

NI Programmable Automation Controllers

Advanced Control

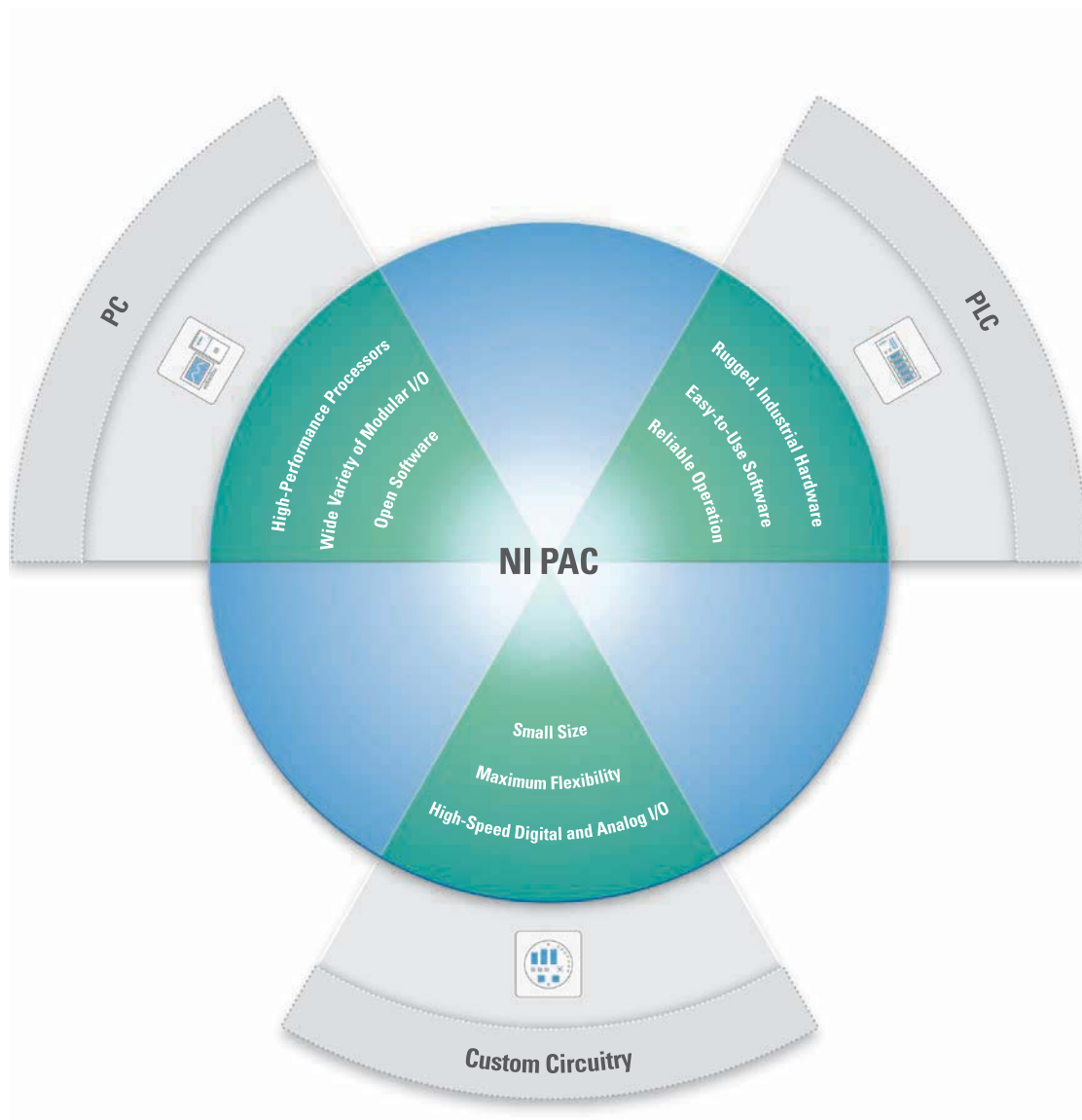
High-Speed Measurements

Custom Hardware Flexibility



Programmable Automation Controllers

Programmable automation controllers (PACs) combine the ruggedness of programmable logic controllers (PLCs) with PC functionality. National Instruments PACs, programmed with NI LabVIEW software, also provide the flexibility of custom field-programmable gate array (FPGA) circuitry so you can design, prototype, and deploy industrial systems much faster and at a lower cost.



The NI PAC Advantage

The intuitive nature of LabVIEW means engineers, scientists, and domain experts can develop and deploy systems that traditionally required large teams of specialty engineers to complete. With NI PACs powered by LabVIEW, you can:

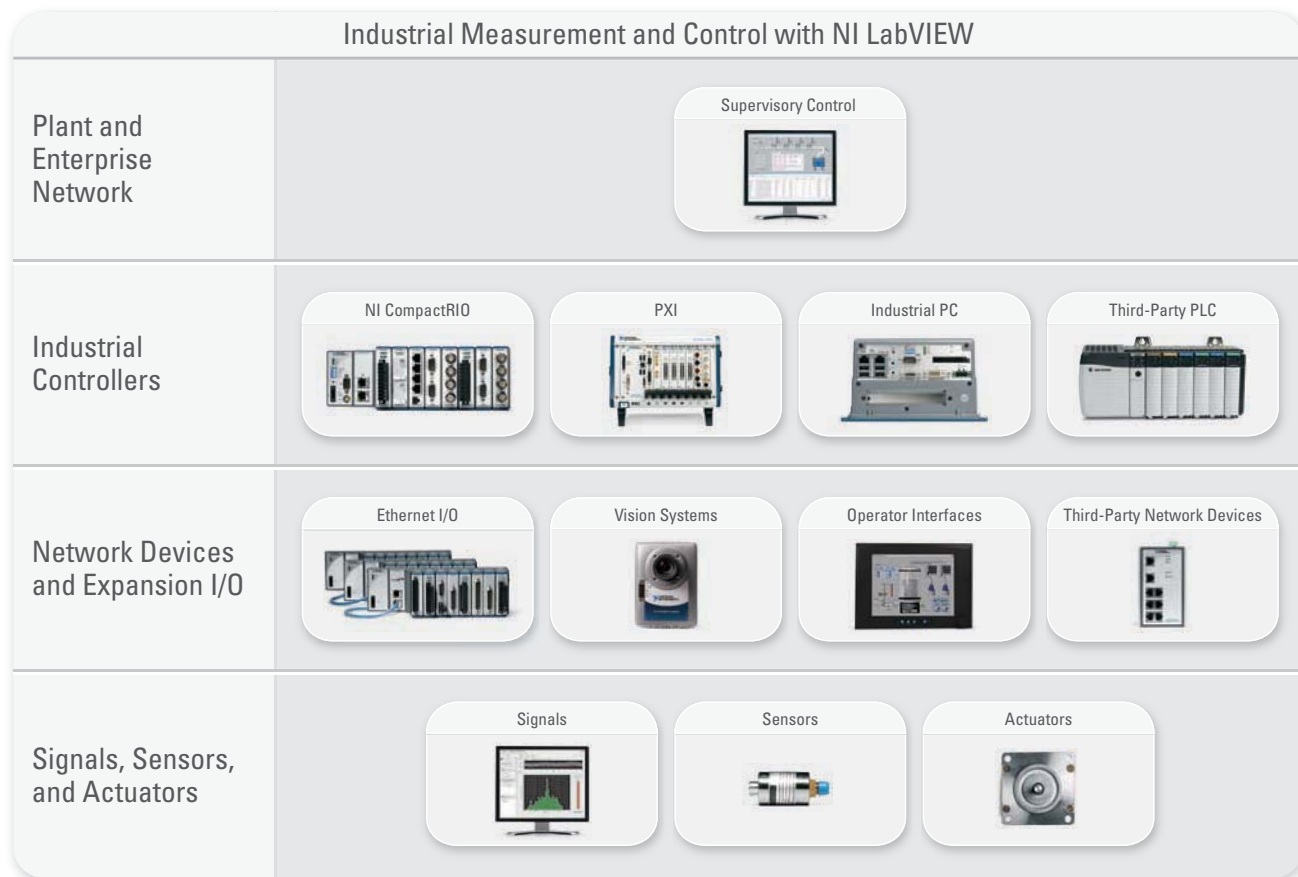
Measure and log high-speed and high-precision measurements from thousands of industrial sensors

Analyze incoming signals with advanced signal and image processing tools

Connect and communicate with PLCs, human machine interfaces (HMIs), enterprise software, and the Internet

Control high-speed systems with PID or other advanced algorithms

NI PACs can connect to a variety of system components, including supervisory control terminals, expansion I/O, local HMIs, sensors, and actuators. In addition, NI PACs can easily integrate and communicate with PLCs, so you can optimize existing machines and automation systems.



“By incorporating NI PACs into our existing systems, we can achieve advanced control while maintaining our PLC investment.”

– Mark Nikirk, Controls Engineer, Praxair

NI PAC Hardware

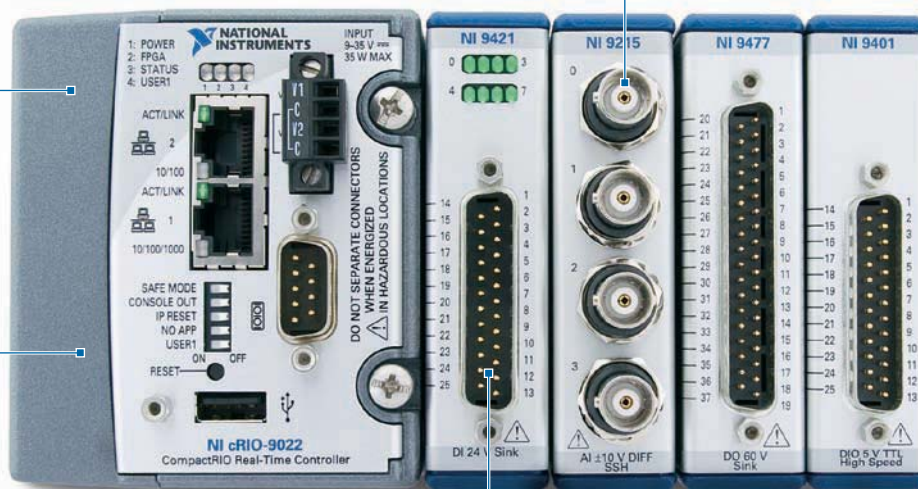
National Instruments PAC hardware platforms programmed with LabVIEW include NI CompactRIO, NI Smart Cameras, NI Compact Vision Systems, NI Compact FieldPoint, industrial PCs, and PXI. These NI PAC products help companies build advanced systems to meet their industrial measurement and control needs. CompactRIO combines real-time and FPGA technologies to deliver high performance in a small, rugged industrial control and acquisition platform.

Ethernet and Industrial Networking

Dual Ethernet port for deterministic communication
Modbus TCP, EtherNet/IP, EtherCAT, and IEEE 1588
Built-in Web server

High-Speed Analog and Digital I/O

Up to 800 kHz analog I/O and 10 MHz digital I/O
PID control up to 50 kHz
Reconfigurable FPGA for high-speed control



NI CompactRIO

Graphical Programming for Quick Development

Thousands of graphical blocks for control, analysis, and I/O
Built-in function blocks for common industrial applications

Connectivity to Any Sensor Type

Accelerometers/microphones
Strain gages, thermocouples, and RTDs
Power quality measurements

“CompactRIO and LabVIEW Real-Time delivered the reliability and precise timing resources required, and the system was rugged enough to withstand the high temperatures and vibration of the operating environment.”

– Carroll G. Dase, President, Drivven Inc.

NI PAC Software

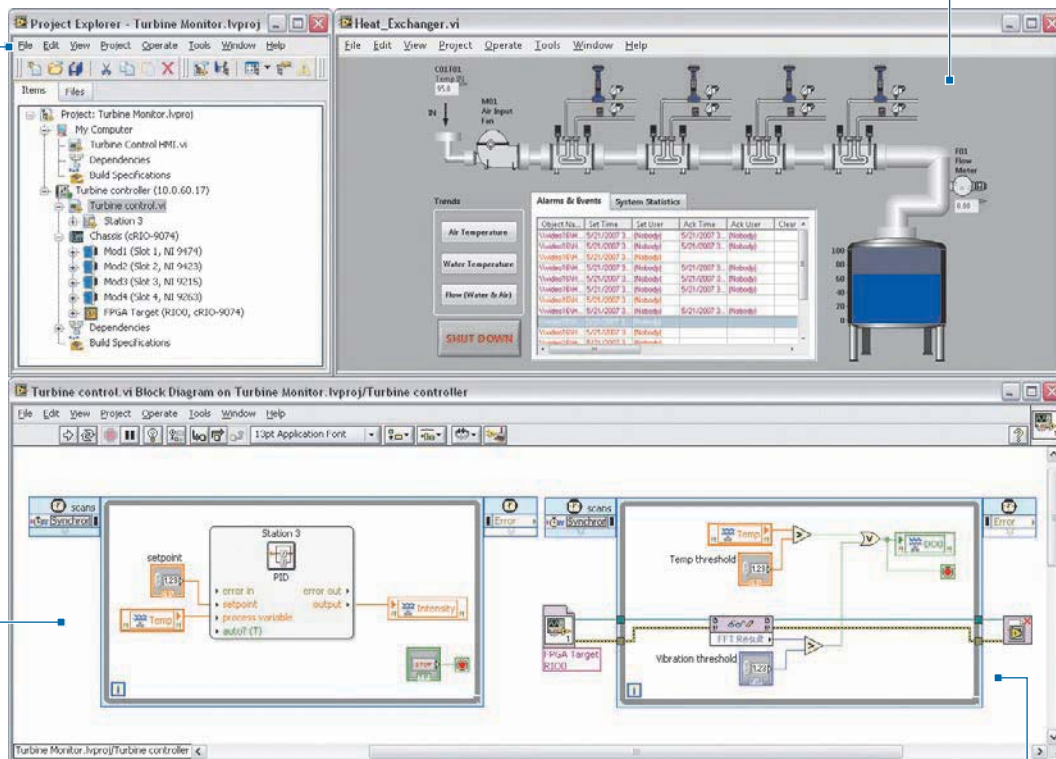
With increasing global competition and pressure to get to market faster, engineers are looking to optimize existing systems and build complex machines with differentiated intellectual property (IP). NI PACs are programmed with the intuitive LabVIEW graphical development environment, which you can use to develop HMIs and systems for measurement, monitoring, and control in one environment, resulting in shorter development times and maximum skill reuse.

Large Project Management

- Manage multiple hardware targets
- Deploy to remote PACs and touch panels
- View tags for the entire system

Built-In User Interface for HMI and Debugging

- Build intuitive HMIs with industrial controls and indicators
- Communicate with deployed devices through remote user interfaces and Web services
- Connect to databases and enterprise systems



NI LabVIEW

High-Speed Measurement and Advanced Control Tasks

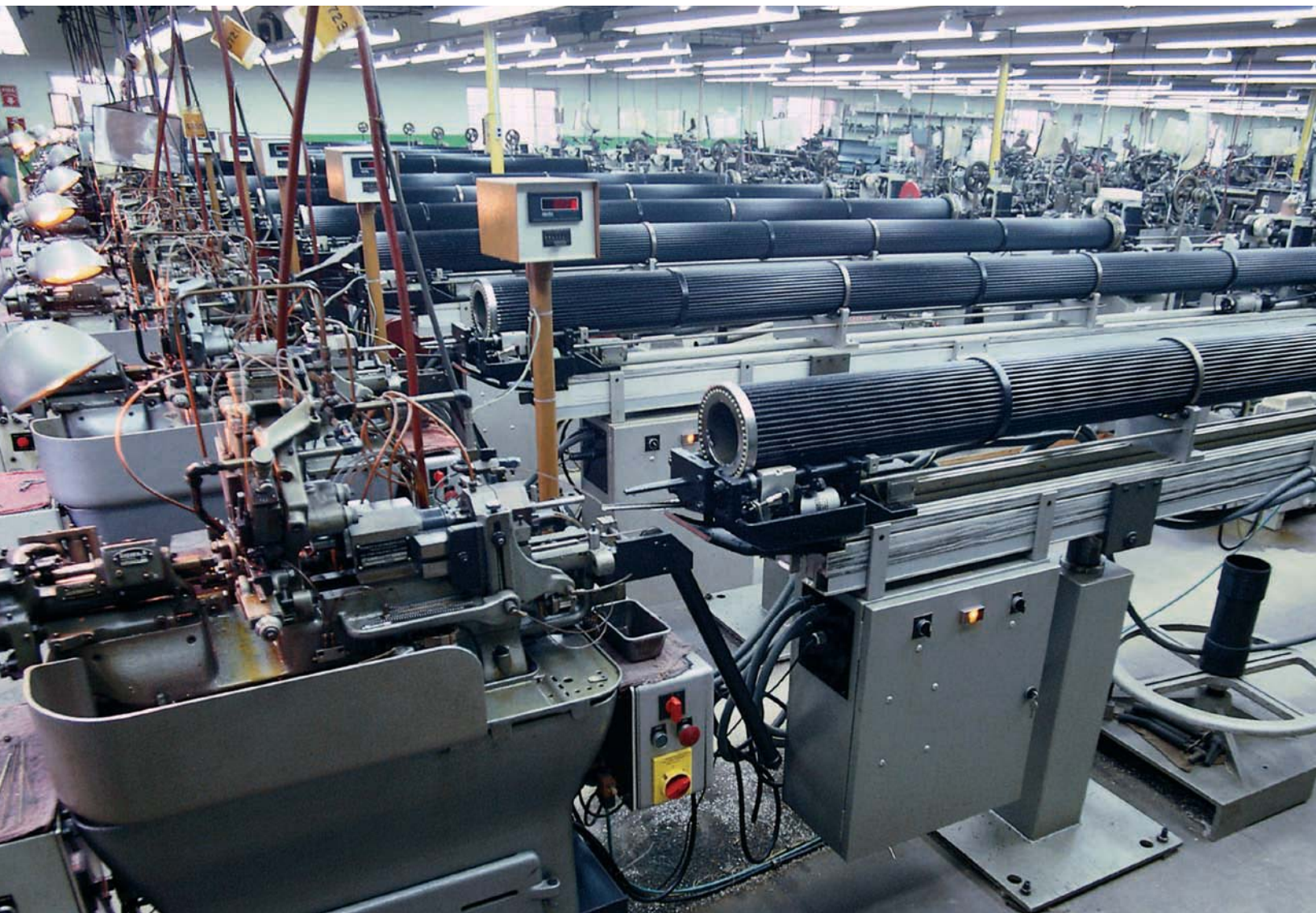
- Create applications easily with a graphical development environment
- Perform advanced analysis with hundreds of built-in functions
- Build advanced control applications with function blocks

Tight Integration with Hardware

- Program PACs to execute deterministic tasks
- Acquire data from high-speed, high-resolution I/O directly
- Program the FPGA for custom timing and signal processing

Measurements

Acquiring accurate and timely measurements is the foundation of any industrial monitoring or control system. National Instruments has been a world leader in measurement hardware and software for more than 20 years. With NI industrial measurement hardware, you can readily connect to thousands of industrial sensors and specialty I/O to build high-channel-count distributed systems to acquire high-speed and high-resolution data even in the most demanding industrial environments.



Machine monitoring benefits from the high-resolution and high-speed analog measurements of NI PACs.



NI C Series Industrial I/O

Analog and Digital I/O

High resolution and high-speed data are important for increasing performance and reducing inefficiencies.

With NI PACs, you can:

- Acquire high-speed analog I/O up to 800,000 samples per second

- Take advantage of 12- to 24-bit resolution for highly accurate measurements from accelerometers, tachometers, and dynamic pressure sensors

- Use a wide selection of high-performance digital I/O and counter/timer modules

ni.com/compactrio

Sensor Connectivity

The ability to connect to a wide variety of sensors makes measurement platforms more versatile. NI PACs provide:

- Communication with thousands of industrial sensors and actuators

- Integrated junction box with screw terminal, BNC, or D-Sub connectivity for flexible, low-cost signal wiring

- Built-in signal conditioning for extended voltage ranges or industrial signal types such as 4 to 20 mA

ni.com/distributedio

Machine Vision

Machine vision is a reliable and important tool for identifying production flaws and part defects. With NI machine vision tools, you can:

- Acquire images from hundreds of different cameras

- Perform onboard embedded image processing with NI Smart Cameras and Compact Vision Systems

- Use one software package that scales from development PCs to smart cameras

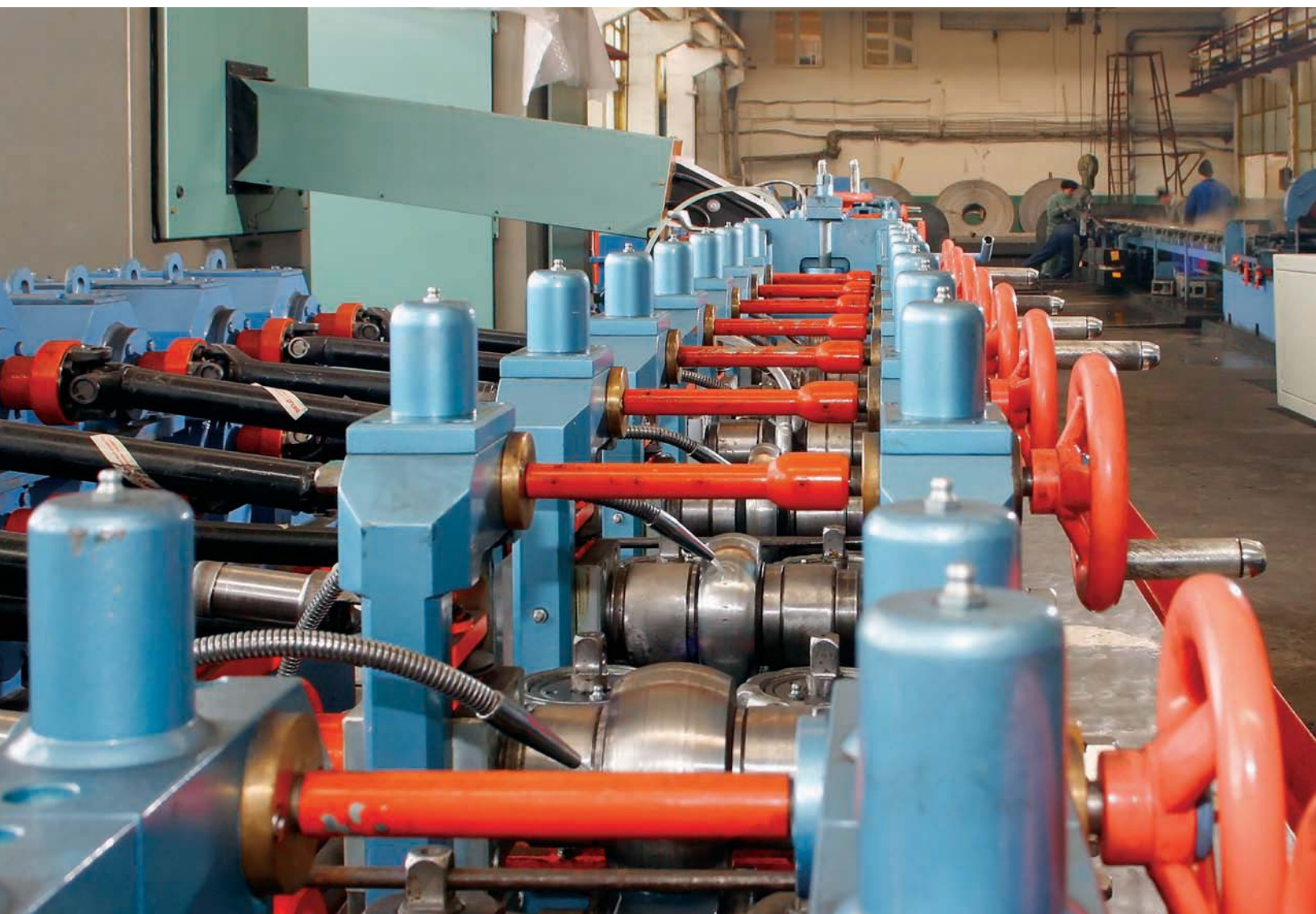
ni.com/vision



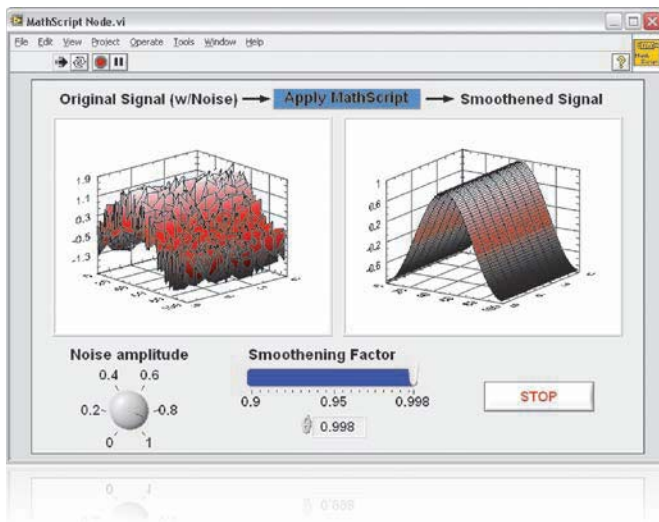
NI Compact Vision System, NI LabVIEW, and NI Smart Camera

Analysis

National Instruments software provides algorithms and functions designed specifically for advanced analysis and signal processing. You can easily integrate these into your industrial measurement and control applications, take advantage of functions such as order analysis capabilities for machine condition monitoring, and use software image libraries to analyze acquired images for machine vision applications.



Perform inline advanced analysis and signal processing in real time with LabVIEW.



Advanced Math Plot with LabVIEW

Signal Processing

LabVIEW provides hundreds of signal processing functions for signal generation and manipulation and waveform conditioning. With LabVIEW, you can:

- Generate signals and data for modeling, simulating, and designing systems

- Perform inline analysis in real time on acquired signals

- Implement signal processing with built-in functions such as digital filtering, data windowing, and spectral analysis

ni.com/signalprocessing

Advanced Analysis

Analysis is key to converting raw data into information that you can use to make decisions. With LabVIEW, you can:

- Combine general-purpose algorithms with built-in specialized algorithms for your application needs

- Analyze vibration, process variables, and power quality for machine diagnostics and online condition monitoring

- Execute machine vision analysis algorithms such as pattern matching, edge detection, and optical character recognition

ni.com/analysis



CompactRIO and LabVIEW

Optimize Your Automation Assets through Services and Support

NI can help you get the most from your automation systems to meet your production and business goals. The NI services and support portfolio is delivered through an integrated, global network and includes both personal and online support, training courses, system assembly and configuration, selectable software installation, and warranty and repair.

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Connectivity

With nearly every industrial application, automation controllers must be able to connect to and communicate with other industrial components, such as PLCs, HMIs, and enterprise software. This is especially true when adding a high-performance PAC to an automation system. With LabVIEW, you can build distributed monitoring, logging, and control systems. NI PACs can easily integrate with a variety of PLCs and industrial devices, as well as provide a straightforward approach to HMI and supervisory control.



LabVIEW can monitor and store data from NI PACs and third-party devices over large distances.



NI PPC-2115 with the LabVIEW Datalogging and Supervisory Control Module

Data Logging and Supervisory Control

LabVIEW makes it easy to build distributed monitoring, logging, and control systems. With LabVIEW, you can:

- Connect and observe data from thousands of tags over OPC, Modbus, and custom I/O servers
- Monitor and log data to a built-in, networked historical database or to corporate databases
- Build intuitive and flexible HMIs using industrial controls and graphics

ni.com/dsc

Industrial Communications

LabVIEW and NI PACs help you communicate with a wide variety of PLCs and industrial devices. With LabVIEW, you can:

- Acquire high-speed measurements deterministically over EtherCAT
- Implement easy expansion I/O for time-critical applications over Ethernet
- Communicate over Modbus/TCP using built-in serial and Ethernet ports
- Connect to industrial fieldbus interfaces such as EtherNet/IP, PROFIBUS, OPC, TCP/IP, and CANopen

ni.com/comm



NI 9144 Real-Time Ethernet Expansion Chassis

HMIs and Operator Interfaces

NI offers a wide variety of touch panel hardware devices to which you can deploy HMI applications based on LabVIEW. With LabVIEW and NI touch panels, you can:

- Integrate HMI and logic into one development environment
- Design and run HMIs on Windows XP and Windows XP Embedded touch panels
- Easily compile and download LabVIEW to Windows CE touch panels

ni.com/hmi



NI PPC-2115, TPC-2106, and TPC-2012 with LabVIEW

Control

Accurate measurements and industrial connectivity form the foundation for the high-performance control offered by NI PACs. For the most reliable and fastest control loops, many NI PACs feature onboard FPGAs that you can use with LabVIEW to define your own control circuitry. NI PACs and FPGAs programmed with LabVIEW provide the flexibility and performance of custom circuitry without the cost and complexity traditionally required to create custom hardware.



Reduce inefficiencies and increase throughput by implementing advanced control with NI PACs.

Advanced Control

LabVIEW can execute virtually any advanced control algorithm, such as PID, adaptive control, or fuzzy logic. These types of algorithms are often used to control complex mechatronics and robotics systems. With LabVIEW, you can:

- Use built-in LabVIEW function blocks for PID and advanced nonlinear control

- Execute control algorithms on FPGAs, real-time processors, or digital signal processors

- Interact with graphical tools for direct servo and stepper motor control



LabVIEW and CompactRIO

ni.com/pac



LabVIEW, CompactRIO, PXI Motion Modules, and NI Motors and Drives

Precision Motion Control

Motion control is often the core of mechatronics systems. With NI PACs, you can:

- Control motors using PCI/PXI plug-in devices, CANopen distributed smart drives, or software-based custom controllers

- Quickly prototype and generate LabVIEW code with easy-to-use software

- Tightly integrate motion control with NI data acquisition and vision

ni.com/motion

High-Speed Control

NI PACs exceed the performance and reliability of traditional control systems by running control loops directly on FPGAs. NI PACs provide:

- True parallel processing ideal for running simultaneous control loops

- Increased reliability and reduced jitter from dedicated hardware executing control algorithms

- The ability to customize timing and synchronize multiple loops running on an FPGA



LabVIEW and PXI

ni.com/compactrio

Case Studies

Today, engineers are using NI PACs to address diverse applications ranging from industrial measurements to mechatronics system design. Visit ni.com/industrial to view more real-world case studies of NI PACs in action.



Nucor Steel

Green Engineering

Nucor Corporation, the largest recycler of steel in North America, needed to reduce the amount of energy it used to melt scrap metal in order to eliminate flicker on the power grid. Using LabVIEW and CompactRIO, Nucor met its goals by developing a control system capable of determining the exact amount of electricity required and, therefore, reducing the amount of power drawn.



CERN

Motion Control

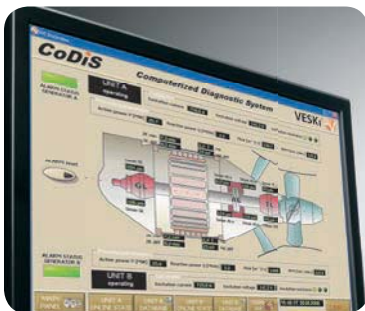
Spanning more than 27 km, the Large Hadron Collider (LHC) at the European Organization for Nuclear Research, or CERN, is one of the largest and most complex machines on earth. To redirect any potentially dangerous stray particles, CERN selected LabVIEW and PXI from NI to control the motion inside 108 collimators with an accuracy of 20 microns. The final system uses more than 100 PXI systems, which are synchronized within 1 ms of each other.



VAPO Hydraulics

Advanced Control

VAPO Hydraulics, which specializes in custom industrial hydraulics, needed to build a precision position and control system for four hydraulic cylinders. These cylinders needed to lift 20 tons of liquid concrete while staying within 2 mm of accuracy across all four cylinders. The company chose LabVIEW and CompactRIO to solve this complex control problem and was able to achieve an accuracy of 0.1 mm.



VESKI

Machine Monitoring

VESKI, a Croatian-based consulting firm, was tasked with developing a computerized diagnostic system for power plants that can predict malfunctions and identify irregularities. Using LabVIEW and CompactRIO, the company built a cost-effective, highly configurable, reliable machine condition monitoring system that streamlines routine maintenance to prevent long-term, costly damages. With this system based on NI technology, VESKI has helped nearly a dozen power plants reduce maintenance and repair costs by up to 50 percent.



SLI Lighting

Machine Vision

To achieve higher throughput and accuracy, SLI Lighting's next-generation production machines required a high-precision vision system that also integrated with industrial I/O, motion control, and high-powered lasers. Using LabVIEW and NI PACs, SLI was able to achieve performance goals while creating a machine flexible enough to handle a wide range of light bulbs. The company also completed the project in only 25 percent of the budgeted time.



PEMEX

Data Logging and Supervisory Control

PEMEX Exploración y Producción transports and distributes 43 percent of Mexico's crude oil daily. To monitor the transportation and distribution of this oil, the company required an integrated and low-cost system that could coordinate the thousands of measurement systems already in place. With LabVIEW, PEMEX developed an application capable of monitoring elements from communication to final report generation. And they were able to do it completely in-house.

Alliance Partners

The National Instruments Alliance Partner program is a worldwide network of more than 600 consultants, system integrators, developers, channel partners, and industry experts who collaborate with NI to provide complete, high-quality solutions to customers. From small integration projects to in-depth expertise in building large multifaceted systems, National Instruments Alliance Partners have the resources and know-how to provide what you need in every region and every industry.

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Reference Architectures

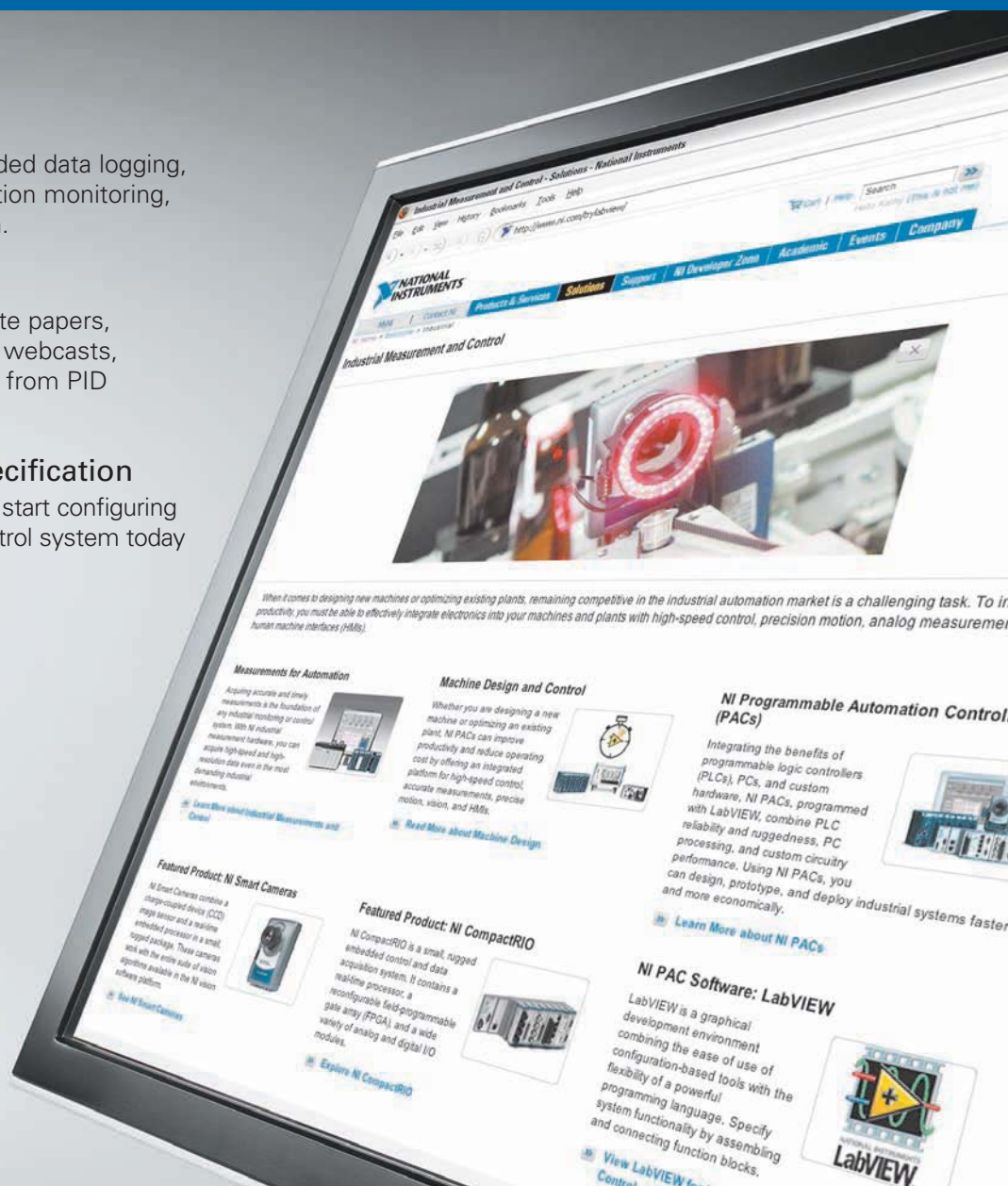
Explore solutions including embedded data logging, high-speed control, machine condition monitoring, motion control, and machine vision.

Technical Reference

Browse an extensive library of white papers, application notes, how-to tutorials, webcasts, and case studies on topics ranging from PID basics to system architectures.

Evaluation and System Specification

Download software evaluations and start configuring a PAC-based measurement and control system today with interactive advisors.



U.S. Corporate Headquarters 866 463 5417

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