

# Instrumentation Newsletter

The Worldwide Publication for Measurement and Automation | **First Quarter 2010**

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# Facing a New Decade

It does not seem that long ago that we were waking up to the start of a new century and realizing that the Y2K bug had in fact not crashed our systems. We started the first decade with euphoria. Of course that euphoria did not last long. Now as we look back on the past 10 years, we see that it was one of the most challenging periods since the Great Depression.

## One Decade, Two Recessions

The last decade saw two significant industrial recessions, the first brought about by the dot-com crash and terrorist attacks. We ended the decade with what is being referred to as the Great Recession, caused in part by a housing bubble and some creative financial engineering. (As we pointed out during the NIWeek 2009 keynote in August, engineering is best left to real engineers and scientists.)

There are very few of us that have not been personally and professionally impacted by the challenges of the past decade. Businesses around the world have had sudden and dramatic change forced upon them, and many industries are still feeling the effects.

## Looking Ahead with Optimism

As we look forward to the new decade, I believe we should be optimistic. The changes forced upon many businesses and industries have helped companies gain a better understanding of their strengths and weaknesses. Yes, many companies have become very lean, but as the industrial economy recovers, these businesses will be in a position to fund new initiatives that can make them more competitive and drive growth.

## Our Role During the Next Ten Years

At National Instruments, we are very pleased with how we have emerged from the last decade and the recent challenging times. While 2009 was only our second year to ever see a revenue decline in a 33-year history, we continued to invest in strategic areas of our business. In fact, we have more than doubled our R&D investment since the start of 2000.

Research has shown that the seeds of innovation and success are best planted during challenging times. As National Instruments looks ahead to the start of a new decade, we want to work even more closely with our customers to help drive the innovation leading to your growth and success.



– John Graff john.graff@ni.com

*John Graff has been with National Instruments since 1987 and is the vice president of marketing and customer operations. He received a bachelor's degree in electrical engineering from The University of Texas at Austin.*

# Instrumentation Newsletter

Volume 22, Number 1 First Quarter 2010

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*Instrumentation Newsletter* is published quarterly by National Instruments Corporation, 11500 N Mopac Expwy, Austin, TX 78759-3504 USA.

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# Introducing LabVIEW Robotics – From Fantasy to Fact

Not long ago, robots were little more than science fiction and highlights in Hollywood.

Now they assist in surgery, navigate Mars, and help the blind drive vehicles. And the NI LabVIEW graphical programming environment is making these things possible.

With robots becoming a part of everyday life, what does this mean for you? If you are a LabVIEW user or considering using LabVIEW, you are more robot-capable than you may think. National Instruments is excited to introduce LabVIEW Robotics, a new software package for designing sophisticated autonomous systems. LabVIEW Robotics is built on the LabVIEW programming language, taking advantage of more than 20 years of proven development and unmatched productivity.

You can break down the key offerings of LabVIEW Robotics into six areas:

- **Intellectual property (IP)** – New algorithms are specifically designed for creating complex, mobile systems
- **Graphical programming** – The fundamental building block of the LabVIEW programming language provides unmatched productivity for designing sophisticated mechatronics systems
- **Deployment to real-time and FPGA hardware devices** – Seamless embedded real-time and field-programmable gate array (FPGA) hardware integration makes implementing your robotics applications significantly easier than with traditional tools
- **Connectivity to sensors and actuators** – From standard robotics sensors such as ultrasonic and infrared (IR) sensors to higher-end devices such as light detection and ranging (LIDAR) sensors and controller area network (CAN)-based smart motors, LabVIEW Robotics comes complete with sensor and actuator drivers for Windows, real-time, and FPGA devices
- **Easy integration of text-based tools** – LabVIEW Robotics makes it simple to integrate existing code with the LabVIEW MathScript RT Module, as well as native C and HDL import capabilities
- **Examples of real-world robotics applications** – LabVIEW Robotics provides many helpful example programs that demonstrate how to connect your sensor data and robotics IP to create a sophisticated, autonomous system

## Intellectual Property (IP)

LabVIEW Robotics features a new Robotics palette containing algorithms for designing your next robotics controller. You can find everything from sensor drivers to inverse kinematics on the new Functions palette:

- Connectivity VIs for third-party software integration
- Obstacle Avoidance VIs for mobile systems
- Path Planning VIs to calculate a path to a goal point within a map
- Protocol VIs to process data formatted in communication protocols such as National Marine Electronics Association (NMEA) and Joint Architecture for Unmanned Systems (JAUS)
- Robotic Arm VIs to make dynamic and kinematic calculations on a robotic arm
- Sensing VIs that configure, control, and retrieve data from robotics sensors

## Graphical Programming

The dataflow nature of LabVIEW is well-suited for designing robotics applications because this approach almost precisely mirrors the design process of a simple or complex autonomous system. For example, if your initial design is based on a “sense-think-act” architecture, this is clearly represented in LabVIEW, as shown in Figure 1. This architecture not only makes your design more straightforward but also helps your colleagues better understand your program through the intuitive nature of LabVIEW.

## Deployment to Real-Time and FPGA Hardware Devices

A large gap in many robotics software tools available today is the inability to deploy your application to real-time and embedded hardware devices. Many tools allow you to design and explore your application on a Windows,

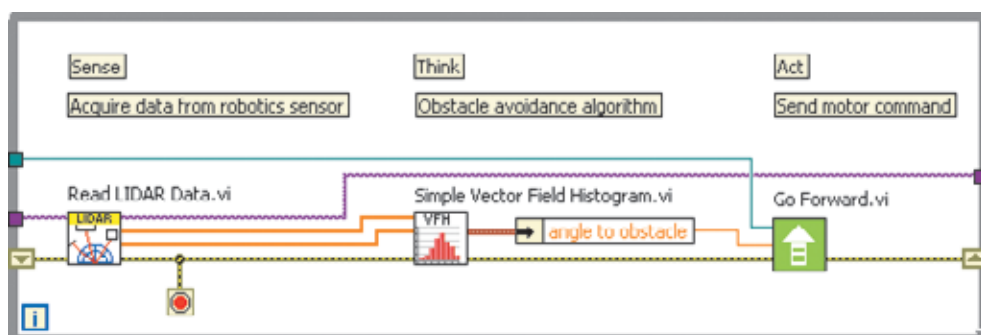


Figure 1. The dataflow programming language of LabVIEW is well-suited for designing robotics applications through a “sense-think-act” architecture.

Linux, or Macintosh platform but leave it up to you to get that same code onto an embedded platform. LabVIEW Robotics IP is specifically designed and optimized to easily deploy to NI reconfigurable I/O (RIO) targets including NI CompactRIO and NI Single-Board RIO devices.

### Connectivity to Sensors and Actuators

From its first release, the LabVIEW programming environment has helped you save time by connecting to instruments and devices. LabVIEW today is the de facto standard for instrumentation connectivity through the high quality and breadth of instrument drivers. LabVIEW Robotics takes advantage of this strength by incorporating an entire suite of robotics sensor and actuator connectivity options. These drivers remove the time-consuming task of writing, testing, and implementing sensor drivers for your robotics system. In fact, LabVIEW Robotics includes multiple versions of many sensor drivers for Windows, real-time, and FPGA-based platforms, ensuring you can connect your sensor appropriately for your I/O needs.

### Easy Integration of Text-Based Tools

The LabVIEW environment is best known for its graphical programming nature, but it also includes a breadth of integrated and imported utilities for text-based algorithms. You can easily incorporate your existing C, .m file, or HDL code into your LabVIEW Robotics application, or you can develop new algorithms within LabVIEW in C (Formula Node), .m files (LabVIEW MathScript RT Module), or HDL [HDL Node or component-level IP (CLIP Node) in the LabVIEW FPGA Module]. These options provide a variety of tools to ensure maximum reuse and offer the right programming model for the problem you are trying to solve.

### Examples of Real-World Robotics Applications

Many helpful tools within LabVIEW Robotics software center around the included example programs. These examples show real-world use cases of assembling the individual robotics functions to perform a useful task. For example, you can use vision algorithms in several different application areas; the development team took the applicable functions and created new robotics examples that help you understand how to apply them to your autonomous applications for target tracking or path following. Other helpful examples include the following:

- **Architectures** – Helpful templates for simple and sophisticated robot design controllers
- **Basics** – Simple FPGA basic code for serial, SPI, and PWM connectivity
- **Third-party connectivity** – From simulators to Microsoft Robotics Developer Studio, Skilligent, MobileRobots, and other robot platforms

- **Communication protocols** – NMEA, SPI, RS232, and I<sup>2</sup>C communication examples
- **Control and simulation** – DC motor control, PID, predictive observer, and Extended Kalman filter examples
- **Motion control** – PWM, CAN-based, and NI-Motion control
- **Path planning** – A\*, AD\*, and Voronoi examples
- **Robotic arm** – Serial robot, forward, and inverse kinematic examples
- **Steering** – Mecanum, omni, differential, and other steering examples
- **Vision** – Color tracking, path following, and target tracking

Some of the examples are actually project architectures, which serve as starting points for various robot applications.

The single control loop robot architecture in the Robotics Project Wizard serves as a starting point for robots that perform simple, repetitive

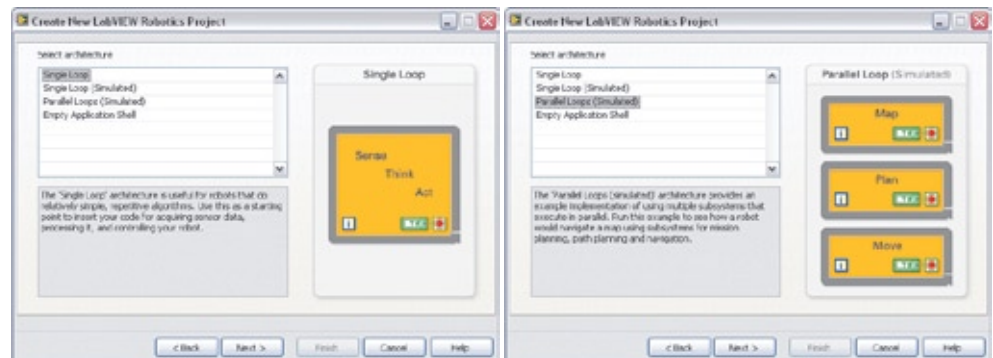


Figure 2. Sample architectures provide guidance for single and parallel loop applications.

algorithms. You can insert code for acquiring sensor data, processing data, and controlling the robot inside the timed loop.

The Robotics Project Wizard also provides a more advanced nested control loops architecture that uses multiple timed loops to handle different aspects of robot control. For instance, the timed loops in this example perform the following tasks:

- **Mission planning** – Returns a random goal position that the robot navigates
- **Path planning** – Searches a map of the robot environment to find a path to the goal position
- **Driving** – Simulates the robot moving along the path to reach the goal position

An advanced robot architecture may also include timed loops that detect obstacles, control movement, and measure the progress of the robot. Loops can run on different hardware targets, so you must implement communication across the application. For instance, the nested control loops example uses shared variables to communicate data between timed loops in different VIs.

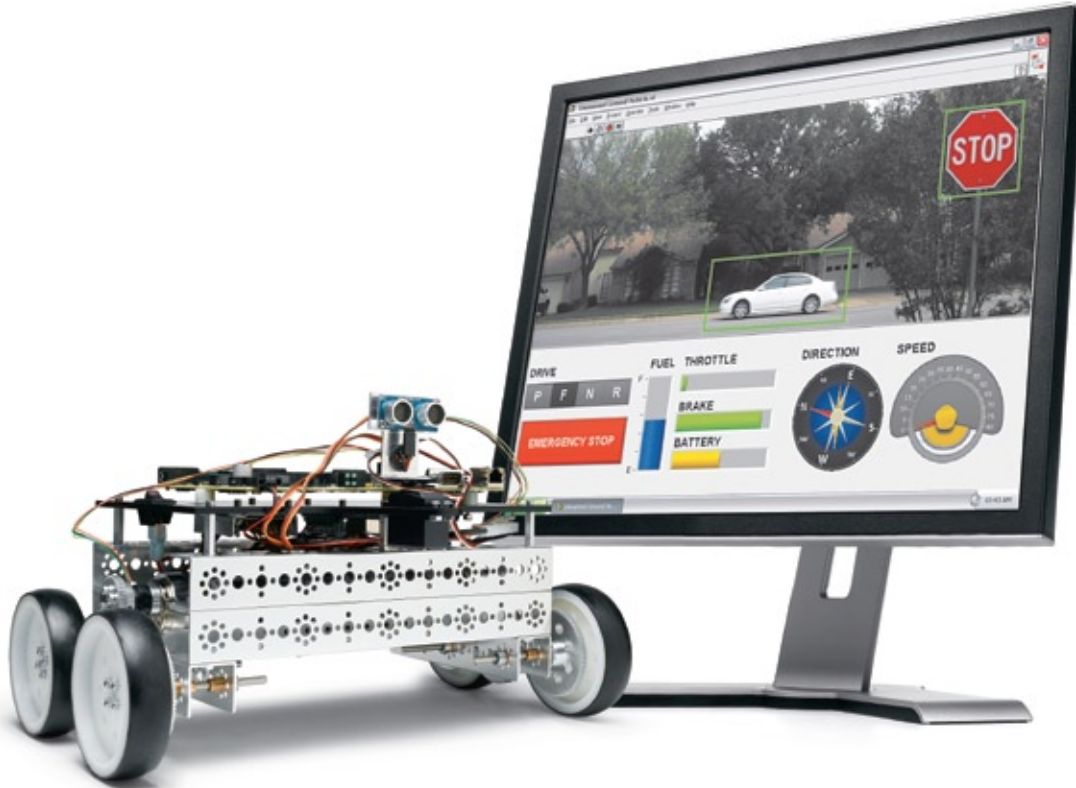


Figure 3. The LabVIEW Robotics Starter Kit provides a low-cost entry into LabVIEW Robotics and RIO hardware as well as a fully assembled, four-wheeled, autonomous robot.

### Get LabVIEW Robotics

If you want to try LabVIEW Robotics and you are new to LabVIEW, take advantage of the LabVIEW Robotics Starter Kit.

This starter kit provides a low-cost entry into LabVIEW Robotics and RIO hardware as well as a fully assembled four-wheeled robot complete with an ultrasonic sensor, TETRIX motors, and two encoders. If you are currently using LabVIEW, you can purchase the LabVIEW Robotics Module to access the new algorithms.

– Shelley Gretlein [shelley.gretlein@ni.com](mailto:shelley.gretlein@ni.com)

*Shelley Gretlein is the real-time and embedded senior group manager at National Instruments. She holds a bachelor's degree in computer science and management systems from the University of Missouri-Rolla.*

**To obtain your starter kit today, visit [ni.com/robot](http://ni.com/robot).**

## NI Updates LEGO® MINDSTORMS® NXT Robotics Software



National Instruments, in conjunction with LEGO, has released a new version of its intuitive drag-and-drop software that powers the LEGO MINDSTORMS NXT 2.0 robotics kits. The software is based on NI LabVIEW, which helps users simply drag and drop icons representing the various tasks they want their robots to perform, similar to how professionals program today's robots with LabVIEW. With this system, children as young as 9 years old can design their own robots using new features such as color recognition and expanded

Bluetooth support. The platform includes new robot models, sensor technology, and more customizable programming, thereby increasing student interest and knowledge in robotics.

**To learn more about the partnership between National Instruments and LEGO, visit [ni.com/mindstorms](http://ni.com/mindstorms).**

# New PXI Express NI FlexRIO Modules Address Challenging Automated Test Requirements

National Instruments has developed NI LabVIEW FPGA and reconfigurable I/O (RIO) technology for leading-edge applications in embedded control and high-performance test.

Since the first demonstration of RIO products at NIWeek 1997, NI has released a variety of devices powered by RIO technology, including NI R Series, CompactRIO, and PXI Express RIO IF transceivers. Though RIO technology has primarily been used in control applications, advances in field-programmable gate array (FPGA) capabilities along with improvements to LabVIEW FPGA are enhancing automated test systems by significantly increasing test throughput, enabling new tests, and reducing costs. The latest PXI Express NI FlexRIO FPGA modules push the limits even further with more powerful FPGAs, deeper onboard memory, enhanced synchronization, and higher-performance data throughput.

## FPGAs in Automated Test Applications

Now you can take advantage of open, user-programmable FPGAs to enhance the performance of existing automated test applications or solve new application challenges altogether. A key application area for FPGA test technology is with closed-loop test systems. In these applications, the automated test system must provide real-time feedback to the device under test (DUT), often to emulate real-world operating conditions. The system can achieve this only with the extremely low latency of an FPGA-based instrument. One example of this type of test is radio frequency identification (RFID) tag testing in which the test system must emulate an RFID tag reader and interface with the tag in as little as 25  $\mu$ s. Another new application area for FPGAs is implementing automated test systems that demand extremely high processing capabilities, more than what the latest multicore processors provide. A wide-bandwidth, real-time spectrum analyzer continuously performs fast Fourier transforms (FFTs) on the data it acquires, as shown in Figure 1, and only an FPGA with enhanced signal processing capabilities has the throughput to meet these requirements for user-defined analysis.

You can also use FPGAs to enhance existing applications. Protocol-aware automated test

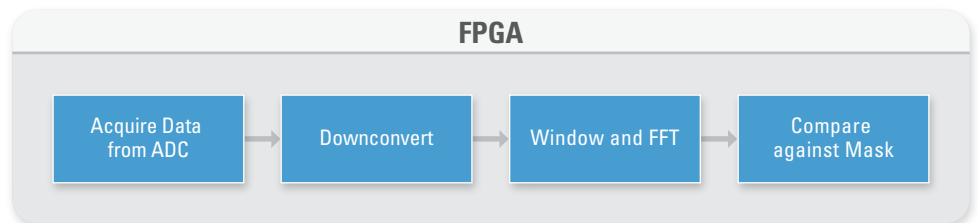


Figure 1. A wide-bandwidth real-time spectrum analyzer is a powerful test instrument enabled by high-performance FPGAs.

equipment (ATE) involves implementing digital protocols on an FPGA to abstract communication with the DUT. These applications replace traditional logic analyzers and pattern generators that can be difficult to program and provide a simpler method to create functional test routines. Finally, existing software-defined automated test systems that use modular instrumentation may be augmented with an FPGA that orchestrates the test hardware to increase throughput. In this case, the FPGA may create hardware-timed triggers for other instruments, detect custom trigger events, or even control the DUT in a deterministic manner. These four general classifications – closed-loop test, enhanced processing, protocol-aware test, and test system control – identify some of the many ways FPGAs can enhance test applications and expand test capabilities.

## New PXI Express NI FlexRIO FPGA and Adapter Modules

To address these needs in automated test applications, NI recently released three new PXI Express NI FlexRIO FPGA modules along with several new NI FlexRIO adapter modules, which deliver flexible I/O to the FPGA. The NI PXIe-7961R, NI PXIe-7962R, and NI PXIe-7965R are PXI Express modules that incorporate high-performance, DSP-focused Xilinx Virtex-5 SXT FPGAs with up to 512 MB of onboard DRAM, as detailed in Table 1. You can use them as stand-alone coprocessors, offloading computations from

Model	FPGA	FPGA Slices	FPGA DSP Slices	FPGA Memory – Block RAM (kb)	Onboard Memory – DRAM (MB)
NI PXIe-7965R	Virtex-5 SX95T	14,720	640	8,784	512
NI PXIe-7962R	Virtex-5 SX50T	8,160	288	4,752	512
NI PXIe-7961R	Virtex-5 SX50T	8,160	288	4,752	0

Table 1. New PXI Express NI FlexRIO FPGA modules offer multiple options for memory, DSP slices, and FPGAs.

the host processor to the FPGA, or with an NI FlexRIO adapter module that offers high-performance analog or digital I/O, creating an FPGA-based instrument.

NI chose Xilinx SXT FPGAs because they incorporate up to 640 DSP slices, which you can use to implement digital filters, custom signal processing, and FFT logic – all commonly found on FPGA-based instruments with analog I/O. Complementing the processing capabilities of the FPGA, the onboard DRAM doubles the bandwidth and quadruples the capacity of the existing NI PXI-795xR NI FlexRIO FPGA modules, providing DRAM throughput up to 3.2 GB/s, which is necessary when operating on large data sets with the highest-performance adapter modules.

In addition to being the first NI FlexRIO FPGA modules incorporating PXI Express, the NI PXIe-796xR devices also feature the new NI-STC3 application-specific integrated circuit (ASIC), which powers direct data streaming (also known as peer-to-peer streaming) between multiple FPGA modules, or between PXI Express



Figure 2. New PXI Express NI FlexRIO FPGA modules interface with I/O adapter modules such as the NI 5781 baseband transceiver.

MB/s or in both directions at more than 700 MB/s per direction, for a total module throughput of more than 1.4 GB/s.

National Instruments and NI Alliance Partners continue to develop NI FlexRIO adapter modules, listed in Table 2, to create FPGA-based instruments incorporating NI FlexRIO FPGA modules. For example, the new NI 5781 baseband transceiver module features two channels of 14-bit, 100 MS/s analog input and two channels of 16-bit, 100 MS/s analog output. This module is targeted at creating FPGA-defined baseband interfaces to RF upconverters and downconverters and provides the I/O necessary for ultrahigh-speed control applications.

With the new high-performance NI FlexRIO FPGA and adapter modules, you can implement FPGA-based systems to quickly and efficiently test today's complex devices.

– Ryan Verret [ryan.verret@ni.com](mailto:ryan.verret@ni.com)

*Ryan Verret is a product manager for signal generators and FPGA-enabled test products at National Instruments. He holds bachelor's and master's degrees in electrical engineering from Rice University.*

**To learn more about the new NI FlexRIO adapter modules, visit [ni.com/flexrio](http://ni.com/flexrio).**

Module	Description
NI 5761 digitizer module	4-channel, 250 MS/s, 14-bit digitizer module
NI 5752 ultrasound module	32-channel, 50 MS/s, 12-bit ultrasound module
NI 6584 RS422/485 module	16-channel RS422/RS485 serial module
NI 6583 high-speed digital module	32 single-ended and 16 differential channels at 200 MHz
Adsys Camera Link module	Camera Link interface supporting base, medium, full, and 80-bit configurations
Prevas gigabit Ethernet module	Dual RJ-45 Ethernet connections supporting 10/100/1000 Mbps rates
SET ARINC module	16 Tx or Rx channels of ARINC429 for interfacing and testing
Alfamation multimedia interface	Multi-interface module including CAN, LIN, I <sup>2</sup> S, I <sup>2</sup> C, and SPI

Table 2. There are several new and upcoming NI FlexRIO adapter modules from National Instruments and NI Alliance Partners.

digitizers and FPGA modules. Using this powerful capability, you can avoid sending data back to the host processor and create FPGA-based instruments from high-performance NI digitizers. When used with the NI PXIe-5122 digitizer, you can stream both channels to a PXI Express NI FlexRIO FPGA at the full sample rate of 100 MS/s, or 400 MB/s total. You can also stream data from the NI PXIe-5622 intermediate frequency (IF) digitizer or NI PXIe-5663 vector signal analyzer up to the maximum I/Q rate of 75 MS/s, or 300 MB/s total. For the most computationally demanding applications, you can spread your algorithm across multiple FPGAs while peer-to-peer streaming from one to another at more than 800

# Three Steps to Save Three Weeks with LabVIEW – Automating Report Generation

To engineers, “report” is a dreaded word synonymous with “wasted time.”

Although the IEEE 829 standard on software test documentation refers to the acronym TPS as “test procedure specification,” many engineers commonly refer to it as “totally pointless stuff.” Ironically, the delivery of a report often signifies the completion of a milestone or project, meaning the job is not finished until a report is completed and handoff occurs. Engineers have been successfully automating tests and processes with NI LabVIEW software for more than 20 years, but few automate the reporting task.

A key reason engineers struggle to automate reporting is that they lack the right tool for the job. Microsoft Excel is the main tool engineers attempt to use for reporting for two reasons: familiarity and accessibility. Many people use Excel for basic finance management in their personal lives; surely, it can be used to display time-domain waveforms and frequency harmonics of vibrating physical structures, each channel containing multiple millions of samples. Right? Too often, this perception intensifies frustration with reports more than attempting to complete a report in the first place.

Engineers struggle when using Excel for automated reporting primarily because the environment is not designed to work with the data-intensive demands of their applications, such as sophisticated algorithm computations, large data set handling, and complex visualizations. Alternatively, engineers can select an engineering software program such as NI DIAdem, which is designed to simplify postprocessing and off-line reporting of engineering data. Then, they can use LabVIEW, the same tool used to automate the capture and analysis, to save significant time by automating reporting in three steps.

## 1 Create a Report Template

All reports have at least one thing in common: a starting template. Before even thinking about delivering a polished report, engineers must ensure a report template is set up to easily plug in new test data as they acquire it. A report template provides guidance on which information to include and how the report should basically look. DIAdem offers an intuitive report design interface in which engineers can create multipage reports containing 2D and 3D graphs and tables, data properties, images, graphics, text, and decorations. Figure 1 shows an example of a report template created with DIAdem.

After designing the look of the report, engineers need to define which data to represent in the graphs and text fields. To do this, they can drag and drop the data of interest onto the object in the report template. For

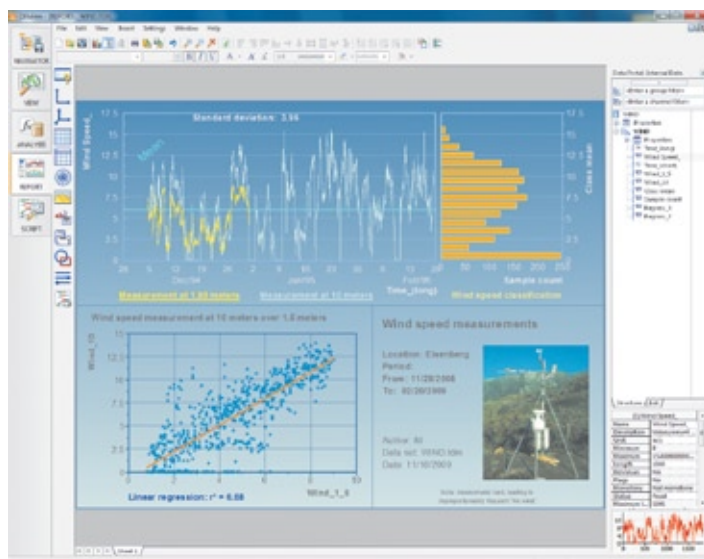


Figure 1. Engineers can create report templates using the drag-and-drop report editor within DIAdem.

instance, to display 30 temperature measurement channels on a graph, engineers select all 30 channels in the DIAdem Data Portal and drag them onto the graph in the report. This step binds the references or names of the channels, for instance TempSensor[0..29], as the input for the graph's display. In the future, any new data written to file as TempSensor[0..29] dynamically displays on the graph.

## 2 Push Data to the Report Template

Assuming a LabVIEW application that acquires and writes data to a file already exists, the basic elements of automating report generation are now available: the LabVIEW application to acquire data and the DIAdem report template. The next step is to dynamically load the LabVIEW data into the DIAdem report. Engineers can apply the LabVIEW DIAdem Connectivity VIs to accomplish this step.

The LabVIEW DIAdem Connectivity VIs provide a LabVIEW palette of VIs to easily exchange data with DIAdem and completely automate the DIAdem environment via ActiveX. Engineers can download the VIs for free at [ni.com/diadem](http://ni.com/diadem). This step can be as simple as four VIs, or flexible enough to scale with automation demands. Figure 2 shows the four VIs used to (1) load the application reference to DIAdem, (2) load data from a file into DIAdem, (3) load the report template, and (4) close the DIAdem reference.

“We use LabVIEW and DIAdem to generate weekly laboratory statistical process control reports to monitor the health of our lab test stations. Before DIAdem, this would take most of Monday morning every week. With DIAdem, we can have the reports in the lab manager’s e-mail before he gets in, saving more than three weeks of engineering time in a year.”

– Joe Gerhardstein, Principal Engineer, Sirius XM Radio

### 3 Publish the Report

Automated reporting is now one step away from completion. Publishing the report can be as simple as using another VI from the LabVIEW DIAdem Connectivity palette. By placing the DIAdem Report Print VI in line with the code in Figure 2, the report is automatically printed when called. Alternatively, DIAdem includes functionality to automatically convert the DIAdem report to PDF or HTML. Engineers can manually enact this step by selecting Export to PDF/HTML from the DIAdem REPORT file menu. However, to automate this step, engineers can use DIAdem SCRIPT to programmatically call the Convert to PDF/HTML option with a single function and use the DIAdem Run Script VI to automate script execution from LabVIEW. The LabVIEW application can scale even further to automatically e-mail the PDF file to a manager or automatically publish the HTML file to the Web.

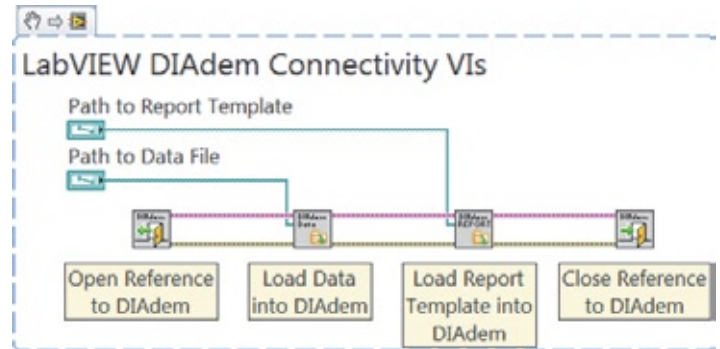


Figure 2. Engineers can automate DIAdem report generation with the LabVIEW DIAdem Connectivity VIs.

takes to prepare, generate, and deliver reports. So the next time someone asks for a TPS report, engineers can have LabVIEW e-mail it.

– Jared Aho [jared.aho@ni.com](mailto:jared.aho@ni.com)

*Jared Aho is the test software group manager at National Instruments. He holds a bachelor’s degree in electrical engineering from the University of Michigan, Ann Arbor.*

### Save Three Weeks with Automated Reporting

As much as engineers try to avoid generating reports, it is an inevitable part of the job. Automating report generation with LabVIEW and DIAdem provides the ideal user experience for simplifying this tedious process. By following three simple steps, engineers can save the days or weeks it

**To download LabVIEW example code and an evaluation version of DIAdem to automate reporting, visit [ni.com/info](http://ni.com/info) and enter **nsi0101**.**

## USB Bandwidth Increases with Windows 7

Recent benchmarks performed in the NI design labs showed that USB throughput increased between 5 and 30 percent when running on Microsoft Windows 7, compared to the same system running on Windows XP. The USB stack optimization in the Windows 7 OS helps advanced USB devices, such as the new NI CompactDAQ chassis (page 11), stream more data back to the PC.

To view a video on these benchmarks, visit [ni.com/info](http://ni.com/info) and enter **nsi0102**.

## DIAdem and CompactRIO Go to Hollywood

On November 25, 2009, NI DIAdem software and CompactRIO hardware made cameo appearances on the popular scientific television show, *MythBusters*. On a recent post from the Sweet Apps blog, check out how Adam and Jamie used NI products to help determine if it is possible to survive a two-story leap into a dumpster.

To read the post and see DIAdem and CompactRIO on *MythBusters*, visit [ni.com/sweetapps](http://ni.com/sweetapps).

# New PXI Precision SMU Improves DC Measurement Speed and Sensitivity

The NI PXI-4132, the newest precision source measure unit (SMU) from NI, offers greatly improved test times compared to traditional solutions. The improved measurement speed is the result of two main architectural benefits – a highly stable analog front end and an onboard sequence engine. Together these provide enhanced speed in applications such as leakage measurements on pins of an integrated circuit (IC) or faster IV sweeps on LEDs and transistors.

## Faster Low-Level Measurements

To get accurate DC measurements, engineers have traditionally had to compromise measurement speed. However, the PXI-4132 offers better than 100 pA sensitivity at measurement rates up to 1 kHz and down to 10 pA measurement sensitivity at lower speeds on its four-quadrant output. Figure 1 shows a comparison of the typical measurement resolution of the PXI-4132 compared to that of a leading traditional SMU measured on the 10  $\mu$ A range of each instrument.

Engineers can use this improved resolution to decrease their test time. For instance, a per-pin leakage test on a semiconductor chip is an example of an application that often must be conducted repetitively and quickly while still maintaining high accuracy on nanoamp-level leakage currents. Over multiple measurements, the improved speed and analog resolution of the PXI-4132 can yield dramatic reductions in test time.

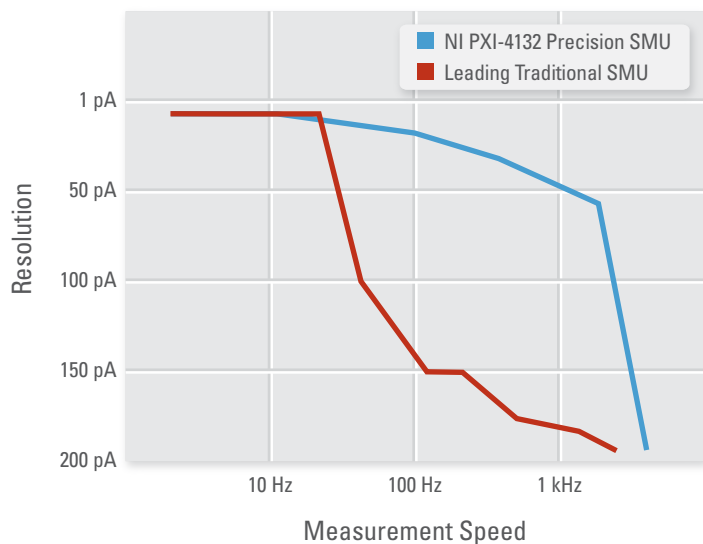


Figure 1. The PXI-4132 precision SMU takes high-resolution measurements at faster rates than traditional SMUs.

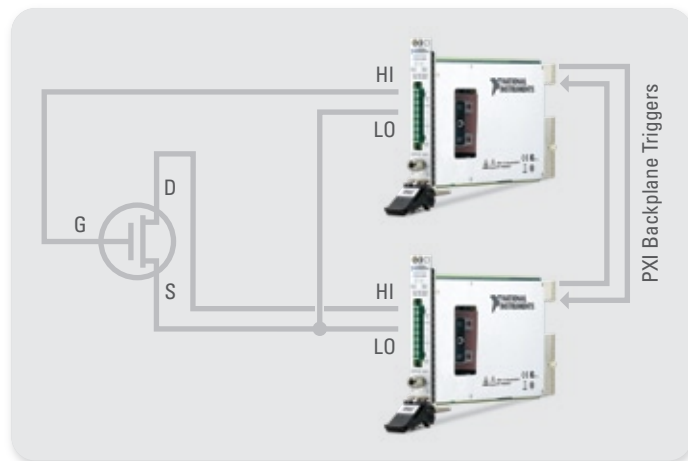


Figure 2. Engineers can synchronize multiple PXI-4132 precision SMUs for fast, hardware-timed IV sweeps on transistors.

## High-Speed Sweeping and Sequencing

SMU measurements often come in bunches, such as a multipoint IV sweep on a single pin or a single measurement performed on many pins via a switch. In both cases, the speed and determinism of controlling multiple measurements are essential for achieving the best test time. To eliminate software delays, the PXI-4132 features an onboard hardware sequence engine that engineers can use to source and measure hundreds of points with no software interaction. Furthermore, with integrated PXI triggering, the PXI-4132 can correlate its output sequences with other SMUs for synchronized sweeps, with PXI switches for tests on multiple pins, or with other PXI instruments such as high-speed digital I/O and digitizers.

With intuitive LabVIEW software for configuration and control, the PXI-4132 precision SMU helps engineers realize the benefits of improved test time and correlated measurements with reduced development effort.

To learn more about the PXI-4132 precision SMU, visit [ni.com/info](http://ni.com/info) and enter **nsi0103**.

# Taking Ultrasonic Measurements with NI X Series Multifunction DAQ Devices

Ultrasonic waves are sound waves with frequencies higher than what the human ear can detect. They have numerous engineering applications, including nondestructive testing (NDT), acoustic emissions (AEs), and distance and thickness measurements. Certain NDT applications use both an ultrasonic emitter and receiver, such as pulser-receiver systems that send an ultrasonic wave into a material and use the response to identify flaws and their respective locations. AE testing uses only a receiver to listen for the ultrasonic pulses emitted by a changing defect within a material.

Engineers can use several ultrasonic receivers around the object and a simultaneous sampling data acquisition (DAQ) device to determine the exact location of a defect. NI X Series multifunction DAQ devices are a cost-effective option to acquire and generate ultrasonic signals when combined with piezoelectric transducers. Simultaneous sampling X Series devices have up to 16 analog inputs per device with 16-bit resolution and up to 2 MS/s/channel sampling rates. Engineers can synchronize several X Series devices within a PXI Express chassis for up to 272 simultaneous inputs.

The NI LabVIEW graphical programming environment and NI-DAQmx driver software provide an easy way to acquire ultrasonic signals from one



*The simultaneous sampling analog inputs on an X Series device are well suited to acquire ultrasonic waves up to 1 MHz.*

or more X Series devices. Once engineers acquire these signals, they can use the LabVIEW Advanced Signal Processing Toolkit to perform time-domain analysis of the transients.

**To download the Ultrasonic Testing Starter Kit for LabVIEW, visit [ni.com/ndt](http://ni.com/ndt).**

## Increase Your Efficiency with the New NI CompactDAQ Chassis

The new NI CompactDAQ chassis builds on the success of the original chassis with four features that help you do more with your NI CompactDAQ data acquisition (DAQ) system. You now can do the following:

1. Run analog modules at different rates with multiple analog input (AI) timing engines. This feature helps you separate high-speed measurements such as vibration from low-speed data such as temperature, eliminating programming time otherwise used for data decimation. In addition to programming time, NI-DAQmx driver software
2. Perform more simultaneous counter functions with four advanced counter timers. With more 32-bit counters built into the NI CompactDAQ chassis, you can perform more quadrature encoder, frequency, and period measurements with less hardware than before.
3. Import or export up to 1 MHz clocks and triggers without a separate digital module with BNC triggers on the new NI cDAQ-9178 chassis. Program triggers by selecting from a pull-down menu in the NI DAQ Assistant.
4. Choose the chassis that suits your needs with the new four-slot option. For smaller systems, the four-slot NI cDAQ-9174 chassis is lower in cost, takes up less space, and does not compromise on channel density. Measure up to 128 channels in this new chassis.



*The two new NI CompactDAQ chassis add many features that increase ease of use and performance.*

**To learn more about what's new in NI CompactDAQ, visit [ni.com/new\\_compactdaq](http://ni.com/new_compactdaq).**

# Do You Know Where Your Radios Are?

With phase-coherent RF vector signal analyzers (VSAs), you can build a phase-comparison direction-finding system.

Remember jumping on a trampoline as a child and “stealing the bounce” of a friend? A perfectly timed jump would create the destructive interference necessary to bring the unfortunate jumper to their knees. Sometimes, you would try “giving a bounce,” using constructive interference to send your friend much higher than they could have reached on their own.

This behavior was observed in waves long before the introduction of the modern trampoline and has found its way into many applications. In 1905, Karl Ferdinand Braun showed this property could actually be used to enhance a radio transmission in a given direction by using two or more antennas. Since then, applications such as beamforming; multiple input, multiple output (MIMO) communications; and direction finding have all benefited from this effect.

Figure 1 illustrates two transmitters and two possible scenarios of a signal source creating constructive and destructive interference at the receiver with the phase shown in the simplified polar plots. In beamforming applications, a delay in the transmission (phase change) from one of the sources will steer the direction of highest RF intensity, controlling the direction of transmission.

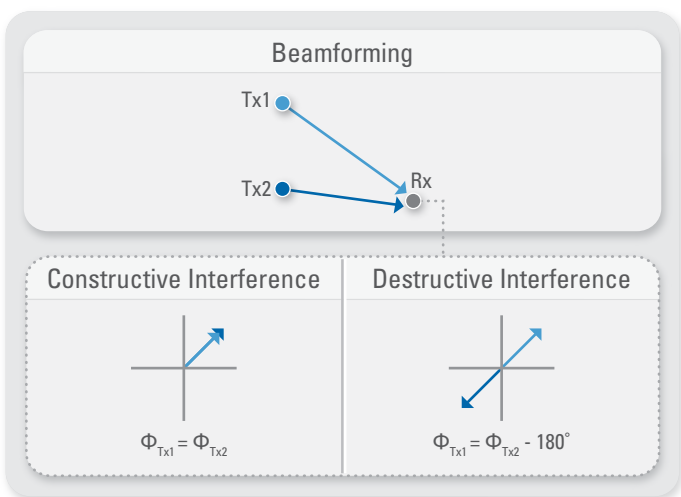


Figure 1. You can control the direction of optimal transmission by adjusting the phase difference between two transmitters.

In Figure 2, receivers are used to measure the difference in phase of a signal received by two different paths. Using this phase comparison, you can detect the direction from which the transmission originated.

Technically, this should also apply to the trampoline example. If two jumpers acted as stationary observers to a third jumper, it would be theoretically possible for them to detect the location of the third jumper solely based on the arrival time of the wave crest created from each bounce.

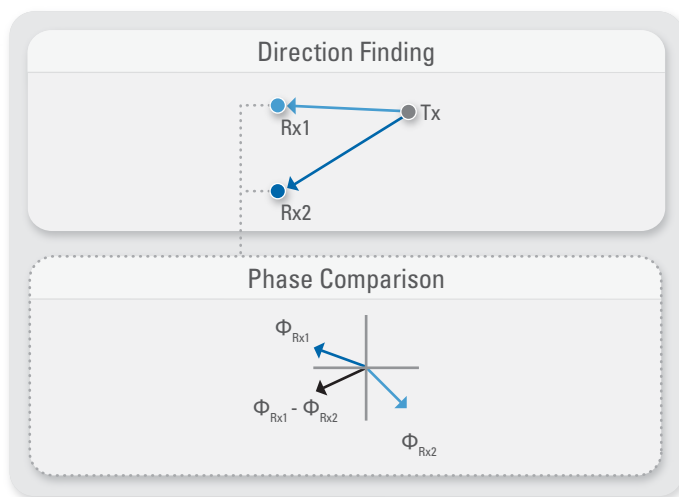


Figure 2. Using multiple receivers for phase comparison between signal paths, you can determine a signal's direction of arrival.

Even though this may not be practical on a trampoline, detecting the direction of an RF transmission in this way is possible using the right tools and techniques.

## Constructing a Direction Finder

To construct a basic phase-comparison direction finder, you need multiple receivers, the ability to measure the phase difference between the received signals, and some math. You can satisfy the first requirement by adding more analyzers to the system, but accurately measuring the difference in phase between two signals is more challenging. To compare the phase difference between two measurements, you must precisely know the phase differences between each oscillator used along the downconversion path from RF, as well as the time difference between multiple records from the analog-to-digital converters (ADCs).

Figure 3 shows a solution using two NI PXIe-5663E VSAs sharing a common local oscillator (LO) for downconversion from RF and a 10 MHz reference clock.

The software-defined PXI platform makes this approach possible, and each NI PXIe-5663E consists of three modular instruments: the NI PXIe-5652 RF signal generator, NI PXIe-5601 RF downconverter, and NI PXIe-5622 IF digitizer. Cascading a common LO between VSAs eliminates the difference in phase noise introduced when each analyzer uses its own LO and the resultant phase measurement error. By sharing a common 10 MHz reference between VSAs, you can synchronize the acquisition triggers of the ADCs and the numerically controlled oscillators used for digital downconversion to baseband. By synchronizing each stage of conversion from RF to

baseband, you can accurately compare phase measurements between multiple signals.

With two phase-coherent analyzers, you can accurately measure any phase difference between the two RF channels and apply it to direction-finding applications. For example, a two-way family radio is used as a transmitter at 462.56 MHz with a pair of general-purpose ultrahigh frequency (UHF) telescoping antennas connected to two NI PXIe-5663E VSAs. By positioning the antennas 32.3 cm (one-half wavelength) apart, you can expect the phase difference to be 180 degrees when the antennas share a line of sight to the receivers and the phase difference to be zero degrees when the transmitter is equidistant from both antennas.

By tuning the VSAs to the carrier frequency of 462.56 MHz, you can begin to continuously acquire I and Q samples to extract the phase. Verify the zero and 180 degree cases by observing the difference between the phase measurements of the VSAs. Lastly, solve for the intermediate cases.

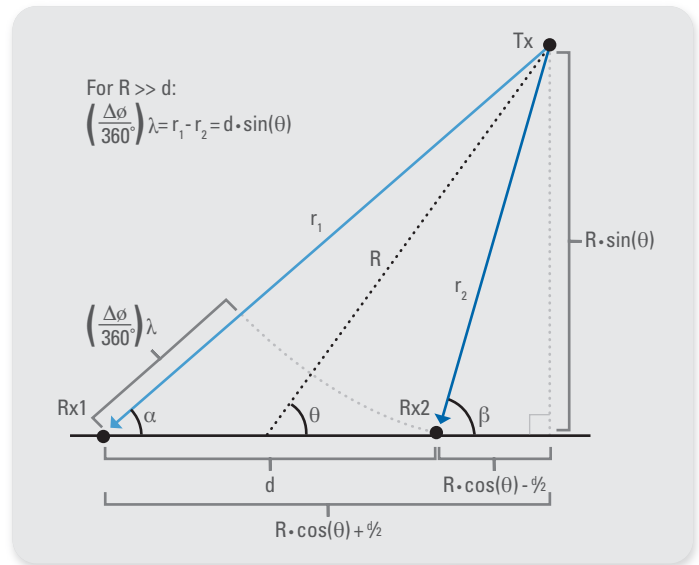


Figure 4. This illustration shows phase-comparison direction finding using two receivers. The VSAs act as Rx1 and Rx2 and the family radio acts as Tx.

As shown in Figure 4, the goal of a direction finder is to solve for  $\theta$ . This math is greatly simplified if you assume that  $R$  is much larger than  $d$ , which is a valid approximation for most signals of interest.

Knowing the frequency of interest, the distance between the antennas, and the difference in the measured phase, you can solve for the corresponding values for  $\theta$ . Measuring a phase difference between two analyzers of 58 degrees would translate to a  $\theta$  of 71.2 degrees, whereas a phase difference of -121 degrees would yield a  $\theta$  of 132.2 degrees.

### Benefits of Phase-Synchronized Instruments

Direction finding is only one of many applications that benefits from phase-coherent analysis and generation. MIMO-based protocols such as 802.11n, WiMAX, and Long Term Evolution (LTE) can significantly increase data rates using these techniques to accurately distinguish between multiple broadcast signals that differ by a spatial signature created by the path traveled from the transmitter to the receiver. With the flexibility of the modular PXI platform, you can prototype and test these types of unique systems and deliver them to market faster than ever before.

– David Broadbent david.broadbent@ni.com

David Broadbent is a product manager for RF and wireless test at National Instruments. He holds a bachelor's degree in physics from Brigham Young University.

To learn more about MIMO test and synchronizing multiple RF analyzers and generators, visit [ni.com/info](http://ni.com/info) and enter **nsi0104**.

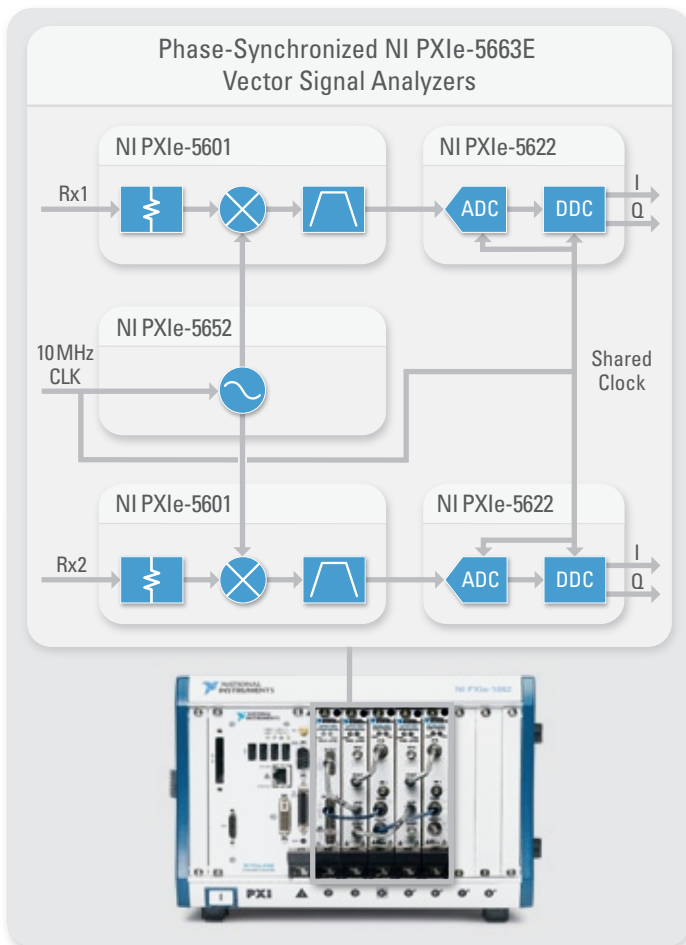
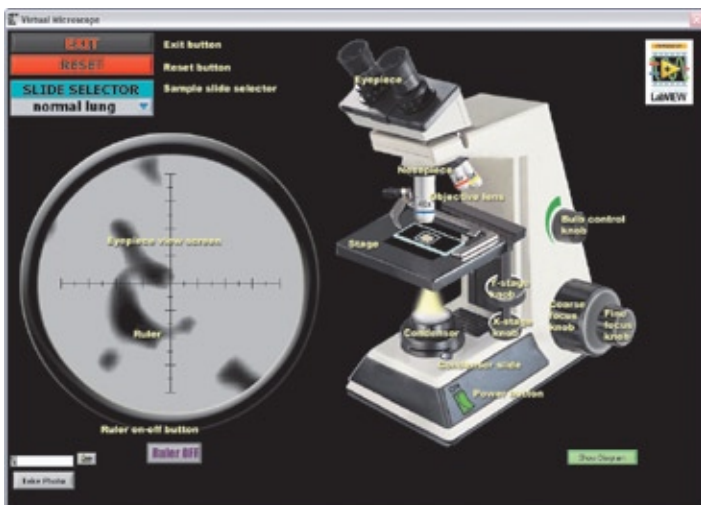


Figure 3. With the modularity of the software-defined NI PXIe-5663E VSA, you can share a common local oscillator and sample clock between multiple analyzers for tight phase synchronization.

# Learning Science Concepts through the Virtual Instrument Project

High school educators teaching students biological science concepts can now do so with a virtual microscope and spectrophotometer they can download for free. These instruments were created through the Virtual Instrument Project, a collaboration between National Instruments, Howard Hughes Medical Institute, the O'Donnell Foundation, The University of Texas Southwestern Medical Center, and Texas A&M University.



Students learning biological science concepts can now do so with a free downloadable virtual microscope and spectrophotometer.

The project was designed to help high school educators who do not have access to the equivalent real-life instruments. Students use a virtual interface that closely resembles using a physical instrument. Dr. Kenith Meissner and his group at Texas A&M University designed the virtual instruments, powered by the NI LabVIEW graphical programming environment.

Four features make the virtual instruments unique:

1. Fully rotatable knobs, buttons, and lens selectors
2. Ability to zoom in and out of samples, similar to a real instrument
3. Ability to create custom slides based on user preferences
4. Adjustable aspects of the instrument such as light intensity and x- and y-axis positions

These features help educators and students experience the instruments as if they were actually in front of them. In addition to the two virtual instruments currently available, the team at Texas A&M University plans on developing a virtual gel electrophoresis and a virtual polymerase chain reaction (PCR) instrument.

To download the Virtual Instrument Project tools, visit [ni.com/info](http://ni.com/info) and enter **nsi0105**.

## Students Explore Electronics with Updated Textbook Editions



*Electrical Engineering: Principles and Applications, Fifth Edition*

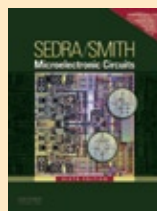
Allan R. Hambley

Prentice Hall

ISBN 13: 978-0-13-213006-6

The fifth edition of *Electrical Engineering* provides a strong foundation in circuits, electronics, instrumentation, and mechatronics. Readers cover NI Multisim software in early chapters to build an understanding of circuits and electronics concepts, followed by the NI LabVIEW graphical programming environment to learn about acquiring signals and analyzing real-world electromechanical systems.

To learn more and view ordering information, visit [ni.com/info](http://ni.com/info) and enter **nsi0106**.



*Microelectronic Circuits, Sixth Edition*

Adel S. Sedra and Kenneth C. Smith

Oxford University Press

ISBN 13: 978-0-19-532303-0

The new modular and streamlined sixth edition of *Microelectronic Circuits* continues its standard of innovation built on the solid pedagogical foundation that instructors expect from Adel S. Sedra and Kenneth C. Smith. The textbook bundles the full version of the Multisim Student Edition, helping students simulate examples and investigate problems within the chapters.

To download Multisim circuit files for *Microelectronic Circuits*, visit [ni.com/info](http://ni.com/info) and enter **nsi0107**.

# Did You Know LabVIEW Could Make a Quadcopter Fly?

One afternoon, a colleague and I were musing about building a flying robot; not long after, we had selected a design, ordered parts, and started receiving packages with cool robot pieces. I had carbon fiber rods, brushless motors, airplane propellers, electronic speed controllers, custom-made circuit boards, lithium polymer batteries, sensors, and a shiny new NI Single-Board RIO to function as the brain. After a few days of building, I had put it all together into a fully functional quadrotor helicopter designed around NI Single-Board RIO. All it needed was a bit of control code to get it off the ground.

We started by reviewing some literature on quadrotor helicopter control and were shocked to discover that our proposed algorithms represented publication-worthy research and state-of-the-art control methods. We may have underestimated the control algorithms a little, but, undaunted, I began designing a model.

The system was simple. Each propeller created a thrust, and the four thrusts combined to counteract gravity. We put together our model using text-based code in an NI LabVIEW MathScript Node, checked it against the literature, and moved forward to the control code.

We wanted to combine a linear-quadratic regulator (LQR) with a Kalman filter to build a Linear-Quadratic Gaussian (LQG) control algorithm. LabVIEW software provided the tools to make the model linear, create the gain matrices for the LQR controller, help tune the Kalman filter, and implement the LQR and Kalman filter. We wrapped the closed-loop system in a LabVIEW Control Design and Simulation Module Loop, tuned a few parameters, and assembled a full simulation of the system.

Here was the exciting part: By using the LabVIEW toolchain, we had the opportunity to reuse the work we did modeling and developing the control algorithm to create the deployed system. We moved the simulation code to the real-time processor of the NI Single-Board RIO and replaced the model of the quadcopter with real I/O. And, with a little tuning, we had a flying robot.



*Two NI engineers built a quadrotor helicopter around an NI Single-Board RIO with a control algorithm designed and implemented using the LabVIEW toolchain.*

– Ben Black [ben.black@ni.com](mailto:ben.black@ni.com)

*Ben Black is a systems engineer for advanced control and robotics at National Instruments. He holds bachelor's and master's degrees in mechanical engineering from Rice University and a doctorate degree in mechanical engineering from the Georgia Institute of Technology.*

**To view the author's blog for the whole story, visit [ni.com/info](http://ni.com/info) and enter [nsi0108](#).**

## Join the LabVIEW APIs Online Group

Take advantage of one of the latest online user groups to exchange technical information on NI LabVIEW APIs and share best practices for building add-on toolkits. Also, visit the site to download new code, such as VI Scripting, which can help you write a LabVIEW program that generates and inspects LabVIEW code.

**To join the LabVIEW APIs group, visit [ni.com/info](http://ni.com/info) and enter [nsi0109](#).**

# A C Series Platform for Every Application – 100 Modules and Counting

With more than 50 NI modules, 50 third-party modules, and a multitude of chassis available, there are several configuration options within the NI C Series platform to address a variety of application needs. Deploy these configurations as a stand-alone system or over USB, Ethernet, or wireless.



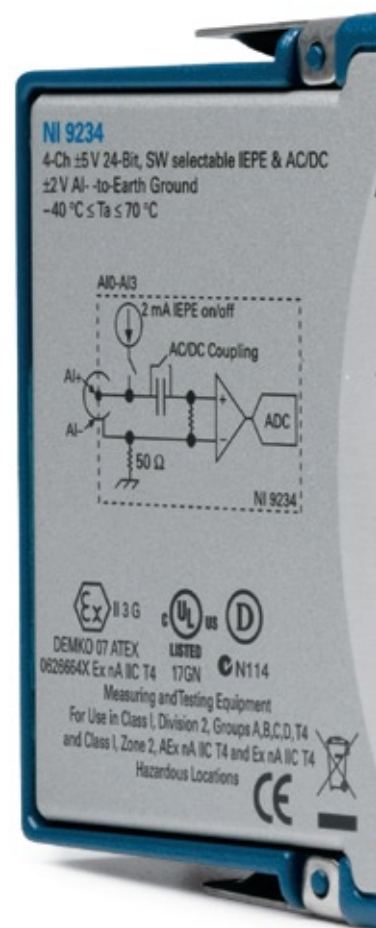
## Industrial Control and Monitoring with CompactRIO

For an industrial machine control and monitoring solution complete with real-time math, advanced analysis, and control, add the NI 9234 module for vibration monitoring and digital modules for PWM and proportional integral derivative (PID) control to an NI CompactRIO system.



## Remote Determinism with CompactRIO Expansion

For applications that require distributed determinism, add an NI 9234 module to an NI 9144 expansion chassis to provide deterministic communication and a field-programmable gate array (FPGA) for distributed real-time signal processing, monitoring, and control functions.





### Mixed-Sensor Test with NI CompactDAQ

For applications such as appliance test, the NI 9234 module measures sound or noise level and can be combined with modules for temperature, power, and other signals in an NI CompactDAQ chassis for a complete measurement system.



### Portable Measurement System with USB

When used with the NI USB-9162 carrier and a netbook, the NI 9234 module becomes an ultraportable measurement system that fits in a small pouch and can gather bearing vibration data for machine condition monitoring applications.



### Remote Monitoring and Test with Ethernet or Wireless C Series

Insert a high-speed sound or vibration measurement into a manufacturing process that is down the line or across the factory by installing the NI 9234 module in an Ethernet or wireless carrier. The measurements take place on the floor while you stay in the control room.

To learn more about the C Series platform, visit [ni.com/info](http://ni.com/info) and enter **nsi0110**.

# Add Vision to Your NI Single-Board RIO and CompactRIO Applications

Imaging capabilities are now available on the NI Single-Board RIO and CompactRIO distributed I/O platforms, widening the scope of advanced measurements for NI embedded systems and programmable automation controllers (PACs). This new functionality makes CompactRIO one of the first PACs to have vision capabilities and provide a fully integrated and efficient design for shorter time to market and reduced physical footprint.



Acquire and process images from IP and analog cameras on CompactRIO hardware with the new NI Vision Development Module.

With the NI Vision Development Module 2009, you can deploy image processing and machine vision applications to both NI Single-Board RIO and CompactRIO deployment targets. There are two methods to acquire images into NI Single-Board RIO and CompactRIO. The first is to acquire compressed images from Internet Protocol (IP) cameras with the latest NI-IMAQdx image acquisition driver. You can also use the new AF-1501 frame grabber from National Instruments Alliance Partner moviMED to acquire monochrome images from analog cameras. Both IP and analog cameras are low-cost options for adding vision to the integrated hardware solution.

These new features address a variety of control and measurement applications that involve mixed I/O, from autonomous robotics to industrial monitoring to embedded medical devices. The IP camera connectivity enhances CompactRIO as a platform for developing professional robotics projects by integrating sensor connectivity, vision, motion, and control functions within a single system. The analog camera connectivity and the small form factor provide an ideal platform for slide scanners and automated microscopy, and the real-time OS makes it easier to obtain FDA validation. Vision capabilities also enhance CompactRIO as a platform for industrial applications such as machine condition monitoring and critical vessel monitoring with area-scan and thermal cameras.

**To read more about vision support on NI Single-Board RIO and CompactRIO, visit [ni.com/info](http://ni.com/info) and enter **nsi0111**.**

## New CompactRIO Rugged Performance Controllers



Two new NI CompactRIO controllers can extend your application's maximum performance and temperature range. The NI cRIO-9023, featuring a 533 MHz PowerPC processor, and the

NI cRIO-9025, featuring an 800 MHz processor, are certified to operate from -40 to 70 °C; offer dual Ethernet, RS232, and USB ports; and are programmed with the NI LabVIEW Real-Time Module for applications that require advanced processing and control in extreme environments.

**To read a white paper on what's new with CompactRIO, visit [ni.com/info](http://ni.com/info) and enter **nsi0112**.**

## New NI Embedded Vision Systems



Take advantage of a rugged controller that combines industrial camera connectivity and open communication with the

high performance and flexibility of a multicore PC. The fanless NI Embedded Vision System is designed to process images in real time from multiple cameras and is suitable for machine vision applications such as high-speed sorting, assembly verification, and packaging inspection.

**To view specifications and pricing for the NI Embedded Vision System, visit [ni.com/evs](http://ni.com/evs).**

# Measurement Studio 2009 Offers New PC Technology and Hardware Support

NI Measurement Studio 2009 dramatically reduces application development time for the Microsoft Visual Studio 2003/2005/2008 developer creating test and measurement applications. It provides integrated I/O support, native libraries, and user interface components that simplify data acquisition, analysis, and visualization. The latest version offers support for recent PC technologies, such as Microsoft Windows 7 and 64-bit .NET application development. It also includes usability improvements and provides faster data streaming with Technical Data Management Streaming (TDMS) enhancements and new data acquisition hardware support.

Measurement Studio developers can now take full advantage of increased processing power and memory capabilities available on 64-bit OSs with added support for advanced PC technologies. They can also easily migrate existing applications to Windows 7 and develop and deploy 64-bit Measurement Studio .NET applications built with Visual Studio 2008.

The latest version includes increased I/O capabilities and reduces data acquisition and instrument control application development time in Visual Studio with support for new NI data acquisition (DAQ) hardware, such



Measurement Studio 2009 increases I/O capabilities with support for new DAQ hardware, such as X Series DAQ.

as NI CompactDAQ, Wi-Fi DAQ, and X Series DAQ. Developers can also stream data to disk 12 times faster with new enhancements to the native .NET TDMS API, including disabled Windows buffering, asynchronous writes, and direct data streaming from the NI-DAQmx software driver.

To evaluate Measurement Studio 2009, visit [ni.com/mstudio/try](http://ni.com/mstudio/try).

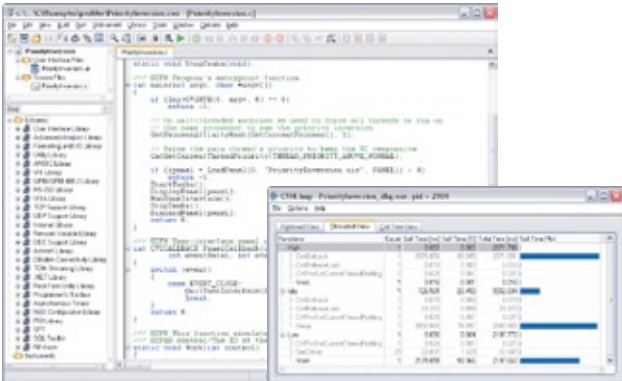
# LabWindows™/CVI 2009 Increases Application Productivity and Reliability

NI LabWindows/CVI 2009 builds on its proven software development history with new features that increase the productivity of test and measurement ANSI C developers. The latest version includes enhanced productivity tools and introduces a new toolkit for run-time analysis and optimization. LabWindows/CVI 2009 also supports new technologies such as the Microsoft Windows 7 OS and 64-bit application development and

deployment. In addition, it provides a new interface for communicating with NI PXI field-programmable gate array (FPGA)-based hardware, including NI FlexRIO and R Series data acquisition (DAQ) devices.

The new LabWindows/CVI Execution Profiler Toolkit provides a graphical representation of function execution, which helps developers analyze and optimize the run-time performance of LabWindows/CVI applications. LabWindows/CVI 2009 also includes additional debug data in the Variables and Watch windows and introduces a new attribute browser that helps developers more efficiently create custom user interfaces by simultaneously selecting and editing common attributes of multiple controls.

LabWindows/CVI developers can now incorporate FPGA-based NI reconfigurable I/O (RIO) hardware modules into their test systems. They can use the NI LabVIEW FPGA Module to define the behavior of an FPGA and use LabWindows/CVI with the new C Interface to LabVIEW FPGA to develop a LabWindows/CVI host application for a Windows or real-time OS using the LabWindows/CVI Real-Time Module.



Developers can analyze and optimize the run-time performance of LabWindows/CVI applications with the new LabWindows/CVI Execution Profiler Toolkit.

To view a webcast on new LabWindows/CVI 2009 features, visit [ni.com/info](http://ni.com/info) and enter **nsi0113**.

The mark LabWindows is used under a license from Microsoft Corporation. Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

# NI Offers Windows 7 on PXI Embedded Controllers, Extends Windows XP Availability

With better multicore performance and USB throughput than Windows XP, better legacy hardware and software compatibility than Windows Vista, and general usability and stability improvements, Windows 7 is well-suited for new automated test, measurement, and control applications.

To help engineers build these systems based on Windows 7 in a compact and powerful form factor, NI has released Windows 7 options for all of its latest PXI and PXI Express embedded controllers. With more than 1,500 supported I/O modules to choose from, engineers can now take advantage of the latest OS to address the requirements of a variety of test, measurement, and control applications.

At the same time, National Instruments also understands the longevity and availability requirements of PXI systems based on Windows XP that either have been deployed or are in development. For many of these systems, the option to upgrade to a newer OS is not always viable.

After Microsoft discontinued Windows XP in June 2008, NI continued to offer Windows XP preinstalled on its PXI embedded controllers by exercising end-user downgrade rights from Windows Vista. NI plans to continue offering this option through 2010. To offer Windows XP preinstalled beyond 2010, NI plans to migrate to a new stock-keeping unit (SKU) of Windows XP Pro known as Windows XP Professional for Embedded Systems (Windows XP Pro FES). Windows XP Pro FES is identical to Windows XP Pro in functionality, usability, and driver and application support; however, it has some licensing restrictions that prohibit its use on general-purpose



*With the Windows 7 option for NI PXI embedded controllers, engineers can now use the latest OS for creating compact and powerful test, measurement, and control systems.*

PCs mainly used to perform standard desktop functions. Because PXI systems do not fall into this category, NI plans to offer this option on all of its PXI embedded controllers as Microsoft has committed to support Windows XP Pro FES through 2016.

**To learn more about Windows XP Pro FES, visit [ni.com/info](http://ni.com/info) and enter [nsi0114](#).**

## New Avionics Interfaces for PXI



In collaboration with AIM USA, a manufacturer of avionics test and simulation products, NI introduces a range of avionics bus interfaces for PXI that meet MIL-STD-1553,

ARINC429, and ARINC664 (AFDX) standards. The modules support the PXI triggering, timing, and synchronization requirements of the PXI standard and are fully compatible with NI LabVIEW, the LabVIEW Real-Time Module, LabWindows™/CVI, Measurement Studio, and NI VeriStand software.

**To learn more about the avionics bus interfaces for PXI, visit [ni.com/info](http://ni.com/info) and enter [nsi0115](#).**

## Electrically Isolated, Long-Distance Remote Controller for PXI Express



The NI PXIe-PCIe8375 fiber-optic MXI-Express remote controller for PXI Express systems is a new electrically

isolated, long-distance interface with sustained bandwidth of up to 838 MB/s. The controller offers up to 100 m of distance between the host PC and chassis with low latency and greater cabling flexibility.

**To view the NI PXIe-PCIe8375 specifications and pricing, visit [ni.com/info](http://ni.com/info) and enter [nsi0116](#).**

# New Tools for Mobile WiMAX Test Improve Measurement Throughput

The new NI Measurement Suite for Mobile WiMAX provides a new solution to Mobile WiMAX device testing. The suite supports various signal configurations including channel bandwidths from 1.25 to 28 MHz; fast Fourier transform (FFT) sizes from 128 to 2,048; and all supported modulation/coding schemes. Combined with PXI instrumentation, such as the NI PXIe-5663E 6.6 GHz RF vector signal analyzer and the NI PXIe-5673E 6.6 GHz vector signal generator, the suite delivers measurement speeds up to five times faster than traditional instrumentation. The new WiMAX tools also provide a lower-cost alternative to R&D-grade WiMAX instrumentation for production environments. With typical error vector magnitude (EVM) results as low as -45 dB (-10 dBm at 2.5 and 3.5 GHz), you can perform extremely accurate EVM measurements on devices such as handsets, power amplifiers, and transceivers.

You can also use the generation and analysis software toolkits for the NI Measurement Suite for Mobile WiMAX with the NI Measurement Suite for Fixed WiMAX, NI WLAN Measurement Suite, and NI GPS Simulation Toolkit for LabVIEW for multiprotocol test applications. Each toolkit supports a range of PXI modular instrumentation and can be used



*The NI Measurement Suite for Mobile WiMAX delivers fast and accurate EVM and RF power measurements.*

with high-speed digital products, arbitrary waveform generators, high-speed digitizers, and RF vector signal generators and analyzers.

**For more information on tools for testing WiMAX devices, visit [ni.com/automatedtest/wimax](http://ni.com/automatedtest/wimax).**

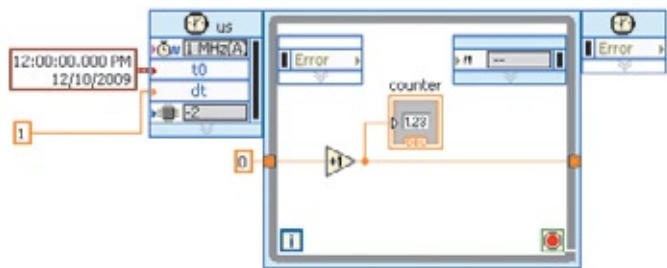
# Synchronize LabVIEW Targets to Absolute Time with IEEE 1588

With the release of NI LabVIEW 2009 software, you can synchronize LabVIEW targets over Ethernet. The LabVIEW Timed Loop and Timed Sequence now reference absolute time sources in addition to the standard 1 kHz and 1 MHz internal clock sources and digital external sources. By referencing an absolute time source in LabVIEW, you can tightly correlate targets located across a network to absolute time with ease.

The IEEE 1588 standard defines a clock synchronization protocol to precisely synchronize clocks over a local area network (LAN). The protocol establishes a means for slave devices to adjust their clocks to

master devices and is being used in a variety of fields including test and measurement, control, and telecommunications. With the NI implementation, configuration is simple. Set up your network and configure the Timed Loop and Timed Sequence with the common API you are familiar with.

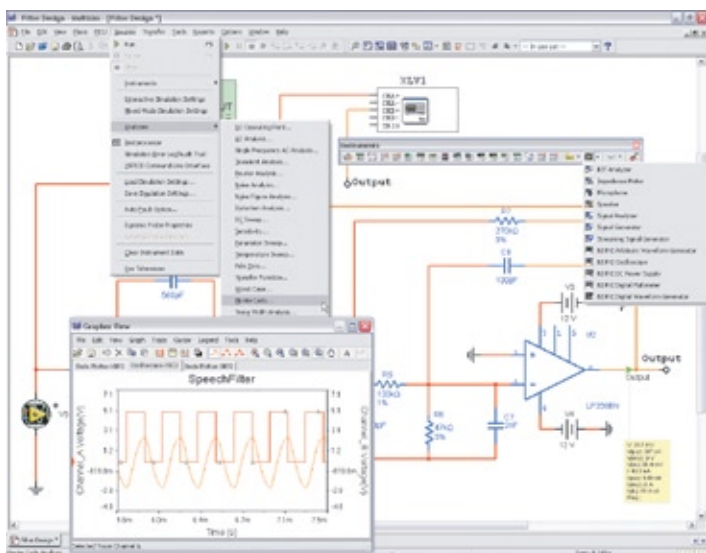
As the first absolute time source supported in LabVIEW, IEEE 1588 makes submillisecond synchronization possible on many existing LabVIEW targets including NI CompactRIO, Smart Cameras, and Compact FieldPoint. On PXI, PXI Express, and PCI platforms, you can take advantage of IEEE 1588 implementation on a dedicated IEEE 1588 network interface card, such as the NI PXI-6682, PXI-6682H, and PCI-1588. These platforms can tightly synchronize to within tens of nanoseconds across Ethernet. Whether implemented with dedicated hardware or standard Ethernet ports, all targets correlate their time to this same reference and greatly enhance the synchronization of your distributed systems.



*You can configure the Timed Loop to reference time sources including IEEE 1588.*

**To learn more about the IEEE 1588 software beta program, visit [ni.com/info](http://ni.com/info) and enter **nsi0117**.**

# A Better Approach to Circuit Simulation



Multisim 11.0 enhances the approach to both teaching and prototyping.

The newly released NI Multisim 11.0 software continues to simplify circuit design and prototyping by abstracting the traditional complexities of simulation. With specialized editions of the software for interactive hands-on learning and professional circuit design, the highly graphical Multisim environment equips educators, students, and engineers with intuitive tools to investigate electronics behavior and complete complex analyses. The latest version, Multisim 11.0, further enhances the approach to circuit teaching and prototyping.

## Build Your Own Temperature Data Logger



Configure an NI thermocouple data logger that fits your specific application needs. Choose from four to 16 channels and USB, Wi-Fi, or Ethernet for PC connectivity.

Easily log data with included NI LabVIEW SignalExpress LE data-logging software or add custom alarming, processing, and real-time data visualization with LabVIEW.

To configure your data logger, visit [ni.com/info](http://ni.com/info) and enter **nsi0118**.

## Multisim in the Classroom

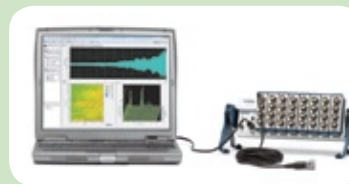
With Multisim 11.0, educators can reinforce theory with a hands-on approach by helping students make the connection between digital theory and hardware implementation by generating raw VHDL code from Multisim. The new programmable logic device (PLD) schematic helps students capture and simulate digital designs in Multisim, then export VHDL code to target hardware such as the NI Digital Electronics FPGA Board. This continued integration of Multisim simplifies the transition from theory taught in the classroom to implementation in the laboratory.

## Multisim in Industry

Engineers worldwide use Multisim to optimize circuit designs, minimize errors, and reduce prototyping iteration. The software integrates with the NI LabVIEW graphical programming environment to define custom analyses to improve design. For engineers creating customized accessories and daughter cards for NI hardware such as NI Single-Board RIO, Multisim 11.0 includes a database of 26 accurate hardware-mating connectors. Engineers can improve the performance of designs by taking advantage of powerful simulation to identify errors earlier in the design flow and reduce costly prototype iterations.

To view videos demonstrating new Multisim features, visit [ni.com/multisim/upgrade](http://ni.com/multisim/upgrade).

## NI Starter Bundle for Noise, Vibration, and Harshness



The NI USB noise, vibration, and harshness (NVH) system is a complete sound and vibration solution for NVH,

acoustics, electroacoustics, vibration, and structural dynamics. The NI USB NVH system comes with easy-to-use software and the NI Sound and Vibration Measurement Suite, which is the most comprehensive collection of NI analysis and signal processing tools for NVH applications.

To view specifications and pricing for the NI USB NVH system, visit [ni.com/info](http://ni.com/info) and enter **nsi0119**.

# Top Five Reasons to Purchase the NI Academic Site License

From classrooms to advanced research labs, the Academic Site License offers flexible licensing options to meet your campus software needs. Adopted by thousands of campuses worldwide, NI LabVIEW software can be incorporated into the classroom or lab through a variety of licensing options.

Consider the following five reasons to adopt the Academic Site License for your campus:

## 1 Gain comprehensive access to LabVIEW software

Take advantage of LabVIEW graphical programming in your campus classrooms. Millions of engineers and scientists use LabVIEW to solve complex test, measurement, and control applications. Access a suite of LabVIEW modules and toolkits to enrich the classroom learning experience and enhance your research applications.



*With the student install option, students can extend access to LabVIEW software from the lab to their personal computers.*

## 2 Get regular software maintenance releases and upgrades

Receive software updates automatically when a new version is available. Take advantage of software features and bug fixes with the latest software release.

## 3 Access expert technical support

Save time by resolving technical issues with the help of NI applications engineers on your next project. Receive one-on-one support over the phone, through e-mail, and on the Web.

## 4 Attend campus seminars and product training

Stay informed about the latest technologies and benefit from product training through on-campus seminars. Access exclusive on-demand Web training to increase your application development skills and expand your technical knowledge.

## 5 Receive discounted student licensing

Universities with an active subscription receive exclusive student discounts for LabVIEW software. From your class to an entire student body, the student install option is available for purchase to extend LabVIEW software from the lab to students' personal computers.

Receive all these benefits with the purchase of a new license that includes a first-year subscription. Maximize the advantages of the Academic Site License by renewing your software subscription each year.

To learn more about the Academic Site License, visit [ni.com/info](http://ni.com/info) and enter **nsi0120**.

## Introducing LabVIEW Core Training Courses

NI LabVIEW training courses lead to faster programming, quicker application development, and less time spent on code maintenance. National Instruments recently introduced the LabVIEW Core training courses, which offer a quicker learning path and more flexible options. LabVIEW Core training is your best path to achieving LabVIEW proficiency.

To view the new LabVIEW Core training path, visit [ni.com/info](http://ni.com/info) and enter **nsi0121**.

## How-To Guide for Calibrating Modular Instruments

While the fundamental principles of metrology and calibration are the same regardless of the instrumentation platform, the Calibrating Modular Instruments guide from NI explains how the flexibility of the modular platform and a software-defined interface provide a variety of options for calibrating your instruments.

To view the guide, visit [ni.com/info](http://ni.com/info) and enter **nsi0122**.

# Parallel Programming for Everyone – Take Advantage of Multicore CPUs with LabVIEW

NI LabVIEW software has been empowering domain experts to create complex applications for more than 20 years, but one of the most powerful LabVIEW features often goes overlooked.

By programming graphically in LabVIEW, you are doing more than creating a functional program; you are implicitly defining which tasks can execute in parallel and which pieces of data need to be shared between pieces of code. With this information, LabVIEW acts intelligently to automatically run your code across available processor cores. Learn how LabVIEW multicore programming has evolved and how the new parallel for loop in LabVIEW 2009 helps simplify parallel data processing in your applications.

## Background – Parallel Programming in Sequential Languages

Consider a traditional sequential language. In many cases, you must explicitly break your code into separate pieces called threads that can run on multicore processors. (The OS handles these threads after they are created.) Although the concept of threads is straightforward, working with them can be time-consuming and tedious. Each thread must be carefully managed – plus, data accessed by threads is very susceptible to race conditions if not protected carefully.

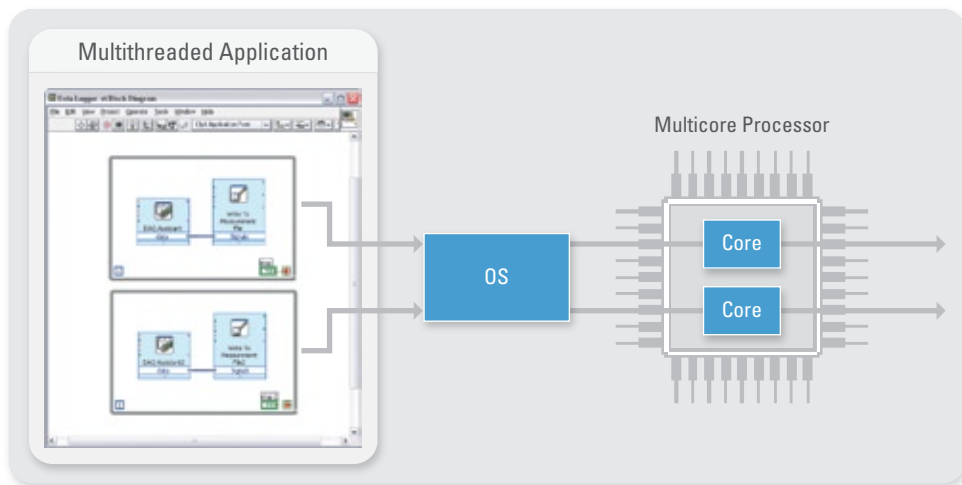


Figure 1. LabVIEW automatically identifies parallel sections of code and maps them into threads, which can take advantage of a multicore processor.

To ease the burden of working with threads and synchronizing the data they access, many programmers use higher-level APIs such as OpenMP. Though this can result in more compact code because the low-level thread operations take place behind the scenes, the designer still needs to manually identify which sections of code can run in parallel. In other words,

with most sequential programming languages, there is no way for the compiler to automatically detect every piece of code that depends on another to execute properly.

## LabVIEW Data Flow Helps You Make Use of Multicore Processors Automatically

In contrast to sequential languages, LabVIEW graphical dataflow programs inherently contain information about which pieces can run in parallel. For example, imagine that you use two separate while loops on the block diagram of a LabVIEW VI – perhaps for data acquisition and user interface updates – and no wires connect them. It is clear to anyone who looks at the code, and to the LabVIEW compiler, that these loops can potentially run in parallel.

When you select the Run button or create an executable in LabVIEW, the compiler works to identify parallel sections of code based on your block diagram. After they are identified, these independent “clumps” of

code are assigned to run in a fixed number of threads that LabVIEW automatically creates. This process helps you take advantage of multicore processors and avoid creating too many threads, which can increase costly switching overhead and lead to inefficient execution.

## A History of Multicore Innovation

Although the ability of LabVIEW to automatically map your graphical code to multicore processors is remarkable, you may be surprised to know that it is not new. In fact, LabVIEW has been multithreaded since Version 5.0. Throughout the years, National Instruments has continually worked to build on this technology and maintain the position as a leader in parallel programming.

View the timeline in Figure 2 for a summary of some of the innovations NI has made since creating LabVIEW.

The latest addition to multicore programming in LabVIEW 2009 is the parallel for loop. With this powerful feature, you can split iterations of a single for loop across multiple processor cores, which means you can

## LabVIEW Multicore Innovations



Figure 2. LabVIEW has been multithreaded since Version 5.0 and continues to evolve to incorporate more parallel programming features such as the LabVIEW 2009 parallel for loop.

process large amounts of parallel data, such as multiple data acquisition channels, while using minimal space in the block diagram. In addition, LabVIEW 2009 helps you identify which loops can be split to run in parallel and precisely control how many parallel iterations are allowed to run at once.

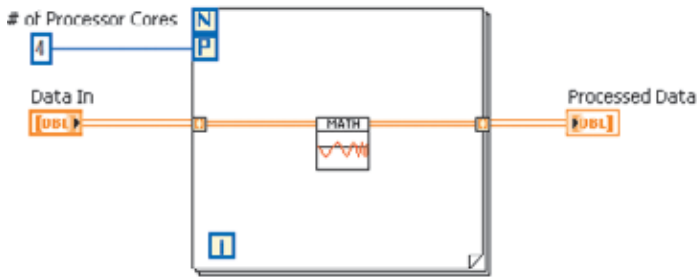


Figure 3. With the parallel for loop structure in LabVIEW 2009, you can process data faster by splitting loop iterations between multiple CPU cores.

Whether you choose to program your application without considering the underlying processor hardware or jump in and optimize your programs using features such as the parallel for loop, LabVIEW helps you make the most of multicore processors. And, you can be confident that whatever hardware comes in the future, National Instruments will help you capitalize on its processing power with LabVIEW dataflow programming.

– Casey Weltzin casey.weltzin@ni.com

*Casey Weltzin is a product manager for LabVIEW Real-Time at National Instruments. He holds a bachelor's degree in electrical engineering from the University of Wisconsin – Madison.*

**To learn how to use your multicore hardware effectively with the new LabVIEW 2009 parallel for loop, visit [ni.com/info](http://ni.com/info) and enter **nsi0123**.**

## How a Marketing Guy Used LabVIEW to Prototype the VI Snippet Tool

With the VI snippet tool, you can create .png images of block diagrams to drag and drop into the NI LabVIEW 2009 graphical programming environment to create code automatically. Domain experts regularly use LabVIEW as a rapid prototyping tool, but did you know that a marketing guy used it to prototype the VI snippet feature in just one evening?

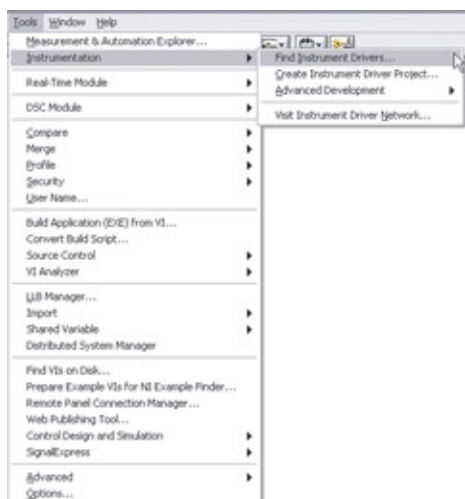
**To read the story behind the feature, visit [ni.com/info](http://ni.com/info) and enter **nsi0124**.**

# Instrument Control – Keeping Up with Technology

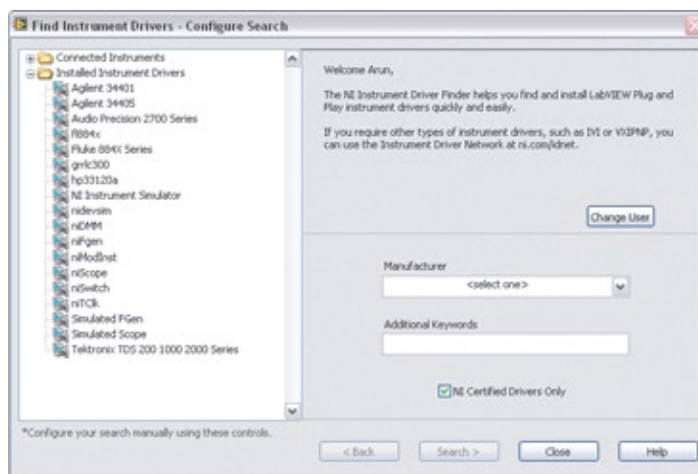
It has been more than 30 years since the concept of instrument control came into existence through the establishment of the IEEE 488 standard and GPIB. Engineers have continued to connect their instruments to PCs for data acquisition, analysis, and visualization capabilities. During the last 20 years, NI LabVIEW software has established itself as the de facto software of choice for instrument control. Whether you are using GPIB or any of the more recent bus technologies including USB, Ethernet, and cabled PCI Express, you can be certain to connect LabVIEW to any of your instruments on all major OSs including Windows, Mac, and Linux.

You can also trust LabVIEW to keep up with other technologies including multicore processors, virtualization, and new OSs such as Microsoft Windows 7. LabVIEW 2009 began supporting Windows 7 from the first day

Application software is important, but it is only part of the story. The interface between the application software and the hardware needs to be taken into account as well. The most popular layer between an application development environment (ADE) such as LabVIEW and the instrument control bus is the NI Virtual Instrument Software Architecture (NI-VISA). NI-VISA provides a common foundation for the development, delivery, and interoperability of software components such as instrument drivers and application software. It is important that along with the application software, underlying interface software such as NI-VISA is compatible with the latest OSs. With the NI-VISA implementation, you can mix and match instrument control buses without worrying about breaking your existing applications.



**Step 1.** Using the Instrument Driver Finder Wizard, you can easily find and install up-to-date drivers from within LabVIEW.



**Step 2.** Configure your driver search based on the manufacturer and other keywords.

of the Microsoft release, helping you migrate to a new OS without worrying about your code compatibility. With the number of drivers in the NI Instrument Driver Network ([ni.com/idnet](http://ni.com/idnet)) growing to more than 8,000, you can continue to find drivers that are up-to-date for both existing and new instruments. National Instruments has a team of engineers dedicated to developing quality drivers by working closely with different instrument vendors. It is now simpler to find and install drivers from within LabVIEW through the Instrument Driver Finder Wizard.

Using LabVIEW, you can take advantage of new technologies and feel confident that your applications work regardless of their platforms. With yearly LabVIEW releases, National Instruments can ensure that LabVIEW is quick to support new OSs and technologies and can connect your instrument over any bus.

**To find the right instrument driver for your needs, visit [ni.com/idnet](http://ni.com/idnet).**

# Help Shape the Future of LabVIEW

The next version of NI LabVIEW software is under development, and NI R&D engineers are looking for your input. User feedback is an invaluable factor when developing new products, and it is taken into consideration when ideas are on the drawing board. Can you recall any glitches you have experienced, ideas on how to increase your efficiency, or even features that you would like to see built into the product? If so, visit the LabVIEW Idea Exchange to get your ideas in front of the LabVIEW R&D team.

The LabVIEW Idea Exchange offers you the opportunity to share your thoughts on ways to improve the LabVIEW user experience and collaborate with NI R&D and other users to further develop possible solutions. You can post new ideas and give votes, or “kudos,” to existing ideas that you would like to see implemented in future versions. As an idea accumulates “kudos,” NI R&D considers it for implementation.

NI R&D is currently developing some ideas such as simplifying the Boolean diagram constant, adding the functionality to move or switch items in the connector pane (rather than disconnecting and reconnecting controls), and enhancing code readability by indicating the display format of string diagram constants.

The LabVIEW Idea Exchange is just one example of how National Instruments is continuously striving to improve products with the customer in mind. Whether it is an idea as creative as updating the front panel control, or one as pragmatic as eliminating a redundant step, all thoughts are valued in this stage of the LabVIEW development process. Take advantage of the LabVIEW Idea Exchange to help shape the future of graphical programming.

**To help shape the future of LabVIEW, visit [ni.com/ideas](http://ni.com/ideas).**

**LabVIEW Idea Exchange**  
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The **NI Idea Exchange** is a product feedback forum where NI R&D and users work together to submit ideas, collaborate on their development, and vote an existing one today in the following:  
[LabVIEW Idea Exchange](#)  
[LabVIEW Real-Time Idea Exchange](#)  
[LabVIEW FPGA Idea Exchange](#)

[View Forum](#) [Top Ideas](#) [View Recent](#)

[Post New Idea](#) | [Idea Exchange Options](#)

**237**  
 ★  
 Kudos!

**New Boolean Diagram constant design!**  
 Labels: UI & Usability Status: In Development 07-03-2009 04:37 PM

by [altenbach](#)

The current boolean diagram constant is potentially confusing and too elaborate.

**Confusing**, because it almost looks like a toggle switch, so the new user might click on the **right half**, expecting an unconditional FALSE. However, there are no active areas, and an inversion of the current value occurs no matter where we click.

**Too elaborate**. All we need to see is the current value! Why do we need to see the “other” value greyed out??? We can guess that by simple elimination. ☹️ There is too much redundant information, wasting twice as much diagram space than actually needed to display relevant information. The current design also makes e.g. 2D boolean diagram constant very confusing. Have a look at the image. Can you immediately tell that the 2D array on the left is only true on the diagonal? (I did not think so!). Now look at the suggestion on the right. Ahh... much better! 😊

**Suggestion:**  
 The boolean diagram constant should be **smaller, simpler, and cleaner**.  
 The image shows the current design on the left and the suggested design on the right.

What a difference in clarity and economy!!

Message Edited by altenbach on 07-03-2009 02:39 PM

**Attachments:**  
 NewBooleans.png (7 KB)

Status: In Development  
 38 Comments (38 New) Permalink

*Give “kudos” to ideas you would like to see implemented in LabVIEW when you participate in the LabVIEW Idea Exchange.*

## Top Five Webcasts

1. What's New in LabVIEW 2009
2. Introduction to the LabVIEW Platform
3. Certified LabVIEW Associate Developer (CLAD) Exam Preparation
4. LabVIEW CD-Based Training Demo Modules
5. Introduction to LabVIEW FPGA

**To view these and other webcasts, visit [ni.com/webcasts](http://ni.com/webcasts).**

# Enhancing Human Health through Smarter Medical Device Test

## THE CHALLENGE

Creating a product life test system for a medical device company to help ensure patient quality of life.

With the latest advancements in medical technology and portable devices, patients can obtain real-time information to monitor and sustain their health and minimize hospital visits. Because these portable devices play a critical role in patient health, quality is paramount in every aspect of the device from individual components to assembly to specified product lifetime test.

A well-known Fortune 500 company that produces high-quality medical devices needed to perform comprehensive product life tests on its newest portable health monitoring devices. The company's product life tests, which

## THE SOLUTION

Testing portable health monitoring devices to improve the quality of product and patient life using NI LabVIEW software and PXI hardware.

last up to several months, simulate product performance at five, 10, and 15 years. The system also needed to perform simultaneous tests by measuring a product or a related version of the product for performance over a sequence of various load and operating conditions.

To meet these test requirements, we at Cal-Bay Systems used our FlexATE test station to supply the power and control the devices under test (DUTs). The FlexATE platform consists of a tower PC, two 18-slot PXI chassis, and a mass interconnect for fixture coupling. The PXI hardware and its seamless integration with NI software were the perfect fit for our system. In addition, the solution is reconfigurable with our software tools; users can download different commutation algorithms depending on the DUT.

Implementing the product commutation algorithm was another critical factor in this application. The test system needed to mirror the internal algorithms executing in the product's embedded code. Using the NI LabVIEW FPGA and LabVIEW Real-Time modules, we prototyped and implemented a motor drive algorithm that we downloaded and easily ran on the NI PXI-7813R R Series intelligent data acquisition (DAQ) device to mimic the behavior of the motor component.

The medical device OEM uses the product life test system to make key design decisions for improving product quality. With the Cal-Bay FlexATE system based on NI software and hardware, the company can reuse the same system to test different product designs and swap out fixtures without requiring new nonrecurring engineering. This flexibility has saved hundreds of thousands of dollars in capital equipment and design costs.

– Derek Fluegge, *Cal-Bay Systems Inc.*

**To learn more about developing and validating medical devices with NI products, visit [ni.com/info](http://ni.com/info) and enter **nsi0125**.**



*The same FlexATE system, based on NI software and PXI hardware, can test different product designs for increased flexibility.*

# HIL Testing Reduces CompactRIO Control System Development Cost

Zodiac Aerospace selected Process Automation to retrofit 80 aircraft arrestor systems by updating the electronic control units with NI LabVIEW and CompactRIO. Using NI VeriStand software and real-time PXI hardware, Process Automation implemented a hardware-in-the-loop (HIL) test system, which produced significant cost savings. Process Automation engineer and Certified LabVIEW Architect Greg Sussman explains more about updating the system.

## Q: How does the aircraft arrestor control system work?

A: This land-based system works similarly to the arresting cable system on an aircraft carrier. As the aircraft lands, it catches the arresting cable spanned across the runway. Two identical braking/control systems are connected to each end of the arresting cable on opposite sides of the runway. Both systems continually communicate back and forth over a high-speed fiber-optic link to share information regarding arrestment parameters and calculate the specific geometry of the arrestment event. When an arrestment is detected, each system adjusts a servo valve to control hydraulic pressure to the cable reel brakes. The applied braking force slows the aircraft to a stop within the necessary distance. After each arrestment, we review the parameters regarding the arrestment event such as engagement speed, cross runway position, and total aircraft run-out.



*HIL testing with NI VeriStand reduced the number of costly field tests required to validate the CompactRIO control system.*

## Q: Why did you create an HIL test system?

A: Validating our system requires the full arresting system to be shipped and set up at a U.S. Navy arrestment test facility, which costs approximately \$20,000 USD per day with limited availability at the test facility and testing restrictions due to weather. Using PXI-based HIL testing, we reduced the number of field testing days from 20 to 10, saving our customer approximately \$200,000 USD. Validating the HIL system against real arrestment data paved the way for future system modifications and upgrades using a significantly shorter testing schedule, giving the customer more confidence in system performance prior to the first actual arrestment test in the field.

## Q: Why did you select NI VeriStand as your real-time test software?

A: Using NI VeriStand, we took our existing models created using The MathWorks, Inc. Simulink® software and coupled them to a real-time test system. NI VeriStand provided us with all of the components we needed, including real-time generation of stimulus signals and acquisition of control system feedback, logging, and display, in a single package. This mitigated significant technical and scheduling risks for developing the HIL simulation system. NI VeriStand tools for integrating the user interface and logging functions were straightforward and efficient for developing our system and adapting to changes that inevitably occur.

## Q: You are a Certified LabVIEW Architect. Couldn't you have written this application yourself?

A: Yes. We could have developed a custom solution, and we did write some LabVIEW code to customize NI VeriStand, but the cost of implementing a completely custom solution would have been significantly higher and created more technical risk. With NI VeriStand, we took the existing framework and built on it, cutting our development and deployment schedule by a significant amount. This correlated directly to a lower overall system cost for Zodiac Aerospace and a higher return on investment.

**To learn how HIL testing can reduce your control system development cost, visit [ni.com/hil](http://ni.com/hil).**

# Third-Party LabVIEW Tools for Robotics Applications

Robotics programs written using NI LabVIEW software require specialized functions to sense, think, and act. New LabVIEW Robotics software along with third-party add-ons can address each of these three tasks by providing drivers for interfacing with sensors, tools for developing or reusing existing algorithms, and integration with NI hardware. Two examples of third-party add-ons applicable for certain robotics applications are the JAUS Toolkit for NI LabVIEW from TORC Technologies and the ImagingLab Robotics Library for DENSO.

## JAUS Toolkit from TORC Technologies

The Joint Architecture for Unmanned Systems (JAUS) initiative was developed and maintained by a combined industry, government, and academic team to provide for interoperability and technology insertion in the field of unmanned systems. The JAUS Toolkit for NI LabVIEW allows for complex JAUS messages to be distilled into LabVIEW functions, effectively shortening the learning curve and rapid adoption of JAUS standards-based development.



Figure 1. TORC Technologies used LabVIEW to develop the JAUS implementation for Team Victor Tango's third-place finish in the 2007 DARPA Urban Challenge, the only JAUS implementation that finished the competition.



Figure 2. With the ImagingLab Robotics Library for DENSO, you can integrate DENSO robotics into new types of systems and applications for automated test, laboratory automation, and precision manufacturing without complex robotics programming expertise.

## The ImagingLab Robotics Library for DENSO

The ImagingLab Robotics Library for DENSO is an easy-to-use library of graphical functions to command and control DENSO robotics directly from LabVIEW software. You can also use the library to perform the following functions:

- Build complete industrial robotics systems entirely in LabVIEW
- Run pre-existing routines on DENSO controllers
- Easily develop vision-guided robotics applications
- Integrate measurements into robotics systems

To view a comprehensive listing of all third-party tools for robotics applications, visit [ni.com/info](http://ni.com/info) and enter **nsi0126**.

## Top Downloads from the NI LabVIEW Robotics Code Exchange

1. NI LabVIEW MobileRobots Interface
2. GPS-Aided MEMS Inertial Navigation System
3. Code and Tutorial on Sensor Fusion
4. SPI Communication Protocol in LabVIEW FPGA
5. FPGA Driver for VEX 6 Channel Radio Control

To download more robotics code, visit [ni.com/code/robotics](http://ni.com/code/robotics).

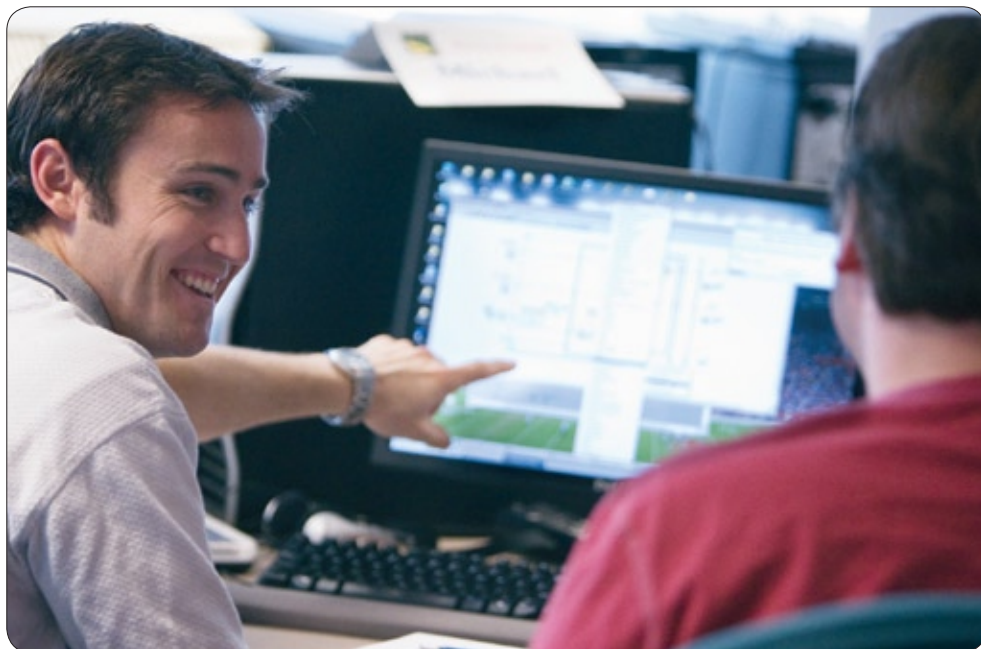
# Take Part in a LabVIEW Virtual User Group Meeting

Are you too busy to make it to a user group meeting in your area? Are there no user groups in your city? National Instruments hosts monthly online virtual LabVIEW user group meetings to make it easier and more convenient for you to attend user group presentations. NI LabVIEW R&D engineers who have several years of experience around advanced topics give these presentations.

Upcoming LabVIEW virtual user group topics include the following:

- Advanced LabVIEW Object-Oriented Programming
- Graphical Scripting with LabVIEW
- Using 3D Graphics for Quality User Interfaces

LabVIEW virtual user group meetings give you access to advanced LabVIEW content from R&D experts without having to leave your desk. You can even ask the presenter questions and interact with other attendees from around the world through the interactive webcast environment. All virtual user group meetings are available to watch on demand after the live event.



*LabVIEW virtual user group meetings deliver highly technical content right to your desk.*

**To view a list of upcoming LabVIEW Virtual User Group topics, visit [ni.com/info](http://ni.com/info) and enter **nsi0127**.**

## Measurement and Analysis Techniques for Embedded System Designers

Register now for this free half-day seminar, presented by National Instruments and Tektronix and led by industry experts. Learn about measurement and analysis techniques that can reduce test and debugging time of your embedded system design. Discover streamlined methods and tools to speed your product design life cycle by making precise measurements, running power efficiency and other custom analysis routines and report generation, and optimizing instrument control on your design bench.

**To register for the seminar, visit [nitekseminar.com](http://nitekseminar.com).**

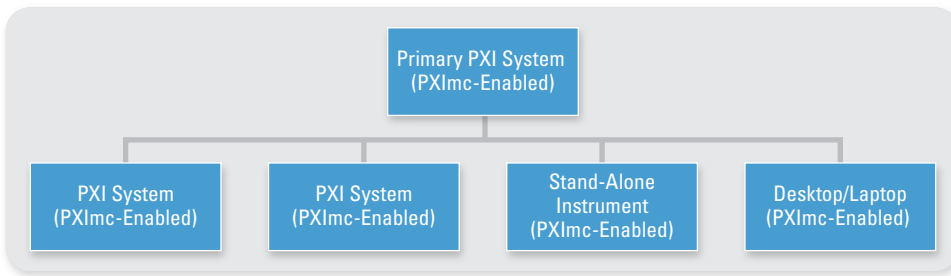
## NI Data Acquisition Advanced Webcast Series

Attend the quarterly live webcast series from National Instruments, and learn advanced programming techniques directly from NI data acquisition R&D staff. Chat online during the event with other data acquisition users around the world and help ensure your continued skill development. Past presentations have included the following: Advanced Counters and Timing, Streaming Waveform Measurements with Wireless Data Acquisition, and NI-DAQmx Development in .NET. The next series, Determining the Accuracy of Your Data Acquisition Device, will be held March 3, 2010, at 11:00 a.m. CST.

**To sign up for the next advanced webcast, visit [ni.com/livewebcasts](http://ni.com/livewebcasts).**

Technology Outlook

# New PXI Specification Enables High-Performance, Multicontroller Systems



Connect multiple intelligent devices over cabled PCI Express using PXImc.

The PXI Systems Alliance recently released the PXI MultiComputing (PXImc) specification to enable multicontroller configurations for PXI and automated test systems. PXImc defines a vendor-interoperable standard for multiple controller communication over the high-bandwidth, low-latency PCI Express bus and maintains backward compatibility with today's PXI systems.

Currently, PXI users have two options when creating multichassis PXI systems. Using MXI-Express, they can communicate over the high-

bandwidth, low-latency cabled PCI Express link but are limited to one system controller. Alternatively, they can use Ethernet to connect multiple PXI chassis, each with their own controllers, but the trade-offs are reduced bandwidth and higher latency. PXImc provides a third option for high-end applications. By specifying the proper hardware and software interfaces, PXImc allows PXI systems with their own system

controllers to communicate over cabled PCI Express.

The standard also supports communication between laptops, high-performance computers, and stand-alone instruments. Finally, PXImc supports the use of multiple processing modules inside a single chassis to enable scalable processing power and pave the way for additional PXI features including enhanced redundancy.

**To view the PXImc specifications, visit [ni.com/info](http://ni.com/info) and enter **nsi0128**.**

## Newsletter Information and Resources

- To view past issues of *Instrumentation Newsletter*, update your subscription preferences; or subscribe to the semimonthly NI e-mail newsletter, *NI News*, visit [ni.com/newsletter](http://ni.com/newsletter).
- For inquiries, requests for permission, or changes of address, e-mail the managing editor at [newsletter@ni.com](mailto:newsletter@ni.com).

## Buy Online

