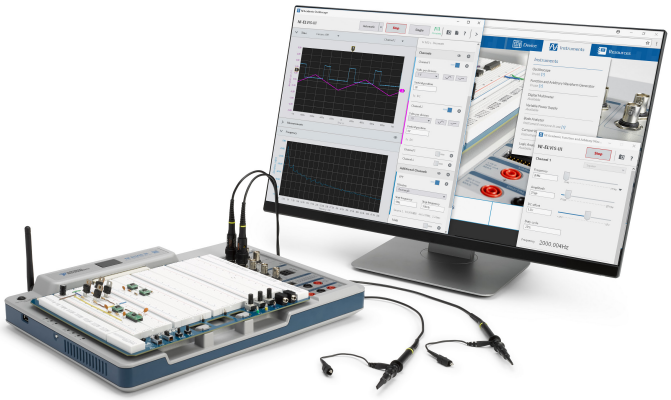
PRODUCT FLYER

NI Educational Laboratory Virtual Instrumentation Suite (NI ELVIS)

CONTENTS

NI ELVIS

NI ELVIS III, NI ELVIS II+, and NI ELVIS II



- Software includes interactive web and desktop soft front panels, instrumentation support for Windows and Mac, API support for LabVIEW and text-based languages, shipping examples, and detailed help files
- Seven hardware instruments plus control I/O containing 16 AI, 4 AO, and 40 DIO
- 4-channel, 100 MS/s (400 MS/s single channel), 50 MHz oscilloscope with 14-bit resolution
- 16-channel, 100 MS/s logic analyzer/pattern generator
- 16-channel, 1 MS/s analog input with 16-bit resolution
- 40 DIO lines individually programmable as input, output, PWM, or digital protocols

Project-Based Learning for the Modern Engineer

NI ELVIS is a project-based learning solution that combines instrumentation, embedded design, and web connectivity for engineering fundamentals and system design. It provides a comprehensive teaching solution for engaging students in hands-on labs involving analog circuits, mechatronics, power electronics, instrumentation, digital communications, digital electronics, controls, and more. Each laboratory solution includes lab material and complete experiments developed by experts in industry and education, so students can explore theory in the physical laboratory with a safe, in-depth experience.

With its hands-on approach, NI ELVIS helps educators teach students practical, experimental engineering skills. Built on the concept of teamwork, this solution connects students to their experiments, which enables them to collaborate using the same technology in over 35,000 companies worldwide. It combines the precision and accuracy of seven benchtop instruments with the speed and customization of industrial embedded controllers in one single platform. Students can use its easy, prebuilt interfaces to customize at a level not available in any other educational laboratory equipment.

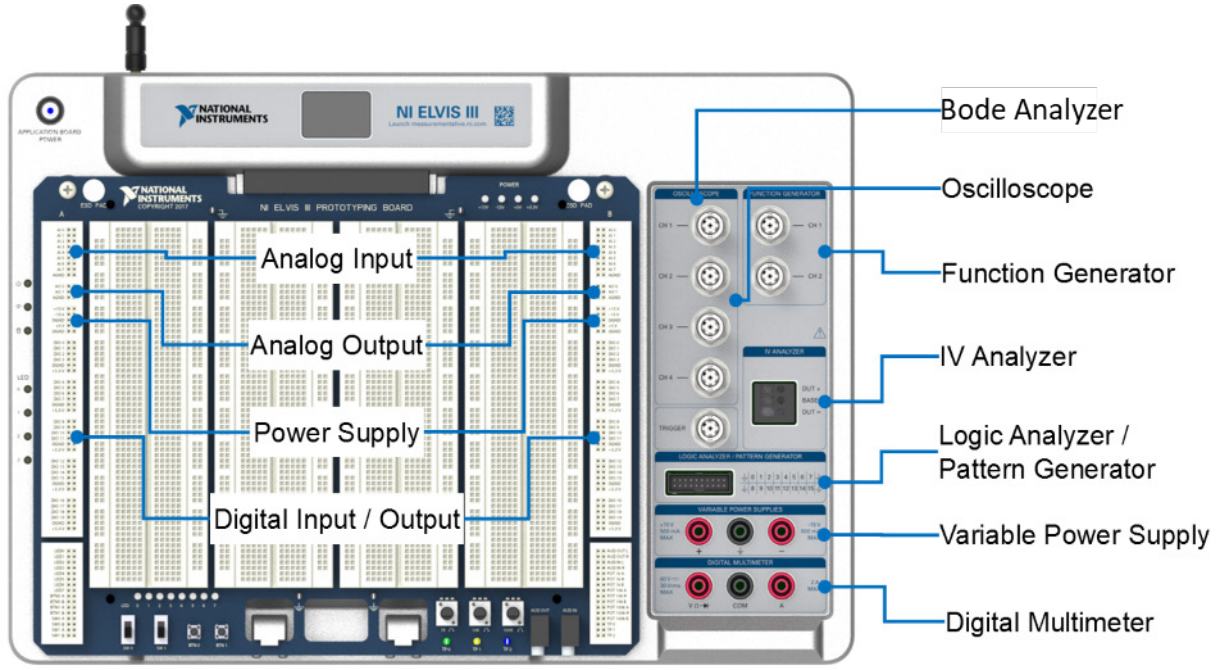
Table 1. NI offers three NI ELVIS models.

	NI ELVIS II	NI ELVIS II+	NI ELVIS III
Description	Legacy NI ELVIS	Legacy NI ELVIS with higher oscilloscope performance	Latest NI ELVIS with integrated instrumentation and control I/O
Oscilloscope	2 ch, 1.25 MS/s, 10 bits	2 ch, 100 MS/s, 8 bits	4 ch, 400 MS/s,[1] 14 bits
Function Generator	1 ch, 5 MHz, 10 bits	1 ch, 5 MHz, 10 bits	2 ch, 100 MS/s, 15 MHz, 14 bits
Logic Analyzer/Pattern Generator	—	—	16 ch, 100 MS/s
IV Analyzer	—	—	±10 V, ±30 mA, 15 MHz
Digital Multimeter	5½ digits	5½ digits	4½ digits
Variable Power Supply	±12 V, 500 mA	±12 V, 500 mA	±15 V,[2] 500 mA
Processor FPGA	—	—	Xilinx Zynq-7020
AI/AO	16 ch, 16 bits/2 ch, 16 bits	16 ch, 16 bits/2 ch, 16 bits	16 ch, 16 bits/4 ch, 16 bits
DIO	24 DIO, 15 PFI	24 DIO, 15 PFI	40 ch
SFP Support	Windows	Windows	Windows, Mac, Web
Programming Language Support	LabVIEW	LabVIEW	LabVIEW, Python, C, Simulink
Enclosure	plastic, white	plastic, white	metal, NI compass silver

[1]400 MS/s achieved on single channel only through repetitive sampling; 4-channel continuous sample rate is 100 MS/s.

[2]Variable power supply is rated to source from 1 V to 15 V and from -1 V to -15 V.

Detailed View of NI ELVIS III



Key Features

Teach Innovation by Integrating Instrumentation with Embedded Design

Projects that inherently challenge students to use innovative design thinking often involve interacting with an unknown process or device. Students are encouraged to understand the unknown through theory, simulation, and experimentation; however, projects that introduce the unknown in messy, multisystem environments tend to challenge the students to be much more innovative. Designing a test in this style requires not only knowledge of the specifications, equipment limitations, and fundamental concepts being applied but also the ability to contend with outside factors and grasp how one change can have a cascading effect on the experimental setup.

Figure 1. NI ELVIS III

To most effectively analyze concepts this way, students need the ability to not only instrument and analyze the experiment but also precisely control and manipulate the type and behavior of the inputs to the system. NI ELVIS III is the only engineering laboratory solution that combines seven traditional instruments with fully customizable I/O to enable the complete implementation of the concepts in this approach.

Engage Students with a Modern, Web-Driven Experience

NI ELVIS meets students where they are with a web interface that drives collaboration, reduces time to measurement, and integrates with teaching and learning resources to fully equip students in their educational careers.

The seven instruments on NI ELVIS III are all accessed through a minimal installation for both Windows and Mac. This gives all students access to the instruments on their own computers instantly via USB, Ethernet, or Wi-Fi. The Bode Analyzer and the IV Analyzer are immediately accessible using a web soft front panel. This means that students can access the instruments on any device, computer, tablet, or cell phone without installing them. Only these two instruments are accessible via the web; however, every instrument will have an associated web soft front panel by the end of 2019.

Figure 2. NI ELVIS Experiment and Simulation Comparison

With NI ELVIS III, educators can find resources to teach and develop labs all in one place. Using the labs created for NI ELVIS, students gain access to the lab instructions, simulations, and instrument launcher all in the same window. Then, when students complete the labs, the answers are compiled and sent in as a lab report. Moving lab resources to the web with NI ELVIS III saves time and reduces the number of programs students need to use.

Drive Teamwork with Easy Coordination of Experiments

One of the major requests from industry and accreditation bodies is for students to graduate from college with an understanding of how to work in teams to solve a common engineering problem. Because NI ELVIS III is a network-connected device, it enables collaboration on experiments through multiuser access. Each of the seven instruments can be accessed simultaneously by different students connected wirelessly to NI ELVIS III. Also, the control I/O can be programmed independently by students accessing the instrumentation. This means that in a group of students, each individual can interact with NI ELVIS III to perform part of an experiment, so everyone is involved in a completely collaborative experimentation environment.

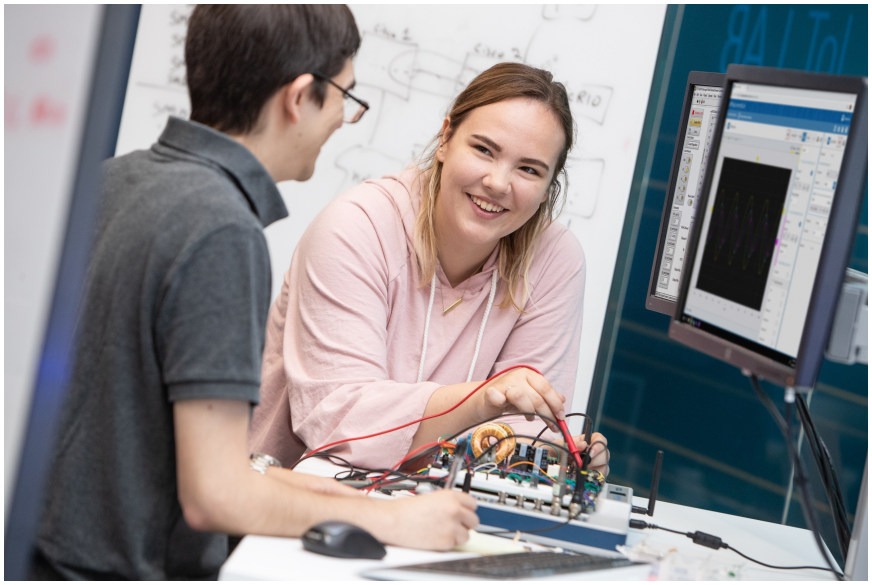


Figure 3. Remote Student Design

Similarly, since NI ELVIS III can be remotely accessed, teaching assistants find assessing student work much simpler. Rather than designating time to meet in person with each student, the TA can be a remote resource logging in to each device after students complete the assignment.

NI ELVIS III removes barriers to collaboration and enables more students to progress through a lab in less time. This increases student satisfaction and makes the best use of teaching staff resources.

Interchangeable, Course-Specific Experiments

NI ELVIS enhances engineering curriculum by integrating project-based learning, teamwork, and design with course-specific application boards and labs developed by experts from education and industry. With a constantly expanding ecosystem, NI ELVIS enriches courses from the fundamentals of electrical and mechanical engineering to system-level design in power electronics and mechatronics. NI has partnered with leading companies in engineering education such as Texas Instruments, Digilent, Emona, and Quanser to offer complete lab solutions for electronics, controls, mechatronics, and communications.

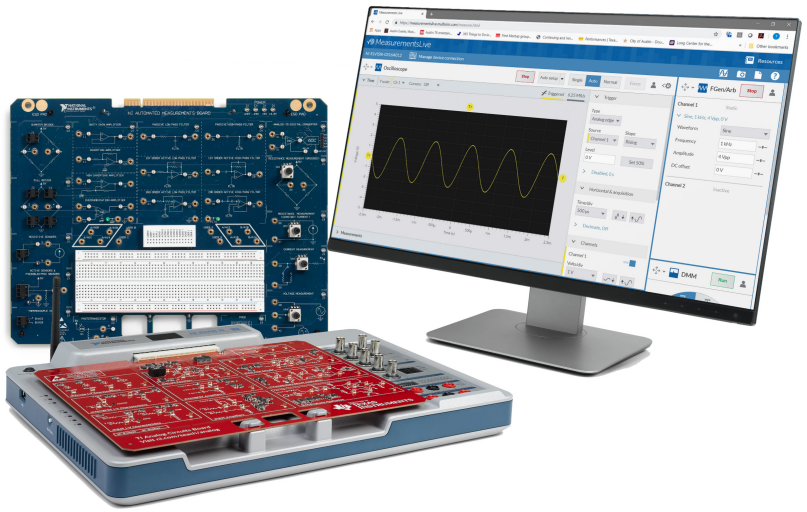


Figure 4. NI ELVIS Ecosystem

The application boards provide easy access to not only the hardware needed to complete engineering labs but also the laboratory exercises and programs to finish the exercises. The exercises and programs are freely available at ni.com/teach even before purchasing the boards.

To explore the application boards for NI ELVIS, visit one of the following pages:

NI ELVIS Electronics Boards

NI ELVIS Mechatronics Boards

NI ELVIS Controls Boards

NI ELVIS Communications Boards

NI ELVIS III Soft Front Panels

NI ELVIS III soft front panels are launched from Measurements Live at measurementslive.ni.com. Each soft front panel corresponds to an instrument with seven soft front panels: Oscilloscope, Function and Arbitrary Waveform Generator, Digital Multimeter, Variable Power Supply, Bode Analyzer, IV Analyzer, and Logic Analyzer and Pattern Generator. The soft front panels are available in two formats: desktop and web soft front panels. The desktop soft front panels, which are installed via a small executable for Windows and Mac, launch when selected in the instrument launcher. The web soft front panels do not require installation and launch in a new browser window.

Measurements Live

Measurements Live is the primary interface for NI ELVIS III. It contains the connection to the device, the instrument launcher, and links to all the additional user resources for the device. You can access Measurements Li at measurementslive.ni.com

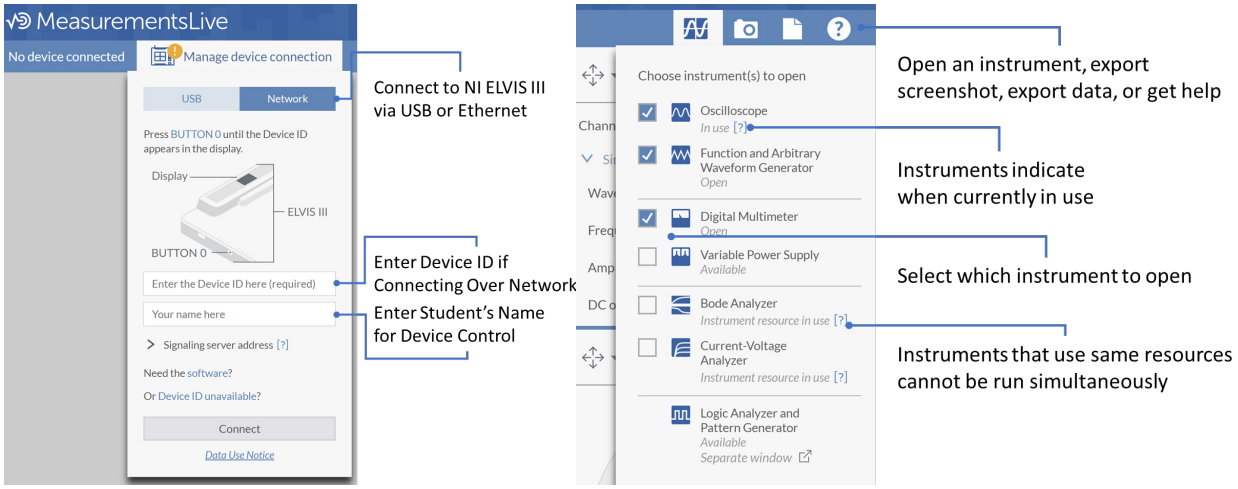


Figure 5. Configuring Measurements Live

Soft Front Panels

Below is an example of NI ELVIS III running an oscilloscope, function generator, and digital multimeter simultaneously in a browser. As an instrument is selected, it appears in the Measurements Live instrument window, so students can configure, read, and report data all from the same place. To try out the Measurements Live instrument window without an NI ELVIS III device, navigate to https://measurementslive.ni.com in a web browser.

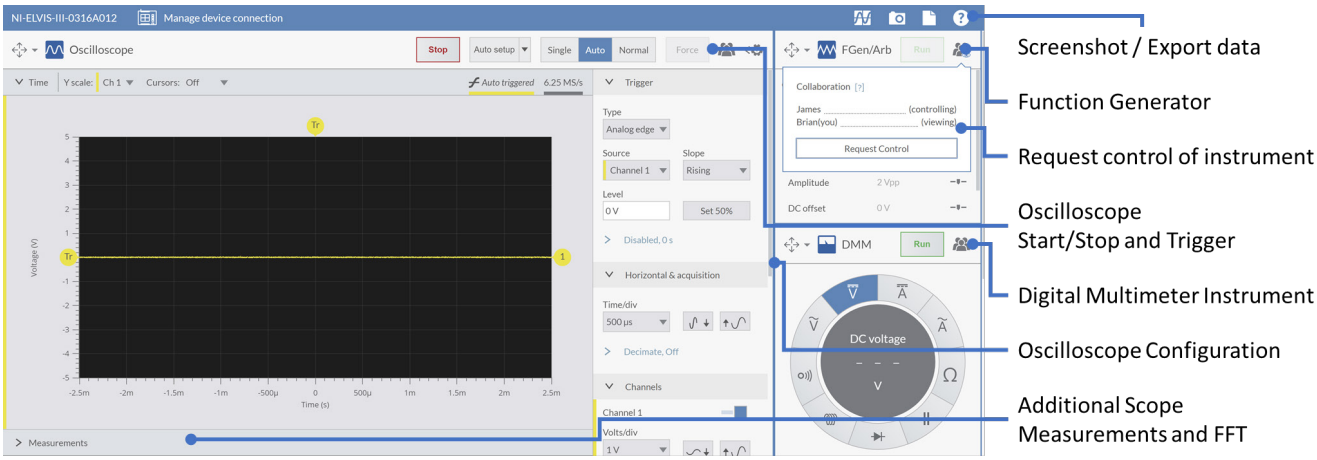


Figure 6. NI ELVIS III Oscilloscope Soft Front Panel

NI ELVIS with Multisim Live

NI ELVIS III soft front panels can turn on a reference channel so additional outside data can be imported. Students performing circuit experiments are traditionally required to fully understand and simulate a circuit before building and beginning the experiment. Doing this reduces the time spent in the lab and leads to more intentional work and less guessing. Multisim Live is a browser-based SPICE circuit simulation environment that provides fully interactive simulation, touch, and mobile compatibility and directly connects with Multisim (for desktop), the standard software for educational circuit simulation. When students create a simulation in Multisim Live, they can easily import it into NI ELVIS III soft front panels for a direct simulation-to-experiment comparison. Now students can fully understand the fundamental differences between the simulation and experiment, which leads to faster conclusions and accelerated discovery. Find more information and instructions in the NI ELVIS III Multisim Live Integration white paper.

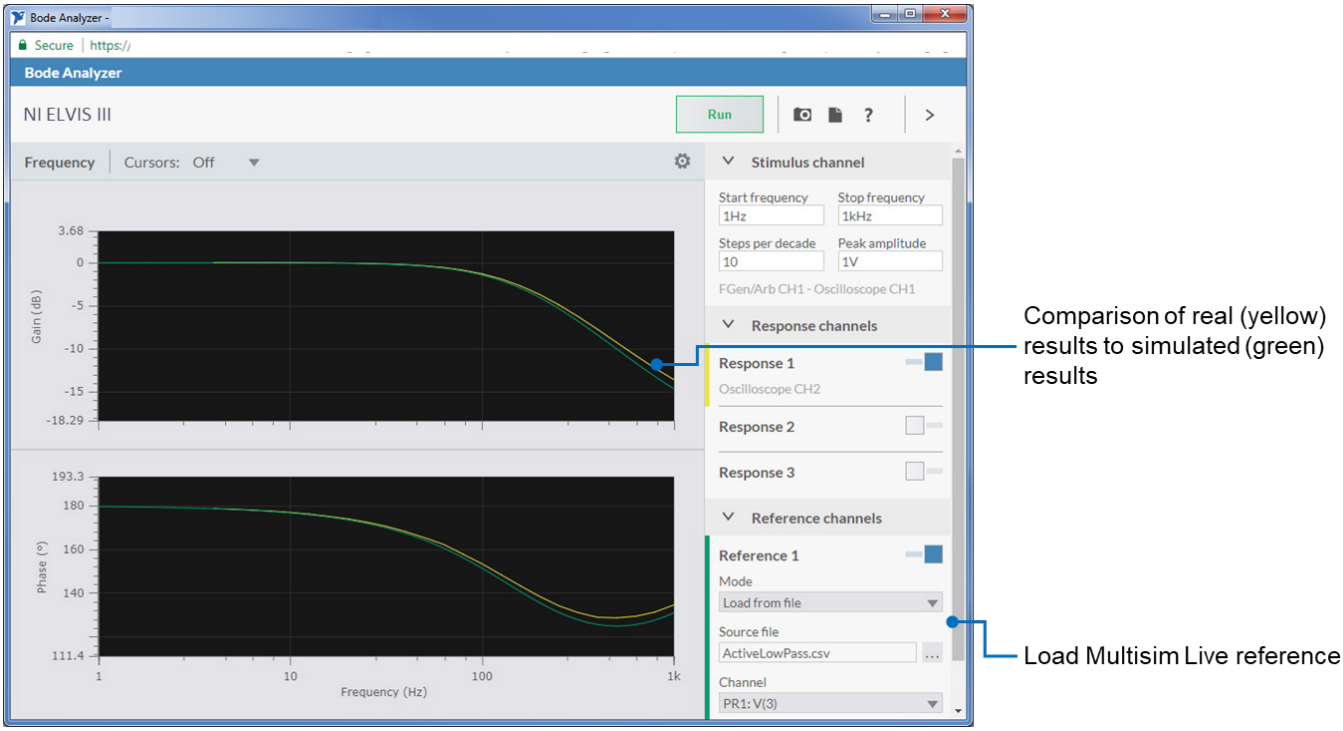


Figure 7. Comparing Multisim Live Data to NI ELVIS III Acquired Data

NI ELVIS III with MathWorks Simulink

The NI ELVIS III third-party software integration strategy is to use the right tool for the right class. For controls courses, many universities have standardized on MathWorks Simulink to simulate and execute controllers. That is why NI designed curriculum using the Quanser Controls Board both in LabVIEW and Simulink. Quanser's software compiles Simulink controllers into C and automatically deploys those compilations on the NI ELVIS III device to run externally. This means students can simulate, experiment, and interact in real time with their controllers all in Simulink.

Explore the Simulink curriculum for the Quanser Controls Board for NI ELVIS III.

Download QUARC software to manage the controls board from Simulink.

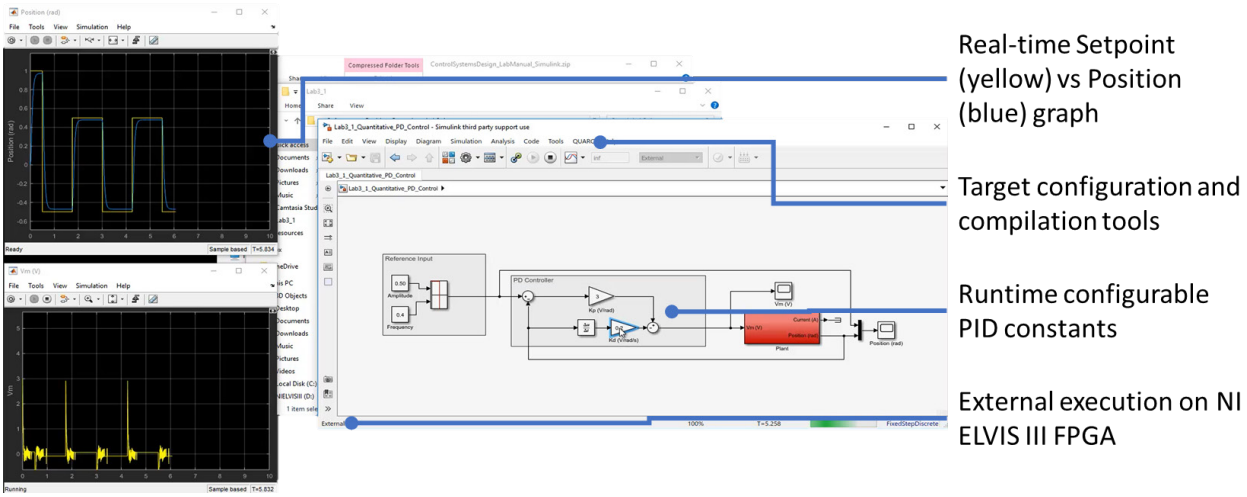


Figure 8. Add a caption.

NI ELVIS III Application Programming Interface (API)

In addition to the soft front panels, NI ELVIS includes a best-in-class API that works with a variety of development options such as LabVIEW, Python, and C. The API can automate measurements from the instrumentation and programmatically acquire, analyze, and control data through the control I/O. The control I/O is accessed via a real-time OS implemented on NI ELVIS III with over 60 lines of customizable analog and digital inputs and outputs. They are traditionally used for courses that require fast response times to impulses or higher channel counts for data acquisition or digital communications.

Learn more about programming NI ELVIS III in LabVIEW.

Learn more about programming NI ELVIS III in Python.

Learn more about programming NI ELVIS III in C.

Programming the Control I/O

The control I/O is programmed on the industry-standard real-time controller through one of two ways: Express VIs or lower level VIs. The Express VIs (Figure 9) are simple blocks configured via a user interface that pops up. They require no knowledge of programming and let the user easily manipulate data while keeping the customization of the data acquisition to a minimum.

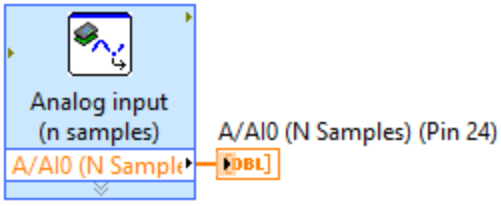


Figure 9. Analog Input Using an Express VI

Lower level programming helps when more control is needed to specify input/output timing, triggering, and more details. You can find the lower level VIs in the same pallet as the Express VIs or by copying the code from Express VIs.

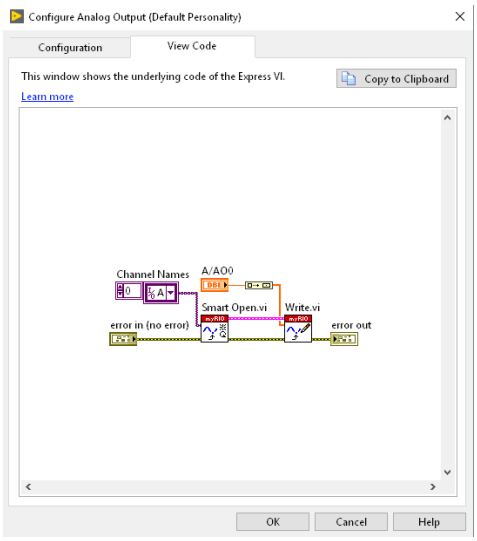


Figure 10. Analog Output Using Low-Level Code

Programming the FPGA

The control I/O does not directly connect from the real-time side to the inputs and output. Instead, it goes through a Xilinx Zynq-7020 FPGA. This FPGA is preprogrammed with a default personality that enables all the Express VIs and other VIs to work seamlessly without users needing to know about the FPGA. However, if users need faster control or data processing, they can customize the FPGA using LabVIEW FPGA. They can take advantage of the convenience of the LabVIEW real-time compiler and easy-to-understand VIs to avoid programming in VHDL or Verilog.

Learn more about LabVIEW FPGA.

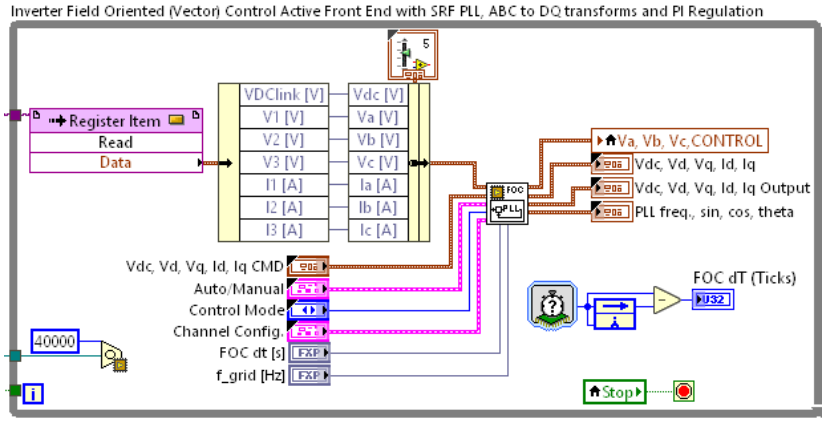


Figure 11. Closed-Loop Field-Oriented Inverter Control Implemented on an NI ELVIS III FPGA

Programming the NI ELVIS Instrumentation

NI ELVIS III instrumentation is programmed similarly to the control I/O. The user can initialize and configure each instrument as needed and then remove and manipulate the data (Figure 12).

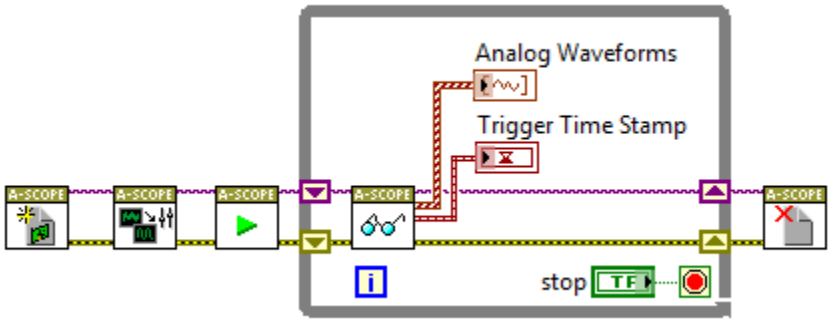


Figure 12. NI ELVIS Instrumentation API Configured to Read from the Oscilloscope

Hardware Services

All NI hardware features a one-year warranty for basic repair coverage and includes calibration in adherence to NI specifications prior to shipment. PXI systems also include basic assembly and a functional test. NI offers additional entitlements to improve uptime and lower maintenance costs with service programs for hardware. Learn more at ni.com/services/hardware.

	Standard	Premium	Description
Program Duration	3 or 5 years	3 or 5 years	Length of service program
Extended Repair Coverage	•	•	NI restores your device's functionality and includes firmware updates and factory calibration.
System Configuration, Assembly, and Test[1]	•	•	NI technicians assemble, install software in, and test your system per your custom configuration prior to shipment.
Advanced Replacement[2]		•	NI stocks replacement hardware that can be shipped immediately if a repair is needed.
System Return Material Authorization (RMA)[1]		•	NI accepts the delivery of fully assembled systems when performing repair services.
Calibration Plan (Optional)	Standard	Expedited[3]	NI performs the requested level of calibration at the specified calibration interval for the duration of the service program.

[1]This option is available only for PXI, CompactRIO, and CompactDAQ systems.
[2]This option is not available for all products in all countries. Contact your local NI sales engineer to confirm availability.
[3]Expedited calibration includes only traceable levels.

PremiumPlus Service Program

NI can customize the offerings listed above or provide additional entitlements such as on-site calibration, custom sparing, and life-cycle services through a PremiumPlus Service Program. Contact your NI sales engineer to learn more.

Technical Support

Every NI system includes a 30-day trial for phone and email support from NI engineers that can be extended through a Standard Service Program (SSP) membership. NI has more than 400 engineers around the globe to provide local support in more than 30 languages. You also can take advantage of NI's award-winning online resources and communities.