

Monitoring Unattended High-Temperature Tests with LabVIEW

by John L. Cashon and Bruce A. Crook,
Allison Engine Company

The Challenge: Integrating a PC-based monitoring system, suitable for unattended operation, into an existing high-temperature testing facility.

The Solution: Using LabVIEW for data acquisition, analysis, and offsite communications controlling a GPIB board, a DAQ board, and a PC sound board.

Allison Engine Company used LabVIEW to develop a PC-based DAQ system that performs unattended monitoring of a high-temperature dynamic oxidation test rig. This application is now one of many, since LabVIEW has been adopted by Allison's research department as its standard data acquisition software package. We chose LabVIEW for many reasons, including its ease of integration

We chose LabVIEW for the ease with which it could be integrated with existing facilities, its flexibility in development of data acquisition and control systems, and the technical support provided by National Instruments.

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An increasingly important part of improving the performance and durability of modern gas turbine engines involves developing advanced materials, such as special coatings, to enhance oxidation and corrosion resistance. Allison evaluates the performance of oxidation-resistant coatings using a commercially available Laboratory Combustor System (LCS) manufactured by Becon Inc.

The LCS is designed for automatic operation using a proportional-integral-derivative (PID) process controller to maintain specimen temperature and a programmable logic controller (PLC) to



The LabVIEW-monitored 2000° F burner with test samples and top-level VI front panel.

interlock safety systems and sensors built into the rig. However, data logging and facilities monitoring (air, fuel, and exhaust systems) are additional tasks that must be provided for the particular installation. We thus decided to build a PC-based system to take care of these housekeeping tasks as well as to monitor the LCS and provide communication with an offsite operator.

Hardware Design

The LabVIEW monitoring and communications program runs on a 486-66 PC running Windows equipped with an AT-GPIB board, a PC-DIO-24 board, a standard sound board, and a modified modem. The system records process data and checks the status of several rig and facility safety systems. If test parameters exceed specified warning limits or the rig is shut down by any of the safety systems, the computer calls the operator's digital pager via modem. The operator then calls the computer to learn about the problem and responds accordingly. After three unsuccessful paging attempts, the monitoring program defaults to rig shutdown. Thus, although monitoring is primary, the system performs supervisory control and data acquisition (SCADA), exercising supervisory control in the case of shutdown. The status of rig safety systems is communicated to the PC monitoring system via GPIB. A signal scanner/digital

voltmeter combination measures process data and also sends it to the PC via GPIB.

The telephone interface to the DAQ system is a modified serial-port modem, augmented with a PC-DIO-24 digital I/O board. LabVIEW handles telephone on-hook/off-hook and dialing functions using standard Hayes AT commands through the serial port. Digital voice messages are sent using a standard PC sound board.

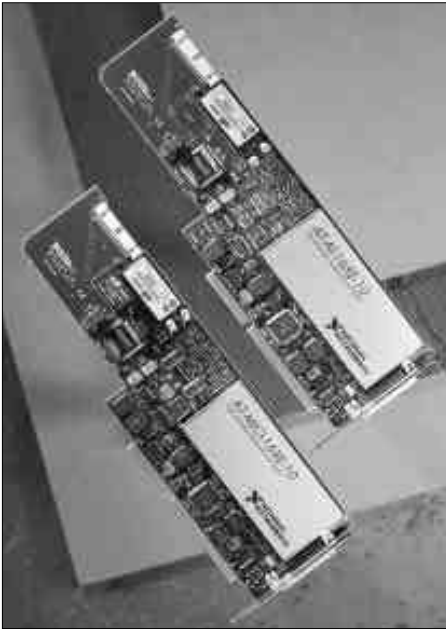
Software Design

Two persons wrote the LabVIEW programs. The user interface and program control required an understanding of the test rig operation and testing goals. Low-level control of the DAQ and "black box" communication hardware required an understanding of hardware operation and interfacing to the host computer. With the subVI programming structure of LabVIEW, it was very easy to divide programming tasks. The LabVIEW programming environment made it easier for both our programmers to debug interface problems as the main program was assembled.

Results

The PC-based monitoring system was placed in service in January 1995. It has been used "after hours" (nights, weekends, and holidays) almost continuously and has operated flawlessly. In the first year of operation, we logged 3,600 hours. ▸

Now Available – Two High-Speed, 16-Bit E Series Boards



The AT-MIO-16XE-10 and AT-AI-16XE-10, our two new instrumentation-class DAQ products, offer high performance and high resolution to assist you in creating cost-effective solutions.

To continue delivering high-performance, reliable DAQ-based tools for your solutions, National Instruments is extending its line of E Series-based DAQ products to include two 100 kS/s, 16-bit ISA boards. Available now, the AT-MIO-16XE-10 and AT-AI-16XE-10 are new instrumentation-class DAQ products that offer high performance and high resolution to assist you in creating cost-effective solutions.

Analog Triggering

The AT-MIO-16XE-10 and AT-AI-16XE-10 extend the capabilities of the popular

AT-MIO-16X, not only by adding E Series technology but also by adding analog triggering – a feature previously found only on the higher speed, 12-bit MIO E Series products. Analog triggering, combined with E Series technology, gives these boards capabilities found in traditional instruments.

E Series Technology

The E Series technology includes numerous technological advancements, such as Plug and Play, guaranteed accuracy, multiboard synchronization, and high-performance counter/timers. Our DAQ-PnP ASIC provides ISA Plug and Play capability for easier installation and configuration when working with Windows 95 and Windows 3.x operating systems.

The AT-MIO-16XE-10 and AT-AI-16XE-10 both use the NI-PGIA for high accuracy at all gains and scanning rates, eliminating settling time inaccuracies caused by high gains or multiple-channel scanning. For example, if you need to measure 16 different temperatures at a gain of 100, you still have 16-bit data, even at the highest sampling rate of 100 kS/s.

For complex systems, you may need more than one AT-MIO-16XE-10; or, you may want to use another MIO-class or digital I/O-class board. By using the RTSI bus, you can synchronize the operation of several E Series boards in one computer. For instance, you can route an analog trigger signal from the AT-MIO-16XE-10 to an analog output board (AT-AO-6) to control the

generation of a waveform used to stimulate the process you are monitoring.

The DAQ-STC ASIC is well suited for complex counter/timer applications that need up/down, wider, or faster counters. With the DAQ-STC, both the AT-MIO-16XE-10 and AT-AI-16XE-10 sample repetitive signals using equivalent-time sampling techniques found in stand-alone oscilloscopes. In addition, you can use the DAQ-STC for pulse generation, instantaneously changing the sampling rate, frequency shiftkeying, buffered timestamping, encoder operations, and much more.

NI-DAQ Protects Your Investment

Powerful, hardware-independent NI-DAQ driver software is at the heart of every DAQ solution. The NI-DAQ API isolates you from the hardware-specific register commands and gives you a simple yet powerful programming interface for use with a wide assortment of programming languages, including LabVIEW, LabWindows/CVI, ComponentWorks, Measure, VirtualBench, Visual Basic, Visual C/C++, and Borland C/C++. The NI-DAQ API empowers you to build portable DAQ solutions and protects your software and application investment. For example, although both boards work with Windows 95 and 3.1 today, when you need PCI E Series boards and Windows NT in the future, you can quickly and easily migrate your application to new hardware and operating systems without rewriting your application. Plus, those applications built using NI-DAQ and the AT-MIO-16X can easily migrate to the new AT-MIO-16XE-10.

The AT-MIO-16XE-10 and AT-AI-16XE-10 extend your possibilities in creating DAQ-based solutions for your test, measurement, monitoring, and control needs. ▶

Features	AT-MIO-16XE-10	AT-AI-16XE-10
DAQ-PnP Plug and Play ease of configuration	Yes	Yes
NI-PGIA Gain-independent settling	Yes	Yes
RTSI Multiboard synchronization	Yes	Yes
DAQ-STC Instrumentation-class counter/timers	Yes	Yes
Analog input channels	16 SE, 8 DIFF	16 SE, 8 DIFF
Maximum sampling rate	100 kS/s	100 kS/s
Resolution (bits)	16	16
Range (V)	0 to 10 V, ±10 V	0 to 10 V, ±10 V
Gains (channel independent)	1, 2, 5, 10, 20, 50, 100	1, 2, 5, 10, 20, 50, 100
Analog output channels	2	–
Resolution (bits)	16	–
Digital I/O channels	8	8
Counter/timers	2, 24-bit, 20 MHz	2, 24-bit, 20 MHz
Analog trigger	Yes	Yes
Digital trigger	Yes	Yes

SE – single-ended, DIFF – differential

Features of the new E Series DAQ boards.

For a free E Series data sheet, circle this option on the reply card.

Low-Cost DAQ Boards Boosted by Plug and Play



Our new low-cost Lab-PC-1200 and Lab-PC-1200AI boards feature added functionality and ease of use, while the PC-LPM-16, our lowest cost analog input board, has been enhanced with Plug and Play capability.

Low-cost products do not have to be low in functionality or use old technology. On the contrary, the newest low-cost boards from National Instruments not only deliver the functionality you need to build solutions but also employ the latest in computer technology, including Plug and Play capability and surface-mount manufacturing.

The Lab-PC-1200 and Lab-PC-1200AI boards, enhanced versions of the Lab-PC+, feature additional functionality and ease of use. Both new boards have ISA Plug and Play compatibility, full software configuration, and overall sampling rates of 100 kS/s. Now, you have the same DAQ functionality across multiple platforms, from ISA (Lab-PC-1200) to PCI (PCI-1200) to PCMCIA (DAQCard-1200) to the parallel port (DAQPad-1200) to remote data acquisition and signal conditioning (SCXI-1200).

Even the PC-LPM-16, our lowest cost analog input board, has been enhanced with Plug and Play capability for easy use with Windows 95 and 3.x. For Windows NT applications, the jumpered version of the board remains.

All your existing programs based on the comprehensive DAQ driver software, NI-DAQ, automatically work with these four new boards. The NI-DAQ software that is shipped with these boards preserves your software and application investment by isolating you from hardware-specific register commands. It gives you a powerful programming API for use with LabVIEW, LabWindows/CVI, ComponentWorks, Measure, VirtualBench, Visual Basic, Visual C/C++, Borland C/C++. NI-DAQ also spans a number of operating systems, making it easy for you to migrate from one operating system to the next. If you are developing or plan to develop an application with Windows NT and you want Lab-PC functionality, you need to use the legacy Lab-PC+, because Windows NT is not ISA Plug and Play compatible.

All our new low-cost boards – the Lab-PC-1200, Lab-PC-1200AI, and PC-LPM-16PnP – are now being shipped. ▶

For a free Lab-PC-1200/Lab-PC-1200AI data sheet or PC-LPM-16PnP data sheet, circle these options on the reply card.

Features	Lab-PC-1200	Lab-PC-1200AI	PC-LPM-16PnP
Direct Replacement	Lab-PC+	–	existing PC-LPM-16
Computer bus	XT	XT	XT
Plug and Play	Yes	Yes	Yes
Analog input channels	8 SE, 4 DIFF	8 SE, 4 DIFF	16 SE
Maximum sampling rate	100 kS/s	100 kS/s	50 kS/s
Resolution (bits)	12	12	12
Range (V)	±5, 0 to 10	±5, 0 to 10	±5, 0 to 10; ±2.5, 0 to 5
Gains	1, 2, 5, 10, 20, 50, 100	1, 2, 5, 10, 20, 50, 100	1
Analog output channels	2	–	–
Resolution (bits)	12	–	–
Digital I/O channels	24	24	16
Counter/timers	3, 16-bit, 8 MHz	3, 16-bit, 8 MHz	2, 16-bit, 8 MHz
Digital trigger	Yes	Yes	No

Features of new low-cost boards.

SE – single-ended, DIFF – differential

Using NI-DAQ for High-Speed Acquisition, Control

When simultaneously performing high-speed data acquisition with high-speed control, the flexibility of NI-DAQ driver software can overcome tradeoffs you might experience, such as sacrificing control rates for higher throughput, leading to the best of both worlds – high-resolution data collection and faster control.

Sampling signals with a DAQ board generally involves one of three techniques:

- Programmed or polled mode I/O using the microprocessor to transfer data from the DAQ board to memory
- Interrupt mode, so that the processor shares between transferring the data and performing other tasks
- DMA-driven acquisition independently transfers data directly into RAM

Techniques for high-speed, continuous throughput usually involve placing data into a buffer that the microprocessor periodically reads. Typical software loop times cannot keep up with acquisition rates, so data points accumulate into a “block,” which the microprocessor then reads. Although block reads permit high-speed acquisition at lower software loop rates, the tradeoff is the frequency at which data is available for control. NI-DAQ can optimize throughput and control rates by checking and moving DAQ pointers. It first checks data to see if a block is ready to be read. If so, data is read and stored. If not, data is passed over. In either case, the microprocessor reads the most current data for updates.

Combining high-speed storage with high-frequency control rates can virtually double the efficiency of your DAQ solution. You can implement this functionality in a single function call or icon. Flexibility in NI-DAQ gives new dimensions of capability for DAQ-based solutions. ▶

For an article reprint titled “Staying in Control with Data Acquisition,” circle A862A on the reply card.

Live Web Demo Shows Remote SCXI and LabVIEW Internet Technology

Interested in seeing a live demo of National Instruments remote SCXI products integrated with wireless technology and a LabVIEW web server? Or, perhaps you want to find out just how hot Texas summers can be. In either case, point your web browser to www.natinst.com/daq/weather and view real-time weather data from National Instruments corporate headquarters, acquired using a SCXI-based remote signal conditioning and data acquisition system.

Weather Data Acquisition

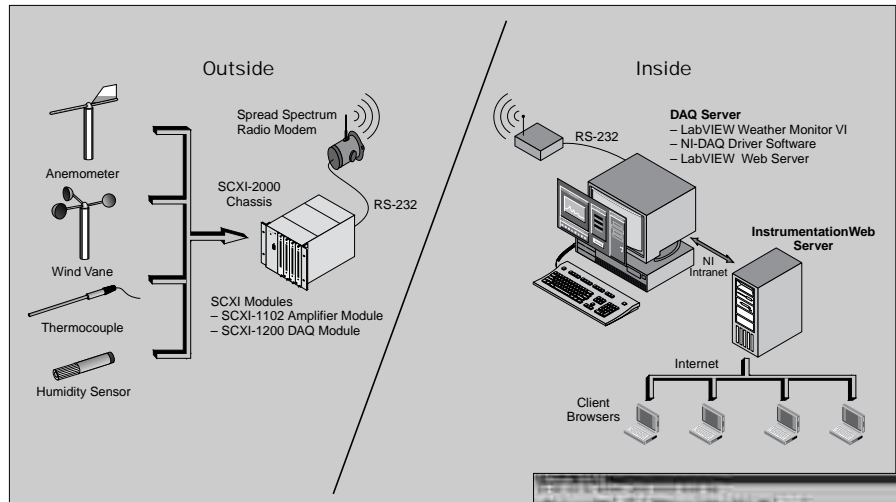
The weather sensors used in this application include a thermocouple for temperature, a weather vane and anemometer for wind direction and speed, respectively, and a humidity sensor. The thermocouple signal, along with the analog voltages generated by the humidity sensor and wind direction sensor (which uses a

The connection from the SCXI system to the computer running LabVIEW is made over a wireless serial data link.

potentiometer) are conditioned and acquired by the SCXI-1102 amplifier module. The SCXI-1102 amplifies and filters each analog signal to maximize accuracy of the measurements. The SCXI-1200 digitizes the conditioned analog signals from the SCXI-1102 module. We use a counter/timer on the SCXI-1200 DAQ module to measure the frequency of the TTL pulse train output by the wind speed sensor.

The SCXI modules are installed in the SCXI-2000 chassis, a four-slot mainframe with a built-in RS-232 and RS-485 serial communications interface. The SCXI system is placed in a weatherproof enclosure and mounted on our rooftop deck at the National Instruments corporate headquarters in Austin, Texas.

A spread spectrum radio modem, connected directly to the RS-232 interface of the SCXI-2000, transmits the data wirelessly to a second modem located

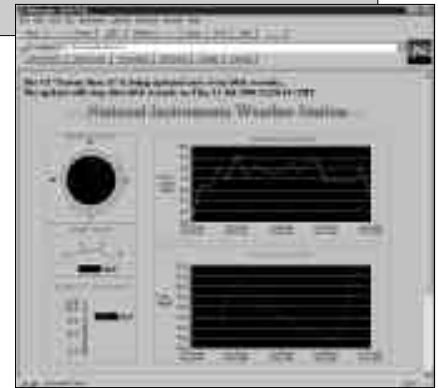


You can see real-time weather data acquired using an SCXI-based remote signal conditioning and data acquisition system.

inside our corporate headquarters. This modem is connected to the serial COM port of a PC running LabVIEW and NI-DAQ to acquire data from the SCXI system. A LabVIEW VI makes standard NI-DAQ calls to collect data from the SCXI modules every few seconds and display the data on the graphical front panel in real time.

LabVIEW Web Server

While the LabVIEW VI collects and displays the weather data, a second LabVIEW program, a web server, provides the connection to the World Wide Web. In general, the job of a web server is to wait for incoming connections from browsers, listen to their requests for information, and then send them the requested information (HTML documents, graphics, sound files, and so on). When a connection comes in from a browser to see the live Austin weather data, the LabVIEW web server (running on the same computer) uses a technique called a server push to capture the graphical image of the LabVIEW weather-monitoring VI, send it to your browser, and refresh it continually. This LabVIEW web server technology was also used recently to monitor the status of the BETSCE experiment onboard the space shuttle Endeavour and provide real-time updates over the Internet.

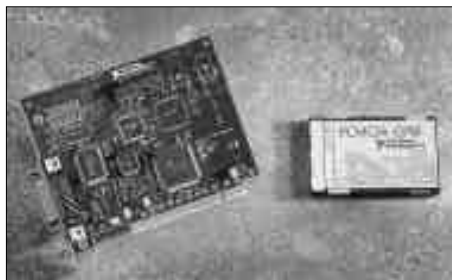


Wireless SCXI System

The connection from the SCXI system to the computer running LabVIEW is made over a wireless serial data link. This is easily implemented by combining the RS-232/RS-485 interface of the SCXI-2000 chassis with standard serial-to-wireless modems. The wireless modems used for this system transparently convert the RS-232 signals to and from the SCXI chassis into spread spectrum RF signals. No additional software or programming is required. Spread spectrum technology, which uses an RF frequency range of 902-928 MHz, is unlicensed in the U.S. and provides a very convenient method for implementing remote or distributed DAQ systems where running serial cable is impractical or too expensive. ▶

To view real-time weather data from National Instruments, point your web browser to www.natinst.com/daq/weather. For a free SCXI kit, circle this option on the reply card.

High-Performance, Portable GPIB Controller Options for Windows NT



For Windows NT solutions, our PCI-GPIB board gives throughput rates in excess of 7.7 Mbytes/s, while our PCMCIA-GPIB provides a portable test platform.

As the test and measurement industry continues to migrate to 32-bit operating systems, Windows NT is fast becoming a viable option for GPIB-based

instrument control. Windows NT combines the cost-effectiveness of general-purpose PCs and the easy-to-use interfacing concept of Windows with the security and robustness of a Unix environment.

Since 1993, National Instruments has provided a Windows NT solution with the AT-GPIB/TNT controller for ISA bus systems. Today, National Instruments also offers PCI and PC Card (PCMCIA) controller options for users who require higher performance and portability in implementing Windows NT-based instrument control solutions.

For users who demand improved performance, our PCI-GPIB board and patented HS488 protocol provide

throughput rates in excess of 7.7 Mbytes/s. For systems that require portability, our PCMCIA-GPIB PC Card controller transforms a general-purpose notebook computer into a portable test platform for interfacing with an array of GPIB instruments. As with all of our GPIB controller products, users can easily port existing NI-488.2™ applications to these new products without software modification.

To ease application development and debugging, we provide several new features, including GPIB Spy, asynchronous event notification, and multithreaded support. ▸

The TNT4882I™ – High-Speed GPIB Chip for Industrial Environments



The TNT4882I, an industrial-rated ASIC, gives increased reliability as well as performance.

Over the past decade, National Instruments has improved the quality and performance of GPIB controllers by developing ASICs for GPIB.

Our new TNT4882I is the latest addition to our family of GPIB ASICs. The TNT4882I is an industrial temperature-rated GPIB Talker/Listener that provides both increased reliability at extended temperature ranges

as well as all the benefits of the high-speed, integrated TNT4882 Talker/Listener. Other commercially available GPIB Talker/Listener chips specify an operating range of 0 to 70° C. The TNT4882I has an operating range of -40 to 85° C, providing high-speed GPIB control under the most severe environmental conditions.

National Instruments has invested in refining GPIB controller technology to better take advantage of emerging PC platforms and changing market conditions. With the advent of the Turbo488® in 1987, we made transfers greater than 1 Mbytes/s a reality. In 1990,

we followed with the NAT4882®, which included complete NEC uPD7210 and Texas Instruments 9914A register sets as well as new registers. In 1993, we created the revolutionary TNT4882™, which incorporated the Turbo488, the NAT4882, GPIB transceivers, and the HS488 patented high-speed GPIB transfer protocol.

Today, instrument control developers who require reliability and performance under harsh industrial conditions can use our TNT4882I as the answer for their GPIB-based instrument control needs. ▸

For free TNT4882I data sheet, circle this option on the reply card.

National Instruments PC GPIB Interfaces – Designed for Windows 95



As a leading supplier of GPIB controller solutions, National Instruments has a long-standing commitment to provide instrument control system developers with the full benefits of industry leading PC technologies. Today, National Instruments is the first GPIB controller supplier to achieve “Designed for Microsoft Windows 95” status. The AT-GPIB/TNT (PnP), AT-GPIB/TNT+, PCI-GPIB, PCMCIA-GPIB, and PCMCIA-GPIB+ controller interfaces

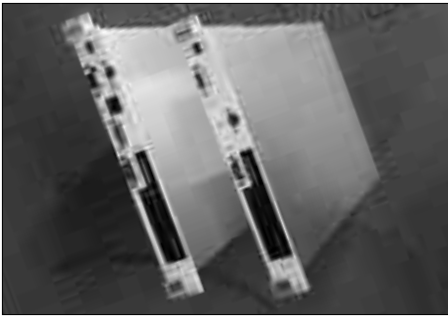
have successfully passed the Microsoft Windows Hardware Quality Lab testing for Windows 95 compatibility and have attained “Designed for Microsoft Windows 95” status.

Windows 95 introduces innovative technologies for increasing user productivity. These technologies include Plug and Play installation of new hardware devices, native 32-bit device drivers, and more intuitive user interfacing to speed development and increase application performance. As more and more products become

available for Windows 95, the issue of compatibility with other Windows 95 peripherals and systems becomes important. National Instruments chose not only to develop native 32-bit driver software for Windows 95 but also to ensure that our GPIB controller products meet all Microsoft requirements for Windows 95 compatibility, including those for Plug and Play installation. ▸

For more information on our Windows 95 GPIB solutions, point your web browser to www.natinst.com/catalog/win95/win95.htm

New VXIpc-740 Controller Drives Down VXIbus Entry Cost



The VXIpc-740 Series drives down VXIbus entry cost while giving superior computer and VXI performance.

A new line of low-cost, single-slot, embedded VXIbus controllers, the VXIpc-740 Series, drives down VXIbus entry cost while giving superior computer and VXI performance. The VXIplug&play-compliant VXIpc-740 Series includes two models, the VXIpc-740/100 and the VXIpc-745/100, both of which feature 100 MHz 486 processors. All VXIpc-740 Series computers have a PCI local bus design as the direct connection to the VXIbus, as

well as primary connection to peripheral devices such as the Super VGA video, PCMCIA, and the enhanced IDE hard drive. A state-of-the-art mechanical design makes the VXIpc-740 Series the first line of embedded VXI controllers to incorporate both a 3.5 in. floppy drive and a hard drive in a single VXI slot.

The VXIpc-745/100 uses the same architecture as the VXIpc-740 but integrates GPIB and 10-Base-T Ethernet capability on the motherboard; it has direct front panel connections to these peripherals. Incorporating the industry-standard TNT4882 ASIC, the VXIpc-745 gives IEEE 488.2-compatible GPIB control of external instruments.

Using the proven 80486 microprocessor, the VXIpc-740 surpasses existing 80486 embedded VXI controllers in terms of PC computer performance with an integrated PCI-based architecture and 128 KB of Level 2 Write Back cache. With this new design, the VXIpc-740 Series delivers approximately 30 percent more performance over the previous

VXIpc-486 Model 599 Series, which also uses the 100 MHz 80486 microprocessor.

Because the VXIpc-740 Series controllers use the MITE and MANTIS custom ASICs, the VXIpc-740 Series also improves on the VXIpc-486 Model 599 VXI performance to offer the most powerful VXI interface available today. With the MITE ASIC, which has integrated DMA, VME64, and built-in PCI, the VXIpc-740 Series can achieve rates of more than 15 Mbytes/s across the VXIbus using 32-bit block transfers and rates of more than 20 Mbytes/s using VME64.

A key feature of the VXIpc-740 Series is the integrated PCMCIA expansion slots available on the front panel. Users can easily add commercially available third-party peripheral cards, such as additional serial ports, removable hard drives, or fax/modem cards, through one of the two PCMCIA slots. The VXIpc-740 Series can accommodate two type II PCMCIA cards or one type III PCMCIA card. ▶

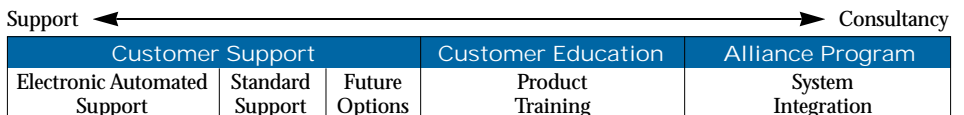
For a free VXIpc-740 Series data sheet, circle this item on the reply card.

CUSTOMER SUPPORT

Added Customer Support Options Planned

At National Instruments, we realize that product training and technical support are just as important to your success as the new technologies we deliver in our products. We provide dedicated technical support, comprehensive product training, and, through our Alliance Program, consulting and systems integration in specific vertical markets.

No two organizations have the same service and support needs; thus, we are expanding and enhancing our service offerings to reflect what we have learned from our customers about the types of technical support you need. Our present Customer Support framework includes easy-to-access online technical and support information as well as standard no-cost support via phone, fax, or e-mail to help you get started with our products.



National Instruments Support and Service Continuum.

Over the years, we have taken many steps to improve and increase our level of product training and technical support. We have staffed our technical support center with highly qualified Applications Engineers (AEs). We have expanded our technical support options from phone only to also include fax, fax-on-demand, e-mail, BBS, and the Internet. These electronic media provide you easy access to online technical and support information 24 hours a day, 365 days a year.

Our guiding principle of total customer satisfaction and continuous

improvement means that we won't stop here. We are increasing our AE staff to improve promptness of service and redesigning our internal processes and systems to better track and respond to customer support requests. In the future, we plan to introduce other Customer Support services that are tailored to meet your specific needs, including priority telephone access to our senior AEs, as well as onsite support and assistance with more advanced applications of our products. ▶

GM Employee Receives Award for Virtual Instrumentation

Don Ferris of the General Motors North American Operations (NAO) Quality and Product Assurance Center recently received the NAO Design and Engineering Centers Special Achievement Award of 1995 for his development of a virtual instrumentation-based test stand using National Instruments products. Criteria for the award include originality, creativity, and leadership.

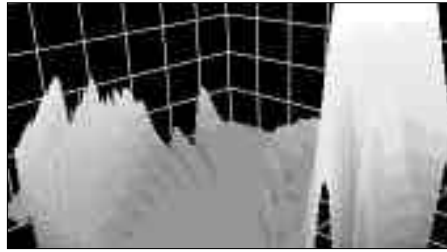
The award, presented in April 1996, honored his development of a virtual instrumentation-based DAQ system that improves voltage and current testing for trucks. Ferris used LabVIEW and National Instruments DAQ hardware in this award-winning system. "LabVIEW and the DAQ products worked together seamlessly to quickly create the solution we needed," Ferris said. "We have now increased our test efficiency by 60 percent." ▶

Join the VI UserNet Today

Are you the main source of information about virtual instrumentation products in your company? Do your co-workers run to you with questions about their LabVIEW-based applications? We have an answer for you – the VI UserNet. As VExperts in the VI UserNet, you can organize and run your own user group meetings. We will send you materials to discuss the latest product advancements, helpful tips and techniques, and applications of National Instruments products. As a result, you will be on the inside track for receiving up-to-the minute news about product developments and directions plus numerous other benefits. ▶

For more information about the VI UserNet, check out the VI UserNet Program web site at www.natinst.com/viusernet

HiQ Beta Version Now on Web



You can now download the HiQ beta version for Windows from www.natinst.com/hiq. Thousands of customers have already downloaded the HiQ beta version within the last few weeks. Using HiQ, you can solve advanced math and data visualization problems, such as data fitting, forecasting, numerical methods, and differential equations. Plus, you can create HiQ notebooks that are interactive reports. You can also use the math user interface controls, 2D and 3D graphs, equations, and data to simulate and model in HiQ. ▶

For your free beta version of HiQ, point your web browser to www.natinst.com/hiq

Free TestSuite Demo Now Available

The New TestSuite Demo helps you learn about the complete line of test development, test execution, and test management solutions from National Instruments. This Windows-based software demo has an online tutorial that gives a comprehensive overview of the TestSuite components, including the Test Executive, SQL Toolkit, SPC Toolkit, LabVIEW and LabWindows/CVI test development environments, and instrument drivers.

The TestSuite demonstration program features the Test Executive and SQL Toolkit and shows how to build and execute test sequences and automatically store and view test results in databases. The demo also includes many sample test sequences that show a variety of test systems you can build with TestSuite. ▶

For your free TestSuite demo, circle this item on the reply card.

New LabVIEW Topics Course Available



National Instruments is pleased to announce the new hands-on LabVIEW Topics course, a set of modules covering specific concepts in LabVIEW. This course expands your knowledge of LabVIEW programming beyond the topics discussed in the LabVIEW Basics and Advanced courses. You will learn detailed information about LabVIEW memory management, calling external code and devices, and the ability of LabVIEW to network with other applications and other computers. The modules, which are independent of one another, are each designed for eight hours of course work.

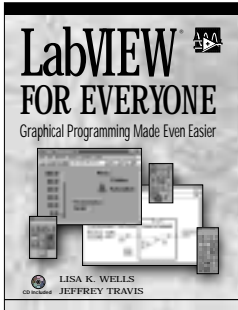
When you finish this course, you will be able to:

- Use the utilities in LabVIEW to monitor memory use
- Understand how LabVIEW allocates memory
- Use memory-efficient programming style and data types
- Use CINS in LabVIEW
- Call DLLs from LabVIEW
- Communicate between LabVIEW and other applications using DDE, TCP/IP, UDP, and OLE

You can create a custom Onsite course to meet your needs by combining topics from other LabVIEW courses with one or more of the modules in the LabVIEW Concepts course using our Onsite Courses à la Carte menu. ▶

For more information or to register, contact our Customer Education Department at (512) 794-0100 in the U.S. or your local branch office.

Graphical Programming Made Easier with New LabVIEW Book



Users throughout industry, academia, and government have adopted the LabVIEW graphical programming environment

for acquiring data and controlling instruments in a myriad of application areas. From retrieving data from the Galileo space shuttle, to computerizing stunt production in Hollywood, to performing tests in a university lab, LabVIEW has played a diverse role in a variety of applications. Now, a new book helps users of all disciplines and experience levels further understand this software technology and the flexibility and power behind it.

LabVIEW for Everyone: Graphical Programming Made Even Easier (ISBN: 013-268194-3) is co-authored by Lisa Wells of National Instruments and Jeffrey Travis of VI Technology. Wells is also

author of two previous books, the *LabVIEW Student Edition User's Guide* and the *LabVIEW Instructor's Guide*. Based on Version 4.0, *LabVIEW for Everyone* guides readers who may range from beginning LabVIEW users to experienced LabVIEW programmers, teaching the skills needed to implement fast and efficient programs in a wide variety of applications. According to Gary Johnson, author of *LabVIEW Graphical Programming*, "*LabVIEW for Everyone* covers ground from beginning to intermediate-plus level. The information is well presented and well organized. This book is clearly of value to the LabVIEW community."

Clear definitions, numerous screen shots, and step-by-step tutorials in the book give readers a feel for LabVIEW and its vast capabilities. The book contains a complete introduction to the basic structures of LabVIEW programs, as well as more advanced topics, such as programming techniques, data acquisition theory and programming, and instrument control.

LabVIEW for Everyone teaches readers about writing LabVIEW programs, designing custom graphical user interfaces, using built-in LabVIEW functions and library virtual instruments (VIs), debugging and optimizing VI performance, and using advanced features, such as globals, locals, and attribute nodes. A CD that accompanies each book provides sample LabVIEW software and solutions to the activities included. With its multiplatform capability, LabVIEW runs on Macintosh/Power Macintosh computers, Windows NT/95/3.1 PCs, and Sun and Unix workstations. ▸

To order in the U.S., contact Prentice Hall at tel (800) 947-7700, fax (515) 284-6719. Direct international requests to (201) 767-4990. Or, point your web browsers to <http://www.prenhall.com>

New Articles, User Solutions, Application Notes Available

Use the enclosed information reply card to order these articles and application notes. Order numbers are listed after the literature descriptions.

Hot Off the Press

"Real-Time Control and Monitoring of a Bearing Test Stand with LabVIEW," by Mike Bonk, User Solutions reprint, April 1996. (A354A)

"Remote Monitoring of Pharmaceutical Plant Using LabVIEW, DDE," by Allen C. Smith, User Solutions reprint, March 1996. (A467A)

"PC-Based Simulation and Monitoring of Automotive Electronic Control Modules," by Chuck Karam, User Solutions reprint, May 1996. (A544A)

"Temperature Control for Measuring Electronic Circuits Using LabVIEW," by Dr. Ken Ashley, User Solutions reprint, April 1996. (A779A)

"LEGO Building Blocks and LabVIEW Teach Laboratory Skills" by Chris Rogers, User Solutions reprint, March 1996. (A803A)

"LabVIEW Controls Capture and Display of Four 'Live' Video Images," by Don E. Nelson, User Solutions reprint, March 1996. (A817A)

"Advances in PCMCIA-Based Data Acquisition Technology," by Ed McConnell, *EDN Products*, April 18, 1996. (A853A)

"Simplified Wheel-Spindle Bearing Testing with LabWindows/CVI," by Charles Puzemis, User Solutions reprint, May 1996. (A855A)

"Try These Two Little Disks for a Big Step In Streamlined, Object-Oriented SCADA," by Bob Sperber, *Control*, April 1996. (A856A)

"Staying in Control with Data Acquisition," by Dave Wilson, *Desktop Engineering*, July/August 1996. (A862A)

"PC Software Bridges Gap from Instrumentation to Plant Floor," by Jane Gerold, *Control Engineering*, August 1996. (A875A-01)

Application Notes

"SCXI Product-Selection Guide," June 1996. (D746C)

"Writing 16-Bit Delphi Applications Using NI-488.2 Software," June 1996. (D1110A)

"Using Quadrature Encoders with the DAQ-STC," June 1996. (D1112A)

"Writing 32-Bit Delphi Applications Using NI-488.2 Software," June 1996. (D1130A)

"Porting a GPIB Interface Design Using the NEC μ PD7210 to the TNT4882," June 1996. (D1142A)

Users and Developers Tap into the Power of Virtual Instrumentation



On August 6-8, 1996, more than 400 people gathered in Austin, Texas for NIWeek 96, the worldwide conference on virtual instrumentation. With technical information spread throughout the week, attendees learned how to squeeze the most out of their system, saw previews of the most innovative emerging technologies, and had the opportunity to talk directly with our management and engineers.

In the evenings, attendees visited the Exhibition Hall to obtain more information about the products discussed at the conference. National Instruments was joined by more than 20 companies to demonstrate products in the exhibit area.

In addition, the poster sessions included more than 40 examples of how users are using virtual instrumentation around the world.

At night, developers and users enjoyed a variety of meals and entertainment. On Tuesday, the evening kicked off with a reception hosted by *Scientific Computing & Automation* and *EDN Products* magazines. Later on, guests were treated to a Casino Night in the Old West by *Test & Measurement World* and *EDN*

magazines. Festivities included a round-up of some of our local dishes, a chance at the blackjack table, roulette wheel, and other games. On August 7, National Instruments threw a party to celebrate 20 years as a leading supplier of virtual instrumentation products, the 10th birthday of LabVIEW, and the launch of many new products announced this year and at NIWeek.

Make plans to join us for NIWeek 97, tentatively planned for summer 1997 in Austin. In the meantime, we are planning a series of NIDays, one-day events held regionally and throughout Europe. Contact your local office for more information. ▶

Contest Winners

For NIWeek 96, more than 40 users participated in the Best Application of Virtual Instrumentation Contest. Criteria included technical challenge, innovation, and cost-effectiveness of the solution.

Jason Dunham from Trilon Technology won the Gold Medal award for his paper "The Urban Gunshot Location System." In his application, LabVIEW and an National Instruments SB-MIO-16 DAQ board continuously monitor a sensor network that locates gunshot sources, helping police respond more quickly and effectively.

Four other entries received Awards of Excellence. Winners included:

- Ted Brunzie, "LabVIEW Data Acquisition Onboard a NAA Microgravity Research Aircraft"
- Allen Smith, "Neural Network Chip Test Controller"
- William Holmes, "Using LabVIEW to Access and Control the ORNL Harsh Environment Laboratory through the Internet"
- Kenneth Hakken, "Simulation of the Control Rod Drive System"

VINCI Brings Image Acquisition and Processing to LabWindows/CVI



Graftek, an Alliance Program member, is now offering VINCI, a LabWindows/CVI library designed for image capture, display, and processing. Based on Concept V.i, Graftek's popular library for LabVIEW, VINCI features

more than 400 image analysis and processing functions. These functions are accessible as LabWindows/CVI panels.

With VINCI, you can easily control live video acquisition, display images, and manage user actions on an image window. This includes zooming, drawing, and manipulating several shapes of region of interest (ROI). All VINCI functions, including display, work on different pixel representations: 8-bit, 16-bit, floating, and true-color RGB pixels.

VINCI contains a full set of entry points dedicated to:

- Image enhancement and analysis
- Reading and writing images in different file formats
- Converting image pixels into data arrays

(and vice-versa)

- Computing histogram and line profiles
- Binary and gray morphology
- Object detection, labeling, and measurement (You can extract 60 parameters for each object in an image – area, length, coordinates, shape factors, densitometry, and so on.)
- Enhanced functions, including look-up table transformations and histogram equalizations, convolutions, and other classic spatial filters
- Frequency domain VIs (FFTs) are available; you can create deconvolution filters ▶

For more information, contact GRAFTEK, 1825 Fortview Rd no. 109, Austin, TX, 78704, tel (512) 416-1099, fax (512) 416-1014.

nuLogic Offers LabVIEW-Compatible PCI Bus Motion Controller



nuLogic, Inc. recently announced the release of FlexMotion™ PCI, the world's first PCI bus motion controller, and FlexMotion VI's™, virtual instruments for LabVIEW programming. FlexMotion PCI, which controls from 2 to 10 servo and stepper axes from a single bus slot,

takes advantage of the high-performance PCI bus. FlexMotion VI's is a library of more than 300 high-level virtual instruments for LabVIEW programming.

The high-performance capabilities of FlexMotion are the direct result of an advanced controller architecture. This dual-processor controller design easily accomplishes advanced motion profiles, including point-to-point, vector motion, jogging, contouring, electronic gearing, master/slave, camming, linear interpolation, circular interpolation, helical interpolation, and spherical interpolation. The FlexMotion FIFO bus interface and powerful command set both provide high-speed communications while off-loading complex motion functions from the host PC for optimum system performance.

nuLogic has invested seven years of LabVIEW-based motion experience into FlexMotion VI's. Users can integrate sophisticated motor control with the power of LabVIEW and LabWindows/CVI programming for the PC. For process control, R&D, or automated quality control, the FlexMotion-LabVIEW combination is a natural. ▶

For more information, contact nuLogic Inc., 475 Hillside Avenue, Needham, MA 02194, tel (888) 444-FLEX, fax (617) 444-2803, e-mail: flex@nulogic.com

VICS Simplifies Communications with Remote Applications

Alliance Program member B&B Technology is offering the Virtual Instrumentation Communications Suite (VICS), a package that provides LabVIEW developers with a complete set of tools for controlling remote applications via modem or direct serial link. VICS handles all the connection details, so the user can concentrate instead on creating the remote application. With the user-defined telecommunications protocol, users can define ASCII instructions to perform any task on a remote computer.

VICS features both modem-to-modem communications and direct serial communications using a null modem cable. VICS, which handles all aspects of a modem connection, even checks for errors in transmission. In addition, VICS features a full implementation of handshaking to ensure that instructions and data are acknowledged. If any application errors occur on a remote system, VICS can handle them without further affecting the system.

The system comes bundled with numerous examples describing VICS

functionality. With additional calls, VICS can talk directly to a remote instrument without a remote computer. Users can connect a modem directly to a remote serial device or put a serial to GPIB converter in line so the VICS application can talk directly to a GPIB device. ▶

For more information, contact B&B Technologies Ltd. Co., 6610 Gulton CT. NE, Suite A, Albuquerque, New Mexico 87109, tel (505) 345-9499, fax (505) 345-9699, e-mail at bbtech@roadrunner.com

Multi-Design SCXI Modules Help You Build Custom Systems

Developpement Ingenierie (Paris, France) is announcing multi-design SCXI modules for use with the National Instruments high-performance SCXI chassis. Multi-design SCXI modules are cost and time-effective solutions for embedding and programming a custom hardware design. With this architecture, you can create custom modules for driving parallel and serial ports, adding displays, adding static memories, building microcontroller systems, or creating specific digital and analog hardware.

Built from National Instruments SCXI-1181 custom modules, these

modules include a set of three solid-state devices, an I/O buffer, an open-collector inverter, and a dedicated 84-pin PLCC ASIC embedded. The ASIC contains all the necessary circuitry to manage the specific SCXI bus requirements and low-level hardware and software protocols between the DAQ board and SCXI chassis.

Multi-design SCXI modules include a complete LabVIEW or LabWindows/CVI software library, driver software, hardware and software examples, and complete technical documentation. Running on Windows 3.1/95, DOS, (development for

the Mac OS environment is in progress), the modules are fully compatible with other National Instruments existing SCXI modules, as well as LabVIEW, LabWindows/CVI, and DOS. ▶

For more information, contact Developpement Ingenierie at 98, rue Saint-Charles, 75015 PARIS, FRANCE, tel 33 (1) 43 67 47 46, fax 33 (1) 43 67 47 42, e-mail: devingfi@worldnet.fr

Announcing Our New AutomationView Newsletter

AutomationView

Volume 1, Number 1, Autumn 1996
 The Industrial Automation Newsletter from National Instruments

BridgeVIEW™ Provides Graphical Tools for Automation Applications



BridgeVIEW combines intuitive configuration and state-of-the-art graphical programming tools into a single package, providing functionality that goes beyond that of traditional MMI software packages.

BridgeVIEW, the newest addition to our industrial automation software family, provides software productivity tools to systems integrators, developers, and users for developing industrial-strength automation applications.

BridgeVIEW now makes it easy to use G, our patented graphical programming language, to build PC-based supervisory control and data acquisition (SCADA) and man-machine interface (MMI) solutions for a wide variety of applications in process and discrete manufacturing industries. BridgeVIEW applications span the manufacturing enterprise, from research, pilot plant, and production to quality control and distribution, while industries for this software include oil and gas, chemical, food, pharmaceutical, semiconductor, and automotive.

BridgeVIEW System Architecture
 BridgeVIEW consists of a modular open system architecture. Its main components include a real-time database, historical trending, event and alarm logging, device connectivity, intuitive system configuration tool, and G, an object-oriented programming language in which you graphically assemble software objects to develop applications.

The BridgeVIEW engine places real-time I/O values and status information from device servers

into a high-performance database that is accessible to MMI as well as control applications written using G. The BridgeVIEW engine also performs other system functions, including engineering unit conversion, event monitoring, alarm processing and logging, historical logging and trending, and system security. Historical information is stored in Citadel™, a database you can access through applications using G or through structured query language (SQL) using open database connectivity (ODBC). You can bring in real-time information from data acquisition (DAQ) boards, remote I/O, programmable logic controllers (PLCs), controllers, and industrial networks through device servers. Servers manage all device I/O and communication functions.

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Continuing in the tradition of the National Instruments Instrumentation Newsletter for our test and measurement and data acquisition customers, AutomationView brings you the latest industrial automation news on National Instruments products, customer applications, and industry trends. We have included the premier edition of AutomationView as a supplement to this issue of Instrumentation Newsletter. To subscribe to AutomationView, be sure to check New Subscription on the AutomationView reply card.

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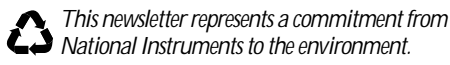
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For Customer Education schedule, see insert.



Trade Shows

Look for the National Instruments booth at these upcoming trade shows:

- Canadian High Technology Show
Toronto, Canada Sept 17-18
- AutoTestCon
Dayton, Ohio Sept 17-19
- Midwest Electronics Expo
Minneapolis, MN Sept 24-25

- Eptech
Québec, Canada Oct 1
- Canadian Mfg Week
Toronto, Canada Oct 1-3
- ISA
Chicago, IL Oct 7-10
- Data Acquisition Expo
Boston, MA Oct 8-10
- Sensors Expo
Philadelphia, PN Oct 22-24

- Wescon
Anaheim, CA Oct 22-24
- Northcon
Seattle, WA Nov 4-6
- Scan-Tech
Chicago, IL Nov 6-8
- Comdex
Las Vegas, NV Nov 18-22
- Int'l Mechanical Engineering Expo
Atlanta, GA Nov 19-21

Corporate Headquarters: 6504 Bridge Point Parkway, Austin, TX 78730-5039 USA • Tel (512) 794-0100 • Fax (512) 794-8411 • E-mail: info@natinst.com • WWW: http://www.natinst.com
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