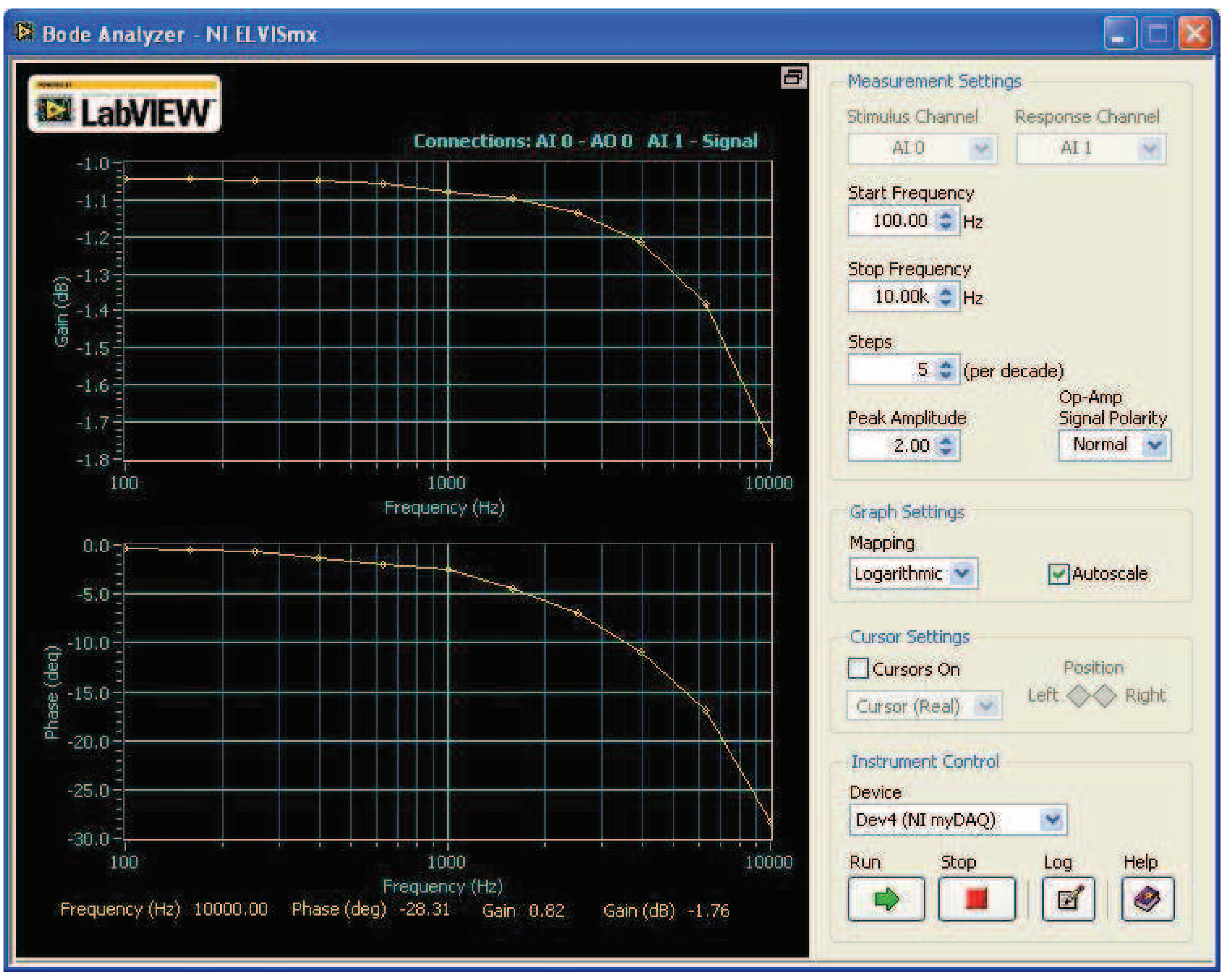


Figure 15. NI ELVISmx Bode Analyzer SFP

Dynamic Signal Analyzer (DSA)

The NI ELVISmx Dynamic Signal Analyzer (DSA) performs a frequency domain transform of the AI or Audio Input waveform measurement. It can either continuously make measurements or make a single scan. You can also apply various window and filtering options to the signal.

This instrument has the following measurement parameters:

- Source Channel: AI 0 and AI 1; AudioInput Left and AudioInput Right
- Voltage Range:
  - For AI channels: ±10 V, ±2 V
  - For AudioInput channels: ±2 V

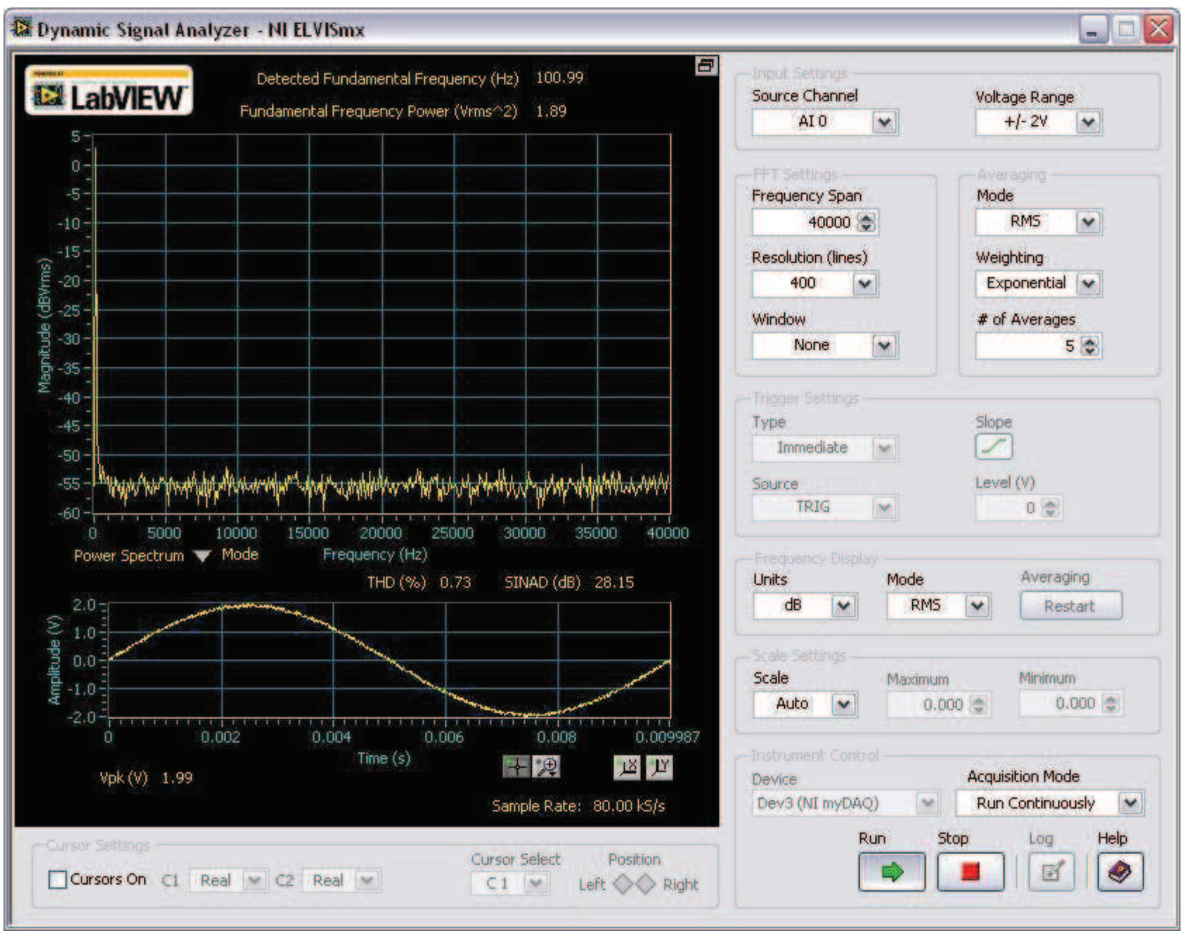


Figure 16. NI ELVISmx Dynamic Signal Analyzer SFP

NI-DAQmx

NI-DAQmx Help—This help file explains key NI-DAQmx concepts, describes how to create common applications, and details device-specific information needed to use NI-DAQmx.

Other Resources

`ni.com/mydaq`—Contains product information, support information, and helpful links to tutorials, examples, curriculum, videos, and more.

Common Terms and Acronyms

Table 7 lists some commonly used acronyms in data acquisition and measurement.

Table 7. Commonly Used Acronyms

Acronym	Definition	Description
ADC	Analog-to-digital converter	Device that converts analog signals into digital data.
AI/AO	Analog input/analog output	A continuous signal that conveys data from physical phenomena such as temperature, strain, pressure, sound, or light.
DAC	Digital-to-analog converter	Device that converts digital code into analog signals.
DAQ	Data acquisition	Measuring an electrical or physical phenomenon such as voltage, current, or temperature using a combination of hardware and software.
DIO	Digital input/output	A non-continuous signal that conveys data in digits or pulses that can be logged as digital data or converted into an analog signal for viewing.
GND	Ground	The ground or earth reference in a circuit.
MIO	Multifunction input/output	The collective term for multiple measurements types, such as AI, AO, DIO, GND, and power signals.
PFI	Programmable Function Interface	A signal that can be configured for different uses, such as a digital input, a digital output, a timing input, or a timing output.
SFP	Soft front panel	The software-based user interface for your NI ELVISmx instrument.
VI	Virtual Instrument	A software program and hardware device that work together to create a user-defined measurement system.