NI Educational Laboratory Virtual Instrumentation Suite II (NI ELVIS™ II) User Manual

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NATIONAL INSTRUMENTS™

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Conventions

The following conventions are used in this manual:

<> Angle brackets that contain numbers separated by an ellipsis represent a range of values associated with a bit or signal name—for example, AO <3..0>.

» 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.

 This icon denotes a caution, which advises you of precautions to take to avoid injury, data loss, or a system crash. When this icon is marked on the product, refer to the *Read Me First: Safety and Radio-Frequency Interference* document, shipped with the product, for precautions to take.

 When symbol is marked on a product, it denotes a warning advising you to take precautions to avoid electrical shock.

 When symbol is marked on a product, it denotes a component that may be hot. Touching this component may result in bodily injury.

bold Bold text denotes items that you must select or click 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. Italic text 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.

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1

About NI ELVIS II

This document contains information about the National Instruments Educational Laboratory Virtual Instrumentation Suite II (NI ELVIS II) architecture and instruments.

This chapter provides an overview of the NI ELVIS II and its possible uses in various academic disciplines.

Note Refer to the *Where to Start with NI ELVIS II* document for information about how to set up the NI ELVIS II.

What You Need to Get Started

Refer to *Where to Start with NI ELVIS II* for a list of hardware, software, documentation, and tools you need to set up and use the NI ELVIS II.

NI ELVIS II Overview

NI ELVIS II uses LabVIEW-based software instruments and a custom-designed benchtop workstation and prototyping board to provide the functionality of a suite of common laboratory instruments.

NI ELVISmx is the software that supports NI ELVIS II hardware. It provides the following LabVIEW soft front panels (SFPs):

- Arbitrary Waveform Generator (ARB)
- Bode Analyzer
- Digital Reader
- Digital Writer
- Digital Multimeter (DMM)
- Dynamic Signal Analyzer (DSA)
- Function Generator (FGEN)
- Impedance Analyzer
- Oscilloscope (Scope)

- Two-Wire Current Voltage Analyzer
- Three-Wire Current Voltage Analyzer
- Variable Power Supplies

Also included are LabVIEW Express VIs and SignalExpress steps to program NI ELVIS II in these environments as well as NI ELVIS instruments integrated into NI Multisim.

Refer to Figure 2-1, *Typical NI ELVIS II System*, for an illustration of NI ELVIS II.

NI ELVIS II in Academic Disciplines

You can use NI ELVIS II in engineering, physical sciences, and biological sciences laboratories. Instructors can implement the NI ELVIS II curriculum with beginning to advanced classes to provide hands-on experience to students.

NI ELVIS II in Engineering

NI ELVIS II is suited for teaching basic electronics and circuit design to students in electrical engineering, mechanical engineering, and biomedical engineering. The suite offers full testing, measurement, and datalogging capabilities needed for such training. Students can use the removable NI ELVIS II Series Prototyping Board (prototyping board) at home to build circuits, thus using laboratory time more effectively.

NI ELVIS II SFP instruments, such as the Bode Analyzer and Dynamic Signal Analyzer, offer instructors an opportunity to teach advanced courses in signal analysis and processing. For example, students can construct software filters in LabVIEW and hardware filters on the prototyping board and compare the performance.

Mechanical engineering students can learn sensor and transducer measurements, in addition to basic circuit design by building custom signal conditioning. Students can install custom sensor adapters on the prototyping board. For example, installing a thermocouple jack on the prototyping board allows robust thermocouple connections. The programmable power supply can provide excitation for strain gauges used in strain measurements.

NI ELVIS II in Biological Sciences

Caution The NI ELVIS II hardware is *not* environmentally sealed; therefore, exercise caution when using NI ELVIS II in chemical and biological applications.

Biomedical engineering departments have challenges that are similar to those of mechanical departments. Students typically learn basic electronics and build instruments such as those used to measure temperature. The prototyping board offers signal conditioning capability for temperature sensors, and the NI ELVISmx SFP instruments are ideal for testing the circuits as students build the signal conditioning circuits.

NI ELVIS II in Physical Sciences

Physics students typically learn electronics and circuit design theory. NI ELVIS II provides these students with the opportunity to implement these concepts. For example, physics students can use NI ELVIS II to build signal conditioning circuits for common sensors such as photoelectric multipliers or light detector sensors.

Related Documentation

The following documents contain information that you might find helpful as you read this manual:

- *Where to Start with NI ELVIS II*, available in PDF format on the NI ELVIS II Software CD.
- *NI ELVISmx Help*, available on the NI ELVISmx Software CD.
- *NI ELVIS II Specifications*, available at `zone.ni.com/manuals`.
- *NI ELVIS II Theory of Operations*, available at `zone.ni.com`.
- *Getting Started with LabVIEW*, available by selecting **National Instruments»LabVIEW *x.x*»LabVIEW Manuals**.
- *LabVIEW Help*, available by selecting **Help»VI, Function, and How-To Help** from the LabVIEW block diagram or front panel.
- *LabVIEW Fundamentals*, available by selecting **National Instruments»LabVIEW *x.x*»LabVIEW Manuals**.
- *Measurement & Automation Explorer Help for DAQmx*, available by selecting **Help»Help Topics»NI-DAQmx** from the Measurement & Automation Explorer (MAX) window.
- *Getting Started with SignalExpress*, available by selecting **National Instruments»LabVIEW SignalExpress**.

- *NI Express Workbench Help*, available by selecting **Help»Express Workbench Help** from the SignalExpress window.
- *Using NI ELVISmx Instruments in NI Multisim*, available in the NI Multisim *Help*.
- `ni.com/academic` for various academic resources.

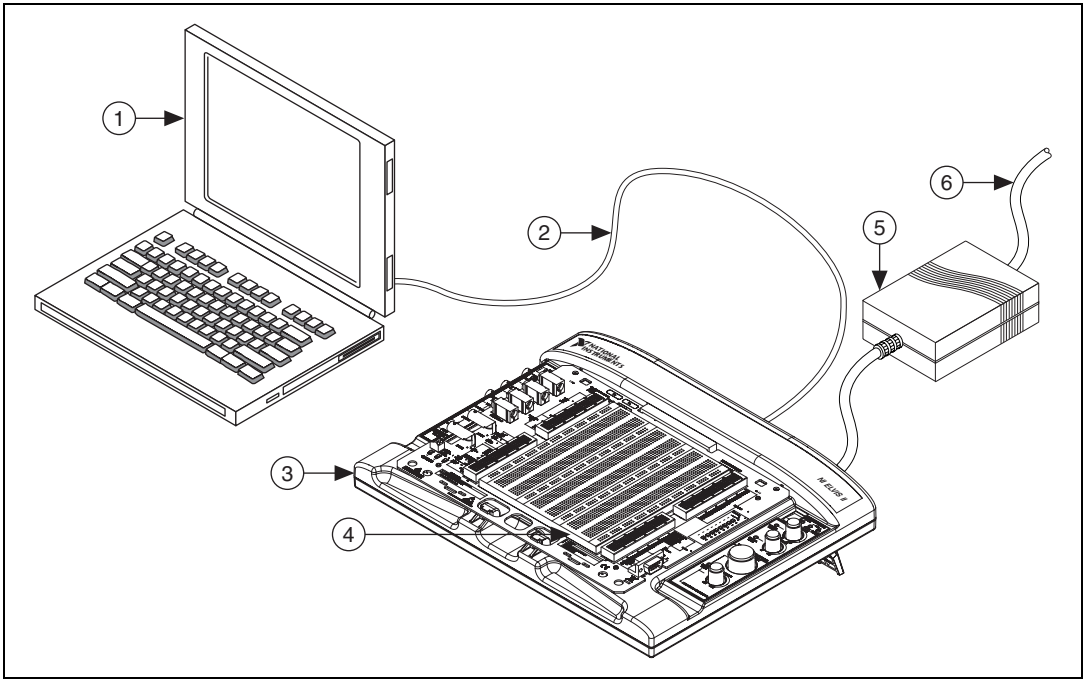
NI documentation is also available at `ni.com`.

2

NI ELVIS II Hardware

NI ELVIS II combines hardware and software into one complete laboratory suite. This chapter provides an overview of the NI ELVIS II Benchtop Workstation.

Figure 2-1 shows a typical diagram of an NI ELVIS II system.



1	Laptop Computer	4	Prototyping Board
2	USB Cable	5	AC/DC Power Supply (Included with NI ELVIS II)
3	NI ELVIS II Benchtop Workstation	6	To Power Outlet

Figure 2-1. Typical NI ELVIS II System

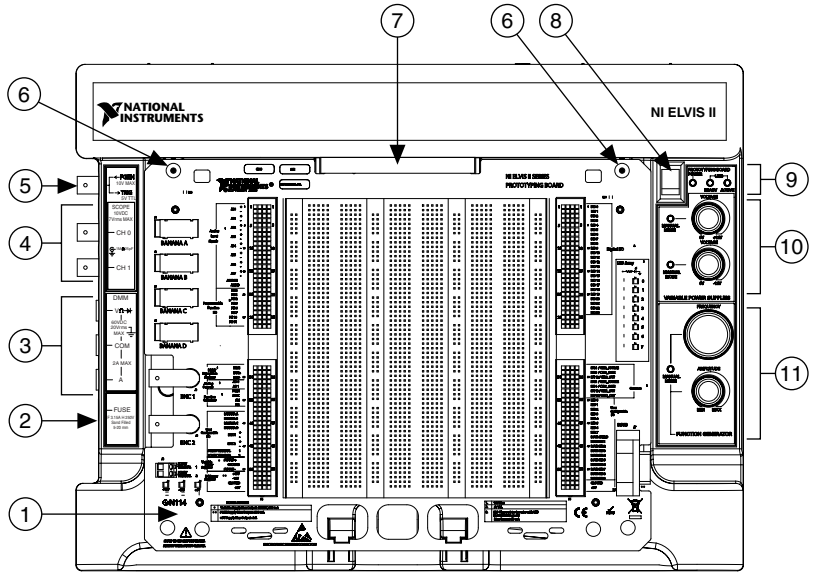
NI ELVIS II Benchtop Workstation

Caution Refer to the *Read Me First: Safety and Radio-Frequency Interference* document before removing equipment covers, or connecting or disconnecting any signal wires.

This section describes the NI ELVIS II Benchtop Workstation.

The workstation control panel provides easy-to-operate knobs for the variable power supplies and function generator, and offers convenient connectivity and functionality in the form of BNC and banana-style connectors to the function generator, scope, and DMM instruments.

Figure 2-2 shows the control panel parts locator diagram.



1 NI ELVIS II Series Prototyping Board	6 Prototyping Board Mounting Screw Holes
2 DMM Fuse	7 Prototyping Board Connector
3 DMM Connectors	8 Prototyping Board Power Switch
4 Oscilloscope Connectors	9 Status LEDs
5 Function Generator Output/Digital Trigger Input Connector	10 Variable Power Supplies Manual Controls
	11 Function Generator Manual Controls

Figure 2-2. Top View of NI ELVIS II Benchtop Workstation with Prototyping Board

The benchtop workstation has the following controls and indicators:

- **USB LEDs**
  - **Ready**—Indicates that the NI ELVIS II hardware is properly configured and ready to communicate with the host computer.
  - **Active**— Indicates activity on the USB connection to the host computer.

Table 2-1. Benchtop Workstation USB LED Patterns

ACTIVE LED	READY LED	Description
Off		Main power is off.
Yellow	Off	No connection to the host computer is detected. Make sure NI-DAQmx driver software is loaded and the USB cable is connected.
Off	Green	Connected to a full speed USB host.
Off	Yellow	Connected to a high speed USB host.
Green	Green or Yellow	Communicating with host.

- **Prototyping Board Power Switch and LED**—Controls the power to the prototyping board.

Caution Ensure that the prototyping board power switch is off before inserting or removing it from the benchtop workstation.

- **Variable Power Supplies Controls**
  - **Positive Voltage Adjust Knob**—Controls the output voltage of the positive variable power supply. The positive supply can output between 0 and +12 V.
  - **Negative Voltage Adjust Knob**—Controls the output voltage of the negative variable power supply. The negative supply can output between 0 and –12 V.

Note These knobs are only active when the associated variable power supply is set to Manual Mode. An LED next to each knob lights when the variable power supply is in Manual Mode.

- **Function Generator Controls**
  - **Frequency Knob**—Adjusts the output frequency of the generated waveform.
  - **Amplitude Knob**—Adjusts the amplitude of the generated waveform.

Note These knobs are only active when the Function Generator is set to Manual Mode. An LED next to each knob lights when the Function Generator is in Manual Mode.

- **DMM Connectors**
  - **Voltage, Resistance, and Diode Banana Jack (red)**—The positive input for voltage based DMM functionality.
  - **Common Banana Jack (black)**—The common reference connection for DMM voltage, current, resistance, and diode measurements.
  - **Current Banana Jack (red)**—The positive input for DMM current measurements.
  - **Fuse Cartridge**—Replaceable fuse to protect the current signal path. Refer to the *NI ELVIS II Specifications* at `ni.com/manuals` for fuse information

Note The NI ELVIS II DMM connections for voltage, current, resistance, and diode measurements are available only through the banana jacks. They are not routed to the prototyping board.

- **Oscilloscope (Scope) Connectors**
  - **CH 0 BNC Connector**—The input for channel 0 of the oscilloscope.
  - **CH 1 BNC Connector**—The input for channel 1 of the oscilloscope.

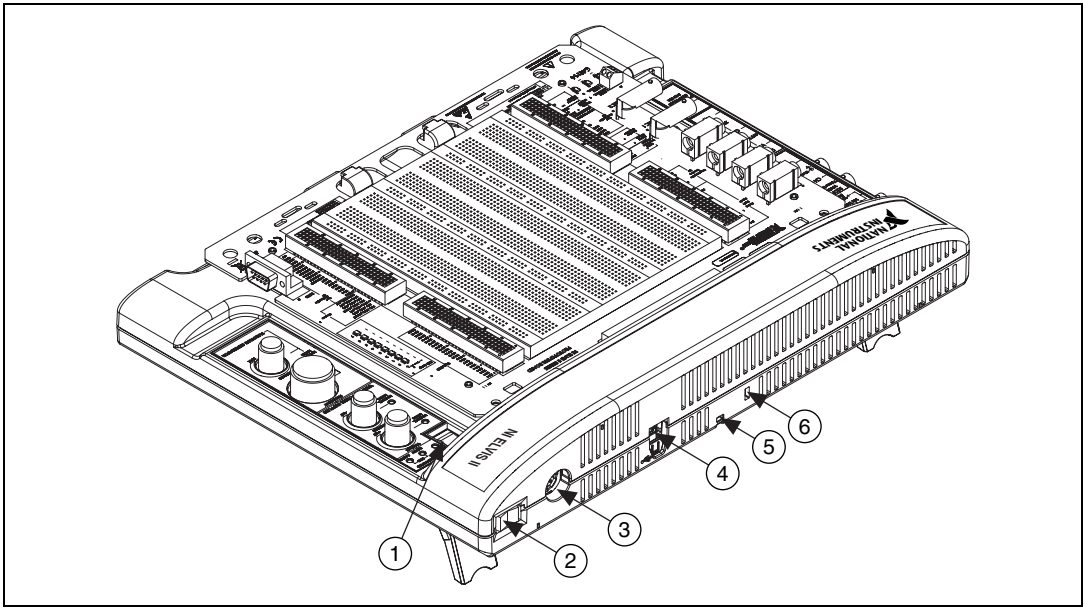
Note The NI ELVIS II Oscilloscope channels 0 and 1 are available only through the BNC connectors. They are not routed to the prototyping board.

- **FGEN/Trigger Connector**—Optional output of the function generator or a digital trigger input.

NI ELVIS II Rear Panel

The NI ELVIS II rear panel has the following components, as shown in Figure 2-3:

- The benchtop workstation power switch. Use this switch to power on or power off the NI ELVIS II.
- An AC/DC power supply connection. Use this connector to provide power to the workstation.
- A USB port. Use this to connect the workstation to a computer.
- A Kensington security cable tie slot. Use this connector to secure the workstation.
- A laptop security cable lock connector. Use this connector to secure the workstation.

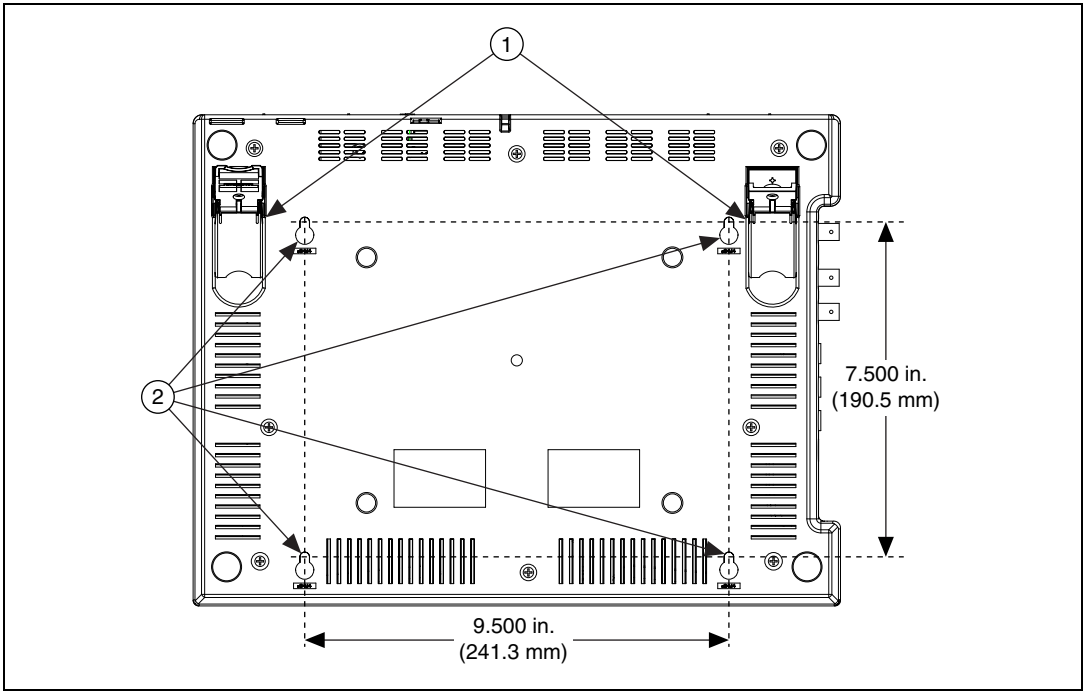


1	Prototyping Board Power Switch	4	USB Port
2	Benchtop Workstation Power Switch	5	Cable Tie Slot
3	AC/DC Power Supply Connector	6	Kensington Security Slot

Figure 2-3. Rear View of NI ELVIS II System

NI ELVIS II Bottom Panel

The NI ELVIS II benchtop workstation bottom panel has two hinged legs to elevate the rear of the workstation, as shown in Figure 2-4.



1 Hinged Rear Elevation Legs	2 Key Slot Vertical Mounting Holes

Figure 2-4. Bottom View of NI ELVIS II Benchtop Workstation

You can mount the benchtop workstation on a panel if required for your application. Figure 2-4 shows the mounting hole dimensions for panel mounting the benchtop workstation.

NI ELVIS II Circuit Protection

NI ELVIS II uses solid-state circuit protection on all I/O lines. The only user-servicable fuse protects the DMM and is accessible through the removable cartridge shown in Figure 2-2.

NI ELVIS II Series Prototyping Board

This section describes the NI ELVIS II Series Prototyping Board and how to use it to connect circuits to NI ELVIS II.

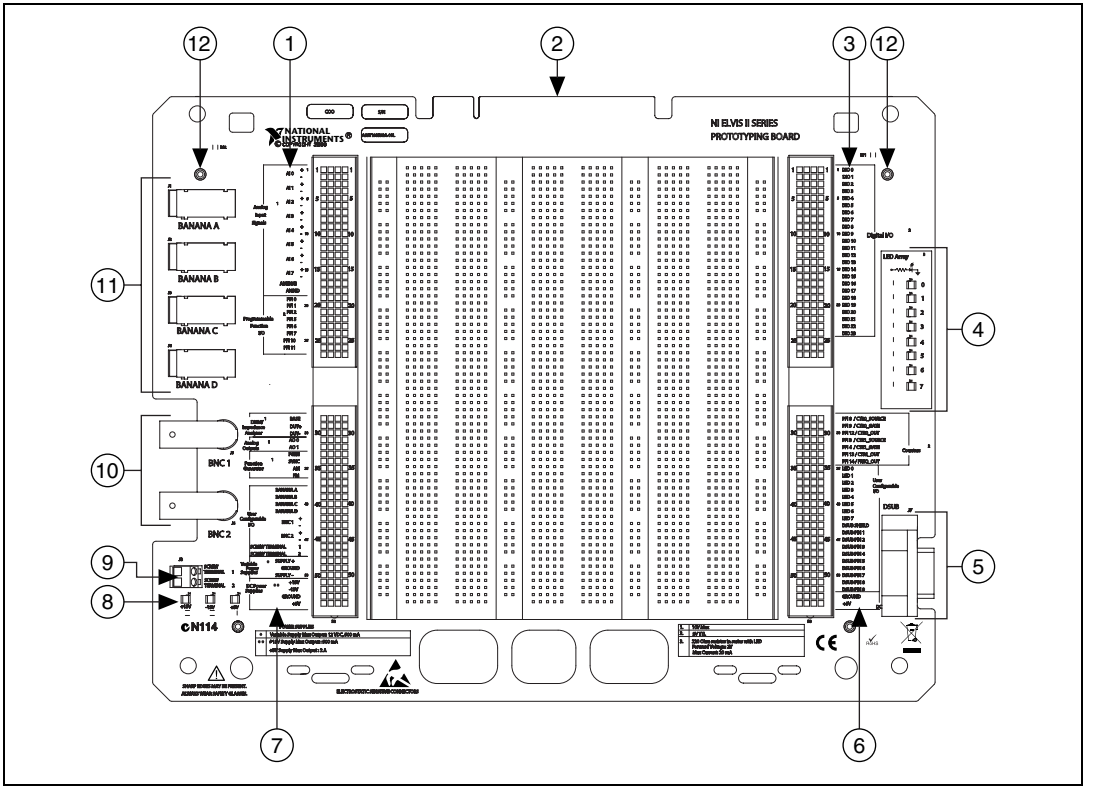
The NI ELVIS II Series Prototyping Board connects to the benchtop workstation. The prototyping board provides an area for building electronic circuitry and has the necessary connections to access signals for common applications. You can use multiple prototyping boards interchangeably with the NI ELVIS II Benchtop Workstation.

Caution Ensure that the prototyping board power switch is off before inserting or removing it from the benchtop workstation.

You can use the prototyping board connector to install custom prototype boards you develop. This connector is mechanically the same as a standard PCI connector.

The prototyping board exposes all the signal terminals of the NI ELVIS II for use through the distribution strips on either side of the breadboard area. Each signal has a row, and the rows are grouped by function.

Figure 2-5 shows the parts locator diagram for the prototyping board.



1 AI and PFI Signal Rows
2 Benchtop Workstation Interface Connector
3 DIO Signal Rows
4 User Configurable LEDs
5 User Configurable D-SUB Connector
6 Counter/Timer, User-Configurable I/O, and DC Power Supply Signal Rows
7 DMM, AO, Function Generator, User-Configurable I/O, Variable Power Supplies, and DC Power Supplies Signal Rows
8 DC Power Supply Indicators
9 User-Configurable Screw Terminals
10 User Configurable BNC Connectors
11 User Configurable Banana Jack Connectors
12 Screw Positions for Locking

Figure 2-5. NI ELVIS II Series Prototyping Board

Prototyping Board Power

The prototyping board provides access to ±15 V and a +5 V power supplies. You can use these voltage rails to construct many common circuits. Refer to the *NI ELVIS II Specifications* at `ni.com/manuals`, for more information about these voltage rails. If any of the power indicators are not lit when the prototyping board power is enabled, check the connected devices for a short circuit. Turn the prototyping board power switch off and back on to reset the current limiters.

Signal Descriptions

Table 2-2 describes the signals on the prototyping board. The signals are grouped by the functionality section where they are located.

Table 2-2. Signal Descriptions

Signal Name	Type	Description
AI <0..7> ±	Analog Inputs	Analog Input Channels 0 through 7 ±—Positive and negative input channels lines to differential AI channels.
AI SENSE	Analog Inputs	Analog Input Sense—Reference for the analog channels in nonreferenced single-ended (NRSE) mode. For more information about AI modes, search for *NI ELVIS II Theory of Operation* at `zone.ni.com`.
AI GND	Analog Inputs	Analog Input Ground—Ground reference for the Analog Input signals.
PFI <0..2>, <5..7>, <10..11>	Programmable Functions Interface	PFI Lines—Used for static DIO or for routing timing signals.
BASE	3-Wire Voltage/Current Analyzer	Base excitation for bipolar junction transistors.
DUT+	DMM, Impedance, 2- and 3-Wire Analyzers	Excitation terminal for Capacitance and Inductance measurements (DMM), Impedance Analyzer, 2-Wire Analyzer, and 3-Wire Analyzer.
DUT–	DMM, Impedance, 2- and 3-Wire Analyzers	Virtual ground and current measurement for capacitance and inductance measurements (DMM), the Impedance Analyzer, 2-Wire Analyzer, and 3-Wire Analyzer.
AO <0..1>	Analog Outputs	Analog Output Channels 0 and 1—Used for the Arbitrary Waveform Generator.
FGEN	Function Generator	Function Generator Output.
SYNC	Function Generator	TTL output synchronized to the FGEN signal.
AM	Function Generator	Amplitude Modulation Input—Analog input used to modulate the amplitude of the FGEN signal.
FM	Function Generator	Frequency Modulation Input—Analog input used to modulate the frequency of the FGEN signal.
BANANA <A..D>	User Configurable I/O	Banana Jacks A through D—Connects to the banana jacks.
BNC <1..2>±	User Configurable I/O	BNC Connectors 1 and 2 ±—Positive lines tie to the center pins of the BNC connectors; negative lines tie to the shells of the BNC connectors.
SCREW TERMINAL <1..2>	User Configurable I/O	Connects to the screw terminals.

Table 2-2. Signal Descriptions (Continued)

Signal Name	Type	Description
SUPPLY+	Variable Power Supplies	Positive Variable Power Supply—Output of 0 to 12 V.
GROUND	Power Supplies	Ground.
SUPPLY–	Variable Power Supplies	Negative Variable Power Supply—Output of –12 to 0 V.
+15 V	DC Power Supplies	+15 V Fixed Power Supply.
–15 V	DC Power Supplies	–15 V Fixed Power Supply.
GROUND	DC Power Supplies	Ground.
+5V	DC Power Supplies	+5V Fixed Power Supply.
DIO <0..23>	Digital Input/Output	Digital Lines 0 through 23—These channels are general purpose DIO lines that are used to read or write data.
PFI8 / CTR0_SOURCE	Programmable Function Interface	Static Digital I/O, line P2.0 PFI8, Default function: Counter 0 Source
PFI9 / CTR0_GATE	Programmable Function Interface	Static Digital I/O, line P2.1 PFI9, Default function: Counter 0 Gate
PFI12 / CTR0_OUT	Programmable Function Interface	Static Digital I/O, line P2.4 PFI12, Default function: Counter 0 Out
PFI3 / CTR1_SOURCE	Programmable Function Interface	Static Digital I/O, line P1.3 PFI3, Default function: Counter 1 Source
PFI4 / CTR1_GATE	Programmable Function Interface	Static Digital I/O, line P1.4 PFI4, Default function: Counter 1 Gate
PFI13 / CTR1_OUT	Programmable Function Interface	Static Digital I/O, line P2.5 PFI13, Default function: Counter 1 Out
PFI14 / FREQ_OUT	Programmable Function Interface	Static Digital I/O, line P2.6 PFI14, Default function: Frequency Output
LED <0..7>	User-Configurable I/O	LEDs 0 through 7—Apply 5 V for 10 mA device.
DSUB SHIELD	User-Configurable I/O	Connection to D-SUB shield.
DSUB PIN <1..9>	User-Configurable I/O	Connections to D-SUB pins.
+5 V	DC Power Supply	+5V Fixed Power Supply.
GROUND	DC Power Supply	Ground.

Connecting Signals

Caution Refer to the *Read Me First: Safety and Radio-Frequency Interference* document before removing equipment covers, or connecting or disconnecting any signal wires.

Analog Input

The NI ELVIS II Series Prototyping Board has eight differential AI channels available—ACH<0..7>. You can configure these inputs in referenced single-ended (RSE) or non-referenced single-ended (NRSE) modes. In RSE mode, each signal is referenced to AIGND. In NRSE mode, each signal is referenced to the floating AISENSE line. Table 2-3 shows the channel mapping for each mode.

Table 2-3. Analog Input Signal Mapping

NI ELVIS II Series Prototyping Board Terminals	Differential Mode (Default)	RSE/NRSE Modes
AI0+	AI 0+	AI 0
AI0–	AI 0–	AI 8
AI1+	AI 1+	AI 1
AI1–	AI 1–	AI 9
AI2+	AI 2+	AI 2
AI2–	AI 2–	AI 10
AI3+	AI 3+	AI 3
AI3–	AI 3–	AI 11
AI4+	AI 4+	AI 4
AI4–	AI 4–	AI 12
AI5+	AI 5+	AI 5
AI5–	AI 5–	AI 13
AI6+	AI 6+	AI 6
AI6–	AI 6–	AI 14
AI7+	AI 7+	AI 7
AI7–	AI 7–	AI 15
AISENSE	—	AI SENSE
AIGND	AI GND	AI GND

Grounding Considerations

The analog input channels are differential, you must therefore establish a ground point somewhere in the signal path. As long as the signal you are measuring is referenced to one of the AI GND pins, the measurement is correctly referenced. If you are measuring a floating source, such as a battery, connect one end of the signal to the ground.

Resource Conflicts

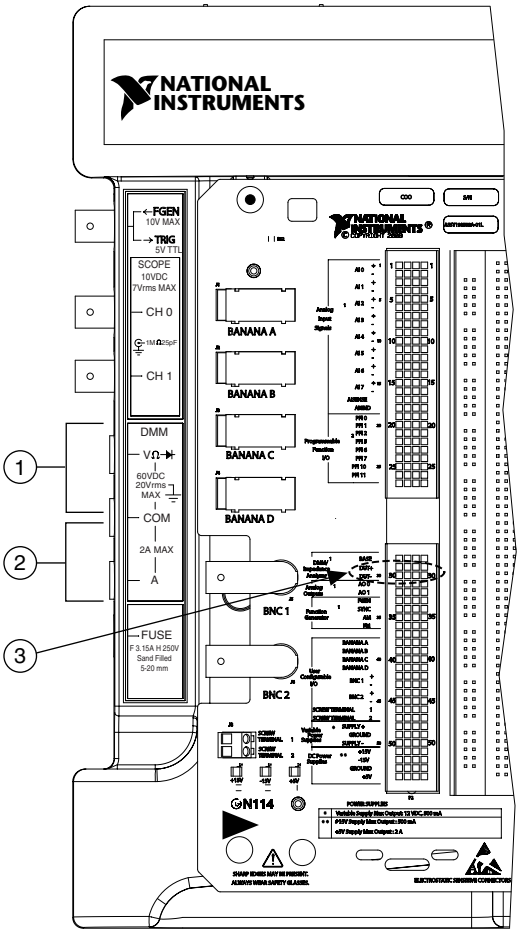
The AI timing engine is shared by several instruments within the NI ELVIS II. This means that these instruments cannot be used at the same time. Search for *NI ELVIS II Theory of Operation* at `zone.ni.com` for more details.

DMM

Voltage, Current, Resistance, Diode, and Continuity

The primary DMM instrument on NI ELVIS II is isolated and its terminals are the three banana jacks on the side of the benchtop workstation. For DC Voltage, AC Voltage, Resistance, Diode, and Continuity Test modes, use the VΩ⊣▶⊢ and COM connectors. For DC Current and AC Current modes, use the A and COM connectors. For easy access to circuits on the prototyping board, you can use banana-to-banana cables to wrap the signals from the user-configurable banana jacks to the DMM connectors on the benchtop workstation.

Figure 2-6 shows the banana jacks on the benchtop workstation used for V/R/Diode/Continuity and for Current.



1 Connectors for Voltage/Resistance/Diode/Continuity
2 Connectors for Current
3 Connectors for Capacitance/Inductance

Figure 2-6. Connections for DMM Measurements

Capacitance and Inductance

The capacitance and inductance measurements of the DMM use the nonisolated Impedance Analyzer terminals, DUT+ and DUT–, on the prototyping board. Refer to Figure 2-6.

Oscilloscope

The two oscilloscope channels are available at BNC connectors on the side of the benchtop workstation. These channels have 1 MΩ input impedance and can be used with 1X / 10X attenuated probes. You can also use high-impedance Analog Input channels <AI 0..7> available on the prototyping board.

Analog Output

NI ELVIS II provides access to the two analog outputs at the AO0 and AO1 terminals. These channels are used for arbitrary waveform generation. AO0 is also used internally for BASE excitation in the 3-Wire Voltage/Current Analyzer. Search for NI *ELVIS II Theory of Operation* at `zone.ni.com` for more details.

Function Generator (FGEN)

The function generator output can be routed to either the FGEN/TRIG BNC connector or the FGEN terminal on the prototyping board. A +5 V digital signal is available at the SYNC terminal. The AM and FM terminals provide analog inputs for the amplitude and frequency modulation of the function generator output.

Power Supplies

The DC power supplies provide fixed output of +15 V, –15 V, and +5 V.

The variable power supplies provide adjustable output voltages from 0 to +12 V on the SUPPLY+ terminal, and 0 to –12 V on the SUPPLY– terminal.

All power supplies on NI ELVIS II are referenced to GROUND.

Digital I/O

The digital lines exposed on the prototyping board are internally connected to port 0 of the device. You can configure them as input or output.

Programmable Function Interface (PFI)

The PFI lines are TTL-compatible I/O that can route timing signals to and from the AI, AO, or counter/timer engines. They can also be configured as static digital I/O.

User-Configurable I/O

The prototyping board provides several user-configurable connectors: four banana jacks, two BNC connectors, and a D-SUB connector. Each pin of the connector has a connection to the distribution strips.

Eight bicolor (green/yellow) LEDs are provided for general digital output on the prototyping board. The green anode of each LED is connected to the distribution strip through a 220 Ω resistor, and each cathode is connected to ground. Drive the line with +5 V to turn the LED green or –5 V to turn the LED yellow,

Bode Analyzer

The Bode Analyzer uses the Function Generator to output a stimulus and then uses analog input channels AI 0 and AI 1 to measure the response and stimulus respectively.

Two-Wire Current-Voltage Analyzer

Connect the signal to DUT+ and DUT– when using the Two-Wire Current-Voltage Analyzer.

Three-Wire Current-Voltage Analyzer

The Three-Wire Current-Voltage Analyzer uses DUT+, DUT–, and BASE to plot the current-voltage response of a NPN or PNP bipolar transistor. Table 2-4 shows the transistor to prototyping board connections.

Table 2-4. Transistor to Prototyping Board Connections

Transistor Node	Prototyping Board Connections
Base	BASE
Collector	DUT+
Emitter	DUT–

Counter/Timer

The prototyping board provides access to the two counter/timers on the device, which are also accessible from software. These inputs are used for counting TTL signals, edge detection, and pulse generation applications. The CTR0_SOURCE, CTR0_GATE, CTR0_OUT, CTR1_GATE, and CTR1_OUT signals are connected to the default Counter 0 and Counter 1 PFI lines. Refer to the *M Series User Manual* for more information.

3

NI ELVISmx Software

This chapter provides an overview of the NI ELVISmx software available for use with the NI ELVIS II.

The NI ELVISmx software, created in LabVIEW, takes advantage of the capabilities of virtual instrumentation. The software includes SFP instruments, LabVIEW Express VIs, and SignalExpress blocks for programming the NI ELVIS II hardware.

Using NI ELVIS II with SFP Instruments

NI ELVISmx provides SFP instruments, created in LabVIEW, and the source code for the instruments. You cannot directly modify the executable files, but you can modify or enhance the functionality of these instruments by modifying the LabVIEW code. The instruments are virtual instruments (VIs) that are necessary in typical laboratory applications.

Note For a detailed explanation of the SFP instruments and instructions for taking a measurement with each instrument, refer to the *NI ELVISmx Help*.

NI ELVISmx Instrument Launcher

The NI ELVIS Instrument Launcher provides access to the NI ELVISmx SFP instruments. Launch the Instrument Launcher by navigating to **Start»All Program Files»National Instruments»NI ELVISmx» NI ELVISmx Instrument Launcher**. This opens the suite of LabVIEW SFP instruments.

To launch an instrument, click the button corresponding to the desired instrument. Select the NI ELVIS II device from the **Device** control.

Some instruments perform similar operations using the same resources of the NI ELVIS II hardware and therefore cannot run at the same time. If you launch two instruments with overlapping functionality that cannot run at the same time, the NI ELVISmx software generates an error dialog describing the conflict. The instrument with the error is disabled and will not function until the conflict is resolved. Search for *NI ELVIS II Theory of*

Operation at `zone.ni.com` for information about possible resource conflicts.

Arbitrary Waveform Generator (ARB)

This advanced-level SFP instrument uses the AO capabilities of the device. You can create a variety of signal types using the Waveform Editor software, which is included with the NI ELVISmx software. You can load waveforms created with the NI Waveform Editor into the ARB SFP to generate stored waveforms. Refer to the *NI ELVISmx Help* for more information about the Waveform Editor.

Since the device has two AO channels, two waveforms may be simultaneously generated. You can choose to run continuously or run once.

Bode Analyzer

By combining the frequency sweep feature of the function generator and the AI 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. Refer to the *NI ELVISmx Help* for required hardware connections.

Digital Reader

This instrument reads digital data from the NI ELVIS II digital lines. You can read eight consecutive lines at a time: 0..7, 8..15, 16..23 either continuously or you can take a single reading.

Digital Writer

This instrument updates the NI ELVIS II digital lines with user-specified digital patterns. You can manually create a pattern or select predefined patterns, such as ramp, toggle, or walking 1s. This instrument can control eight consecutive lines and either continually output a pattern or just perform a single write. The output of the NI ELVISmx Digital Writer SFP stays latched until another pattern is output, the lines it is using are configured for read, or the power is cycled on the NI ELVIS II workstation. Output voltage levels of the NI ELVIS II digital lines are TTL compatible.

Digital Multimeter (DMM)

This commonly used instrument can perform the following types of measurements:

- DC voltage
- AC voltage
- Current (DC and AC)
- Resistance
- Capacitance
- Inductance
- Diode test
- Audible continuity

For capacitance and inductance measurements you must make connections to the DMM/Impedance Analyzer on the prototyping board. For all other measurements make connections to the DMM banana jacks on the benchtop workstation.

Dynamic Signal Analyzer (DSA)

This instrument is especially useful in advanced electrical engineering and physics classes. This instrument uses the analog input of the device to make measurements, and can either continuously make measurements or make a single scan. You can also apply various window and filtering options to the signal.

Function Generator (FGEN)

This instrument provides you with choices 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.

Impedance Analyzer

This instrument is a basic impedance analyzer that is capable of measuring the resistance and reactance for passive two-wire elements at a given frequency.

Oscilloscope (Scope)

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. You can also choose trigger source and mode settings. 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. You can choose between digital or analog hardware triggering. You can connect to the NI ELVIS II Oscilloscope from the BNC connectors on the front panel of the benchtop workstation.

The computer-based scope display has the ability to use cursors for accurate screen measurements.

Two-Wire and Three-Wire Current-Voltage Analyzers

These instruments allow you to conduct diode and transistor parametric testing and view current-voltage curves. The two-wire instrument offers full flexibility in setting parameters such as voltage and current ranges, and can save data to a file. In addition, the three-wire instrument offers base current settings for measurements of NPN and PNP transistors. Refer to *NI ELVISmx Help* for connection details. Both instruments have cursors for more accurate onscreen measurements.

Variable Power Supplies

You can control the output of the positive or negative variable power supply with these SFP instruments. The negative power supply can output between –12 and 0 V, and the positive power supply can output between 0 and +12 V.

Using NI ELVIS II with LabVIEW

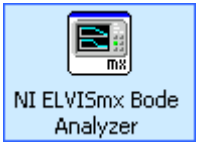
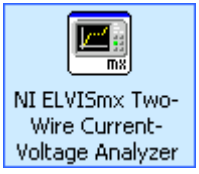
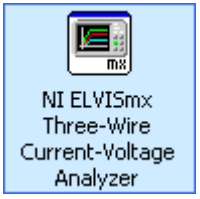
This section provides an overview of using NI ELVIS II with LabVIEW.

LabVIEW Express VIs

With NI ELVISmx, the NI ELVIS II instruments have an associated LabVIEW Express VI. Express VIs allow you to interactively configure the settings for each instrument. This enables you to develop LabVIEW applications without extensive programming expertise. To access the NI ELVISmx Express VIs, open a LabVIEW block diagram and select **Measurement I/O»NI ELVISmx** from the function palette.

Table 3-1 shows the available NI ELVISmx Express VIs. Refer to the *NI ELVISmx Help* for more information.

Table 3-1. NI ELVISmx Express VIs

NI ELVISmx Express VI			
			
			
			—

Using NI-DAQmx with NI ELVIS II

NI ELVIS II is supported by NI-DAQmx, and therefore you can program it using the NI-DAQmx API.

Furthermore, some general AI, AO, and timing functionality of the device is available through the NI ELVIS II workstation and you can program it using NI-DAQmx. Refer to *NI ELVISmx Help* and *NI-DAQmx Help* for more information.

Using NI ELVIS II in SignalExpress

To use an NI ELVIS II instrument within SignalExpress complete the following steps:

1. Launch SignalExpress.
1. Click the **Add Step** button.
2. If NI ELVISmx is installed, NI ELVISmx is in the list of steps. Expand NI ELVISmx.
3. Choose the instrument to add under **Analog** or **Digital»Acquire** or **Generate Signals**.
4. Select the NI ELVIS II device from Device control.
5. Set the various controls on the configuration panel appropriately for the measurement.
6. Run the SignalExpress project.

For more information about using NI ELVIS II with SignalExpress, refer to the *NI SignalExpress Workbench Help*, which you can find through the Help menu in SignalExpress.

For more information about SignalExpress, refer to the *Getting Started with SignalExpress Guide*.

4

Calibration

Electronic components such as ADCs are characterized by nonlinearities and drift due to time and temperature. Compensating for these inherent sources of error requires device self-calibration. To improve the accuracy of the system, you should periodically self-calibrate the NI ELVIS II.

You can self calibrate the NI ELVIS II by right-clicking the device in MAX and choosing the self calibration option.

Note Disconnect all protoyping board signals or remove the prototyping board before running self calibration.