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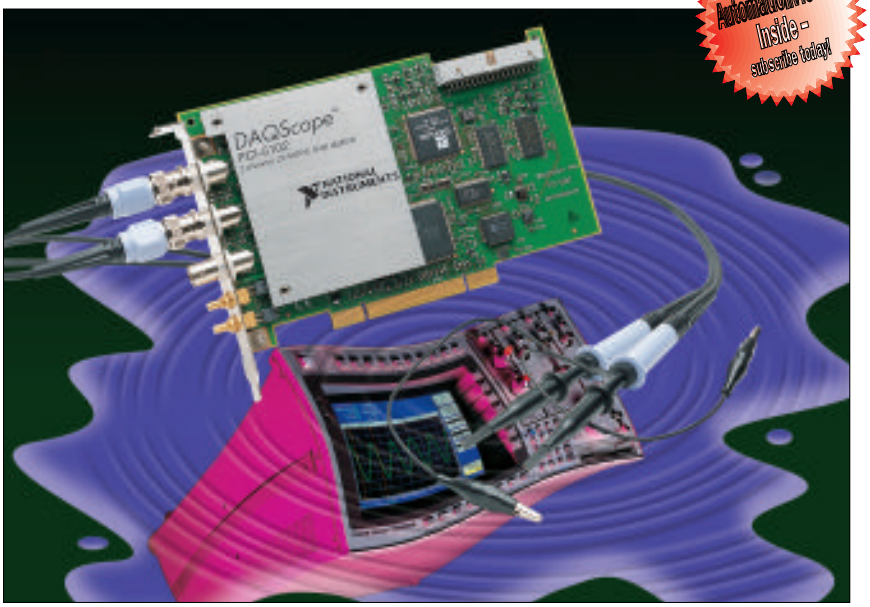
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INSTRUMENTATION NEWSLETTER™

VOLUME 9, NUMBER 1
SPRING 1997
TECHNICAL NEWS FROM NATIONAL INSTRUMENTS

DAQ Instruments Establish a New Benchmark for Instrumentation



DAQ Instruments take advantage of the PC to combine performance with flexibility.

National Instruments introduces DAQ Instruments, a family of plug-in products for PCI, AT, and PCMCIA that combines the performance of stand-alone instrumentation with the flexibility of plug-in data acquisition (DAQ) boards. By merging performance and flexibility, these products establish a new benchmark for instrumentation.

The new DAQ Instruments line includes DAQScope™ oscilloscopes, DAQArb™ arbitrary waveform generators, and a DAQMeter™ digital multimeter (DMM). These DAQ Instruments run on a variety of platforms for stand-alone use, test-stand integration, and portable operation. With our integrated software, DAQ Instruments are ideal for stand-alone use as well as systems integration.

The DAQScope family includes the PCI-5102, AT-5102, and DAQCard-5102 – the DAQCard-5102 is the first PCMCIA-based, dual-channel oscilloscope. The DAQArb family consists of the PCI-5411 and AT-5411, while the DAQCard™-4050 is a PCMCIA-based DAQMeter.

Performance Meets Flexibility

Although improvements in traditional instrumentation have produced performance increases, today's users place an equal importance on flexibility. Next-generation oscilloscopes, meters, and function generators must also offer vast analysis capabilities, compatibility with report-generation tools, and be Internet ready.

Taking advantage of the PC combines performance with flexibility, resulting in a new level of instrumentation that meets

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Windows NT and PCI Power New DAQ Boards

National Instruments introduces new hardware and software that takes full advantage of two of today's most exciting computer technologies – Windows NT and the PCI bus. Combining these technologies with data acquisition creates new capabilities for more powerful DAQ solutions.

NI-DAQ® 5.0 Gives Windows NT Capability to PCI DAQ

NI-DAQ Version 5.0, our latest DAQ driver release, brings Windows NT capability to our new PCI DAQ products in addition to Windows 3.1 and 95. With NI-DAQ 5.0, users can also run our AT and PC bus DAQ products, as well as all SCXI™ modules, under these operating systems. This new release continues our tradition of driver reliability, extensive I/O functional support, and native operating system code.

NI-DAQ 5.0 for Windows NT offers a stable and reliable combination for DAQ systems. From the Windows NT side, this stability stems from the separation of the user and kernel modes. User mode is the area where user programs and data reside, while kernel mode is the area for operat-

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PERSPECTIVE

Reviewing Our Mission

The start of a new year is a good time for us to look back at our accomplishments for the previous year and to look ahead at our plans for 1997. We do this within the framework of our mission statement and mission triangle shown below.



Customer Success

To make our customers successful by providing them with innovative, computer-based hardware and software products and services that have the best long-term value.

At our NIWeek 96 conference, our NI Days events in Europe, user group meetings, and countless interactions with our customers, we have enjoyed hearing the incredible success stories our customers have had with virtual instrumentation. Your feedback helps guide many of the improvements and new products for National Instruments. In 1996, we introduced a number of new products, including Lookout™ and BridgeVIEW™ industrial automation software; IMAQ™ image acquisition hardware and software; a new Windows-based version of HiQ®; our VXI-MIO Series of VXI data I/O modules; E Series PCMCIA DAQCards; 4.0 versions of both LabVIEW® and LabWindows®/CVI software; and remote SCXI products. For 1997, as you can see from this *Instrumentation Newsletter* edition and the latest edition of *AutomationView™*, we are continuing to offer a selection of computer-based products that make you more productive and save you time and money.

We are pleased with our progress in 1996, but look to make even bigger strides in 1997!

Employee Success

To attract, retain, and motivate highly talented people who subscribe to our values by providing them with a challenging growth environment.

With more than 1,200 people today, we continue to grow our staff. In 1996, we initiated more aggressive recruiting efforts to hire top graduates from technical universities and colleges around the world. Our list of new product ideas is long – one of the primary roadblocks to that happening is hiring enough talented engineers. We are also extremely pleased with the culture we have built at National Instruments that helps align all of our employees with our vision. We refer to it as a vision that's *Built To Last,* referring to the book of that same name.

Shareholder Success

To provide an above average return for our stockholders through consistent revenue and earnings growth.

March of 1997 is the second anniversary of our initial public offering. Although we had shareholders prior to this as a private company, we expanded our shareholder base with our offering to include more National Instruments employees. Being public gives us new responsibilities to our shareholders. In addition, we are very pleased with our track record through 1996. We realized revenue growth of more than 20 percent in 1996, with our worldwide revenues topping $200 M.

Supplier Success

To develop and sustain win-win relationships with strategic suppliers and partners.

National Instruments must rely on many other companies for our success. These companies in turn rely on us. Thus, we have increased our efforts to identify our key suppliers and partners and forge stronger relationships with them. In 1996, we made great strides in this area, which carried over to help our customers, our employees, and our shareholders.

We are pleased with our progress in 1996, but look to make even bigger strides in 1997!

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DAQ Instruments Establish a New Benchmark for Instrumentation

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these demands. DAQ Instruments preserve the performance characteristics of stand-alone instruments by placing sophisticated digitizing, triggering, generation, and amplification circuitry on a plug-in board, delivering instrument-grade I/O capability. For flexibility, the DAQ Instruments products use proven DAQ components for timing, synchronization, and direct data transfer to PC RAM. Because the microprocessor has instant access to data from the DAQ Instruments, you have complete control to extend their functionality.

Recent advances in computer and DAQ technologies, such as Windows NT, the PCI bus, the MITE data transfer ASIC, and NI-DAQ driver software, power DAQ Instruments.

Combining DAQ Instruments with analysis creates whole new instruments. For example, the DAQScope PCI-5102 uses analog triggering and digitizing rates of 20 MS/s to capture signals and transfer data to PC RAM for analysis. This analysis includes common functions such as FFT, which turns the PCI-5102 into a spectrum analyzer. Similarly, the DAQArb PCI-5411 generates waveforms at 40 MS/s and the DAQMeter DAQCard-4050 reads ohms, volts, and current all directly in and out of PC RAM. You can use these new instruments standalone or as components of a system.

DAQ Instruments Capitalize on New Technologies

Recent advances in computer and DAQ technologies, such as the PCI bus, Windows NT, the MITE™ data transfer ASIC, and NI-DAQ driver software, power DAQ instruments.

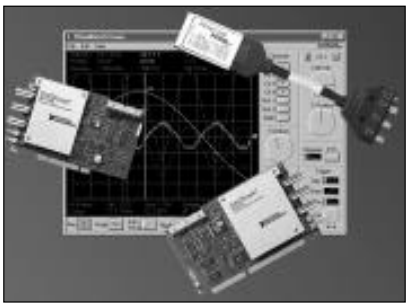
The PCI bus gives a quantum leap in performance compared to older computer buses. The PCI bus can transfer data at rates of 132 Mbytes/s, a more than 10-fold increase in performance over the ISA bus. PCI bus mastering is required for fast data transfer; to maximize performance, this bus mastering process also needs optimization. For this reason, National Instruments developed a special ASIC called the MITE chip. The MITE, a PCI bus master interface with three direct memory access (DMA) channels, uses scatter-gather (link chaining) techniques to free the microprocessor and optimize data transfers to PC RAM. For more information on the MITE, see page 15.

Instant access to higher speed data and faster processing means more valuable information. For this reason, the stability of the operating system is more important. Windows NT, with its separation of user space from operating system space, provides the stability required of these systems.

To take advantage of Windows NT, the DAQ driver must be written specifically for it. NI-DAQ 5.0, the newest release of NI-DAQ, includes specific Windows NT and PCI capability. This 32-bit DAQ driver software handles all functions of all our DAQ products with native Windows NT code, meaning data transfers occur without the overhead inefficiencies and unreliability of 16-bit drivers that are simply ported to Windows NT. NI-DAQ 5.0 for Windows NT preserves performance without compromising the reliability of Windows NT. For LabVIEW users, the NI-DAQ 5.0 application programming interface (API) for programming DAQ Instruments is identical to the API for our line of other general-purpose, multifunction DAQ products. This means you can easily add instrument functionality to your systems using the same standard programming techniques.

Ready-to-Run Software and Development Software

Because the microprocessor is completely free from the task of data transfer, it is available to display and process data. Software defines how the DAQ Instrument is used. We have included VirtualBench™ software instruments with each DAQ Instruments product. This means DAQ Instruments function like traditional stand-alone instruments, such as oscilloscopes, right out of the box. Plug them in, load the software, and operate knobs and buttons in a familiar, stand-alone style. Your desktop computer replaces a variety of benchtop instruments while your laptop becomes a portable, instrument-grade measurement tool. With the flexibility of virtual instrumentation, you can extend your DAQ Instruments into hundreds of common and new instruments. With other VirtualBench components, for example, your DAQScope PCI-5102 quickly becomes an instrument, such as a ⅓ octave analyzer or dynamic signal analyzer.



The DAQScope DAQCard-5102 is the world's first dual-channel PCMCIA-based oscilloscope.

With application software, such as LabVIEW (with which VirtualBench was designed) and LabWindows/CVI, you can develop custom instruments that exactly fit your application. For example, if the application calls for a scope with alarming capabilities and conditional storage to disk, you can quickly develop it. Software is also the key to developing complete, application-specific systems. Because DAQ Instruments share the same proven and flexible API as our DAQ products, you can readily integrate them into your existing DAQ systems.

A New Benchmark for Instrumentation

Combining performance with flexibility produces a new benchmark for instrumentation – completely automated scopes, meters, and arbitrary function generators that immediately produce reports, analyze data, and store the results. For systems development, these DAQ Instruments create powerful new test stands that open up a whole new range of application solutions.

– Dave Wilson, DAQ Marketing Manager

For a DAQ Instruments kit, circle this option on the reply card.

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Windows NT and PCI Power New DAQ Boards

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ing system code. Separating these two areas prevents user programs from corrupting the operating system. Windows NT also features preemptive multitasking, a particular advantage for DAQ systems. Preemptive multitasking means that one program does not completely consume the microprocessor. Instead, the operating system allocates time slices to each program, ensuring that each receives service. In this manner, NI-DAQ 5.0 coexists with other drivers, such as NI-IMAQ™ for image acquisition, so that each receives processor time. The new PCI DAQ products and NI-DAQ 5.0 work with many programming languages, including LabVIEW, LabWindows/CVI, VirtualBench, Measure®, Visual Basic, C, and C++.

Designed for PCI with the MITE

Our PCI DAQ products are designed to take advantage of both the high throughput and architectural benefits of PCI. Our new PCI DAQ boards achieve burst rates of up to 132 Mbytes/s and sampling rates up to 1 MS/s. Because PCI is a bus-master architecture, bus-master boards seize the bus and use total PCI bandwidth for high-speed transfers. Our PCI DAQ boards use a specially developed ASIC called the MITE to achieve the fastest possible data transfers while simultaneously removing all the data transfer burden from the microprocessor. This means that when our PCI DAQ boards transfer data, they take control of the bus, survey memory, and perform 132 Mbytes/s data transfers, even across noncontiguous blocks, without using the microprocessor. In the PCI DAQ category, our boards are among the few products that offer this advanced feature.
For more information on the MITE, see page 15.

The convergence of PCI, Windows NT, and DAQ creates PowerDAQ systems that solve more application needs.

Our new PCI DAQ products use the technologies required to deliver measurements in high-performance systems. All boards feature:

- Automatic software calibration without potentiometers
- Surface-mount components and multiple ground planes to reduce noise
- High-grade components for accuracy
- MITE technology for high-speed data transfers

In addition, the E Series PCI boards feature:

- NI-PGIA™ instrumentation amplifier for high-speed accurate settling
- RTSI® bus for board-to-board synchronization
- DAQ-STC™ for flexible and fast timing
- Switchless configuration for complete hands-free board setup

	Sampling Rate	ADC Resolution	Analog Input	Analog Output	Digital I/O	Counter/ Timer	Triggering
PCI-MIO-16E-1	1 MS/s	12 bits	16 SE, 8 DI	2, 12-bit	8 lines	2, 24-bit	Analog, digital
PCI-MIO-16E-4	250 kS/s	12 bits	16 SE, 8 DI	2, 12-bit	8 lines	2, 24-bit	Analog, digital
PCI-MIO-16XE-10	100 kS/s	16 bits	16 SE, 8 DI	2, 16-bit	8 lines	2, 24-bit	Analog, digital
PCI-MIO-16XE-50	20 kS/s	16 bits	16 SE, 8 DI	2, 12-bit	8 lines	2, 24-bit	Digital
PCI-1200	100 kS/s	12 bits	8 SE, 4 DI	2, 12-bit	24 lines	3, 16-bit	Digital
PCI-DIO-96	–	–	–	–	96 lines	–	–

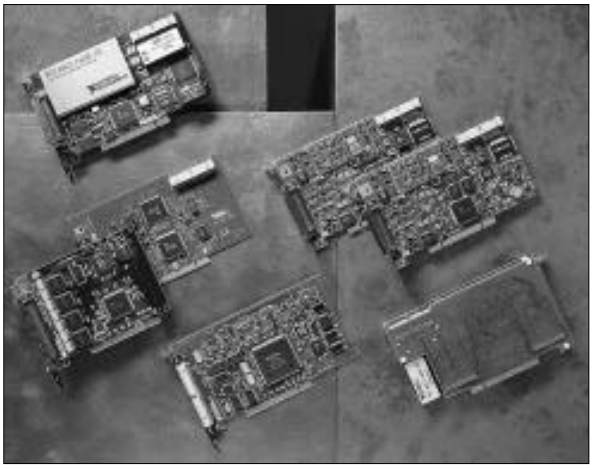
SE=single-ended, DI=differential
All six boards work with Windows NT/95/3.1 and are available in Q1, 1997. The PCI-MIO-16XE-50, PCI-1200, and PCI-DIO-96 also work with Mac OS.

Delivering PowerDAQ™ Systems

The convergence of PCI, Windows NT, and DAQ creates PowerDAQ systems that solve more application needs. An example of a PowerDAQ system is an electronic engine simulator that generates stimulus waveforms, monitors response, and inspects circuits for missing components. A PCI-MIO-16E-1, the fastest of our multifunction PCI DAQ boards, is ideal for performing simulation and monitoring. An analog output channel generates custom waveforms at 500 kS/s – the response of the circuit is up to 100 kS/s. The PCI-MIO-16E-1 analog trigger starts a 1 MS/s acquisition, sampling 10 times faster than the 100 kS/s frequency. Then, the CPU compares the results to known waveforms to determine if the output is correct. While the stimulus/response test occurs, the system also inspects the module for missing components using an IMAQ PCI-1408 image acquisition board. The IMAQ board digitizes an image of the module at more than 16 MHz, then the computer software processes the image to determine if the components are properly placed.

This PowerDAQ system takes advantage of the high-speed and bus-mastering aspects of PCI bus, the performance of a Pentium processor, and parallel DAQ and IMAQ components, creating a test system that previously would have been costly and difficult to develop. Systems like this are now easily and routinely developed as end-users begin to leverage these new technologies and take DAQ solutions to the next level.

For a PCI DAQ kit, circle this option on the reply card.



Our new PCI DAQ boards have bus-master DMA capability.

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Take Measurements – Not Estimates™



Data acquisition is for taking measurements. A properly designed DAQ board delivers true representations in which you can place your trust. Improperly designed boards deliver mere estimations of actual events. Because data acquisition is becoming so widely used in applications where decisions depend on the results, it is important to know that your DAQ hardware delivers measurements – not estimates.

Various DAQ technologies work together to effectively deliver measurements. Some of these are readily apparent, while some of them exist "inside" the product and are unseen. National Instruments goes the distance, even in our low-cost products, to ensure you get the measurements you require, not estimates. The table below lists some fundamental technologies required to give measurements.

National Instruments continues its commitment to delivering measurements you can trust, from low-cost to high-performance E Series-based DAQ products.

Automatic calibration heads the list of technologies that deliver measurements. This means that the DAQ product automatically subtracts offsets that cause inaccurate readings. Offsets occur because of environmental changes, including electronic emissions and temperature drift. Temperature affects both electronic and mechanical components, such as potentiometers. Removing potentiometers from the DAQ board helps in numerous ways. First, inaccuracies caused by temperature drift are eliminated. Second, errors caused by mechanical adjustment are removed.

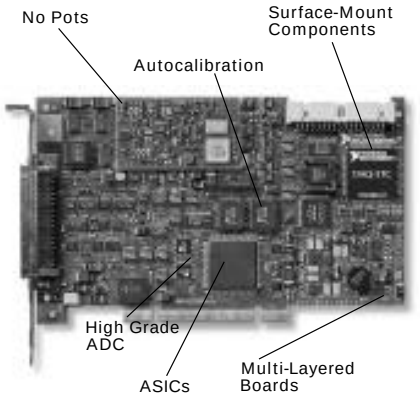
Surface-mount components on the DAQ board result in physically closer components. Longer trace lengths pick up more noise, so reducing this trace length reduces noise. In addition, surface mounting provides tighter clustering of critical circuits, such as analog sections. This, combined with strategic placement, effectively isolates these from more noisy digital sections. Similar to the benefits of surface mounting, ASICs also reduce trace lengths by eliminating components. This provides component consolidation and isolation, along with the added benefits of improved reliability and decreased power requirements.

Using high-grade components delivers more accurate measurements. Manufacturers of A/D converters perform quality tests on their components. Some components meet tight tolerances, while others are less accurate. Some converters span ranges of five or more grades. Better grade components can cost up to 20 percent more than lower grade components. National Instruments uses the highest grade components necessary for the board to deliver measurements.

Multi-layer board design isolates analog and digital sections into different layers on the PCB to reduce noise. The high frequencies associated with digital values changing states can show up as noise on analog lines. By designing the board with multiple ground planes and positioning the analog and digital circuit groups strategically, you can minimize the effects of capacitive, coupling-based noise.

NI-DAQ – to use the DAQ board to its full potential, you need complete driver software. Part of delivering measurements is the ability to put the DAQ product into a configuration capable of making a measurement. NI-DAQ driver software delivers full functionality, meaning you can use all the DAQ board capabilities. Also important in the DAQ driver is the ability to perform several functions simultaneously; measurements often include output as well as acquisition. In addition, the driver must deliver this functionality across several boards – simultaneously.

Technology	Contribution to the Measurement
Automatic calibration	Ensures that offsets caused by temperature drift and other effects are removed.
No potentiometers	Removes drift and mechanical adjustment errors; enables automatic calibration.
Surface-mount	Reduces trace length, minimizing noise. Important in noisy computer environments.
ASICs	Reduce component count, increasing reliability; reducing trace length, decreasing noise.
High-grade components	Ensure components deliver stated accuracy and resolution.
Multi-layer design	Minimizes digital circuitry cross-talk to analog components, reducing noise.
Complete driver software	Delivers full access to board features and preferably ports to various operating systems.



A properly designed DAQ board is measurement ready, using technologies that ensure measurements, not estimates.

DAQ Is Meant for Measurements

End-users of DAQ products use them to deliver true representations of real-world events, or measurements. To deliver measurements, DAQ products must not only be designed properly but must also take advantage of technology improvements. National Instruments continues its commitment to delivering measurements you can trust, from low-cost to high-performance E Series-based DAQ products.

For the technical note "Questions to Ask Before Buying a DAQ Board," circle this option on the reply card.

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Code Management and Tracking Tools Now Available for LabVIEW

Until now, graphical programmers have faced the challenge of managing and tracking code in large development projects. While previously limited to traditional languages like C, new configuration management tools for source code control, code complexity measurements, and programming standardization are now available for G programmers using LabVIEW and BridgeVIEW.

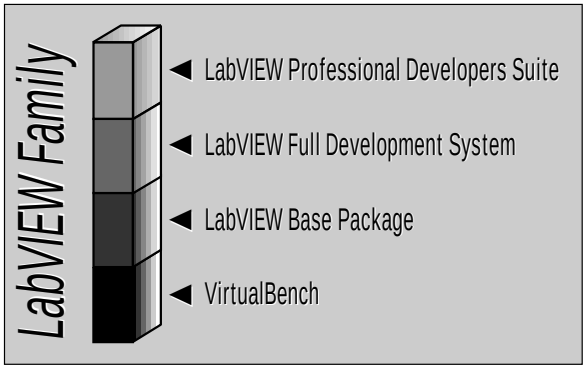
LabVIEW first captured the attention of scientists and engineers in R&D laboratories because of its rapid prototyping capabilities and easy development of desktop DAQ systems. Over the years, the LabVIEW graphical programming model has expanded into the production environment for large-scale automated test and instrumentation systems – areas where traditional, text-based languages such as C and HP-BASIC were previously used. At the same time that system requirements and application functionality have grown, regulatory standards and agencies, such as ISO9000 and FDA, have placed stringent quality requirements on companies throughout the world.

LabVIEW Professional Development Suite

We developed the LabVIEW Professional Development Suite to address LabVIEW users' needs for code management and version tracking tools previously available only with traditional languages. With the Professional Development Suite, you have all of the acquisition, analysis, and presentation tools of the existing LabVIEW Full Development System; the Professional G Developers Toolkit for complete code management and tracking; and the ability to create stand-alone executables with the LabVIEW Application Builder. Existing LabVIEW developers can use the Professional G Developers Toolkit to track and manage G source code using the built-in source code control (SCC) tools, code complexity utilities, documentation tools, and G programming standards and guidelines.

The Professional G Developers Toolkit features built-in source code control utilities for the LabVIEW and BridgeVIEW development environments. By creating "development projects," you can easily check virtual instruments (VIs) out of a project to begin development work, then check those VIs back into the project – ensuring that no two developers modify a VI at the same time. These source code control utilities can also help maintain version control of applications.

We designed our SCC utilities with flexibility and ease of use in mind. These SCC utilities make it simple to create projects, generate reports, track changes, and retrieve older revisions of files. You can either work with a built-in SCC system or you can communicate with third-party source code control systems. The built-in system has most of the code sharing and tracking features found in standard source code control packages. You can use a third-party system if you have an established standard within your organization or if you have higher security requirements.



The LabVIEW Professional Development Suite is the latest addition to the LabVIEW family of acquisition, analysis, and presentation tools.

The SCC tools come with capability for the built-in system and for Microsoft Visual SourceSafe. Because the tools are built on an open, VI-based interface, you can add support for other SCC products.

Code Complexity Utilities

Using the code complexity metric utilities in the Professional G Developers Toolkit, you now have a simple way to determine the complexity of an application. For example, you can automatically determine hierarchy levels; number of nodes and wires; global and local variables; CINs; and so on for a particular object. These metrics are often necessary when submitting a software application for quality certification, such as ISO9000 and FDA approval. Finally, these complexity metrics can help system developers estimate the amount of time it will take to develop large G applications, helping predict the amount of development time needed to complete future projects.

G Programming Standards

To verify code quickly and ensure correct operation, many institutions require that all software adhere to common standards. Often, the company defines these or adopts guidelines presented in various textbooks.

We developed the LabVIEW Professional Developers Suite in direct response to feedback from users who wanted the same code management and version tracking tools available for traditional languages.

To aid companies in this quest for standardization, the Professional G Developers Toolkit presents standard G programming guidelines to help G programmers design and build organized, well structured suites of VIs. These programming standards are useful for development teams to help ensure consistency of interfaces and structure throughout the application. Users of various experience levels will find the techniques in these standards useful for building high-quality LabVIEW applications.

Documentation Tools

Many times, developers of large applications need to create large amounts of printed documentation. Print Documen-

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The Professional G Developers Toolkit presents standard G programming guidelines to help G programmers design and build organized, well structured suites of VIs.

tation dialogs in LabVIEW give you a variety of options for printing a VI, but you only operate on a single VI at a time. The Professional G Developers Toolkit automatically prints several VIs in your development projects at once, making it easier to supply the required documentation.

In addition, with the SCC tools, which contain report generation utilities, you can generate reports about your projects and the revision history of the files in those projects. This type of documentation is crucial in developing large applications with high-quality standards.

If you have not yet taken advantage of the incredible productivity gains available with LabVIEW because you need tools for rigorous source code management, now is the time to order the LabVIEW Professional Developers Suite.

If you are already a G programmer using either LabVIEW or BridgeVIEW and want to bring your VIs under source code control, determine complexity of applications, and follow good G programming standards, then take advantage of the new Professional G Developers Toolkit.

– Tamra Pringle, LabVIEW Marketing Manager

For a Professional G Developers Toolkit flyer, circle this option on the reply card.

The LabVIEW Product Family

The LabVIEW product family is designed to provide you with the exact tools you need to complete your application. No matter what your application-specific needs are, you can take advantage of the ease of use, rapid development productivity, and optimized execution speed of LabVIEW through its graphical compiler. With the various LabVIEW packages, you can simply buy the product that best suits your application, ensuring that you do not have to waste money on functionality you do not need. And, because you can easily migrate from one LabVIEW product to another, you can expand your system as your application needs grow.

New! LabVIEW Professional Developers Suite

If you are working as part of a large team of developers or developing applications that must adhere to stringent quality standards, the Professional Developers Suite is designed for you. This package includes the LabVIEW Full Development System, the Application Builder, and the Professional G Developers Toolkit, providing all the tools you need for developing, maintaining, and documenting complete systems.

LabVIEW Full Development System

If you are developing complete acquisition, analysis, and presentation applications, the LabVIEW Full Development System (FDS) is designed for you. The FDS, our most popular LabVIEW system, includes complete acquisition functionality, as well as analysis libraries such as signal processing, curve fitting, windowing, filtering, and linear algebra. In addition, with the FDS, you can access external applications through dynamic link libraries (DLLs), external C code, TCP/IP, OLE automation, dynamic data exchange (DDE), and more. All of this is available to you in the simple-to-use graphical programming paradigm of LabVIEW.

LabVIEW Base Package

The LabVIEW Base Package is an easy-to-use, simplified version of LabVIEW, designed specifically for users creating simple data acquisition and instrument control applications. With this package, you can take advantage of the simple graphical programming of LabVIEW to create standard applications.

VirtualBench

VirtualBench is a set of ready-to-run virtual instruments developed with LabVIEW that, when combined with a DAQ board, becomes a virtual benchtop of instruments – a digital multimeter, an oscilloscope, a function generator, a data logger, a dynamic signal analyzer, and an arbitrary waveform generator. You can use these VirtualBench instruments, which you can run but not edit, independently or in conjunction with a LabVIEW development system.

LabVIEW Add-On Products

National Instruments also provides 17 add-on LabVIEW products, including the Vision Toolkit for image processing, Internet Toolkit, Structured Query Language (SQL) Toolkit, Test Executive Toolkit, PID Control Toolkit, Statistical Process Control (SPC) Toolkit, and many more. In addition, more than 30 add-on products are available for LabVIEW through the National Instruments Alliance Program.

For a LabVIEW brochure, circle this option on the reply card.

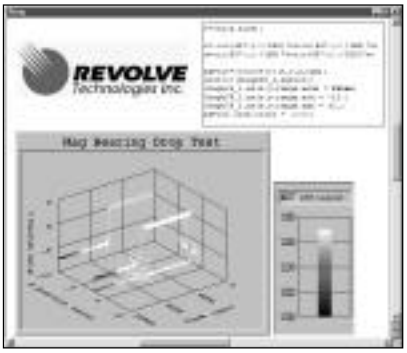
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New HiQ 3.0 Adds Powerful 3D Data Visualization and Report Generation to Virtual Instrumentation

Traditionally, the tasks of analyzing your data, visualizing the results, and creating a technical report have been distinctly separate operations, often performed using several software tools. With the introduction of HiQ 3.0, you can interactively perform your analysis, data visualization, and report generation simultaneously while creating an interactive technical document that you can reuse.

In the world of instrumentation, analyzing and presenting your data are as important as the acquisition process itself. Having the data is just not enough – making the data meaningful in a way that others can understand is what really counts. HiQ 3.0 for Windows 95/NT delivers a powerful environment for analyzing your data and presenting it in a way that others can understand. Using the interactive tools of HiQ, you can create data objects, data analysis, and graphs that you can move, rotate, and customize to bring out the important points in your data. When finished, you have a complete, interactive technical document to share your results with others. Because HiQ works with Microsoft's ActiveX (OLE), you can share all of this data and analysis with other applications, such as Microsoft Office. HiQ also integrates easily with Microsoft Excel, LabVIEW, and LabWindows/CVI, giving users of these software tools some of the most advanced tools for data visualization and report generation.

By combining the power of LabVIEW or LabWindows/CVI with HiQ, you can integrate your data acquisition, analysis, and presentation into a single process. Barrie Drain, Magnetic Bearing Technology Specialist at Revolve Technologies Inc., has done just that. He uses HiQ to analyze the performance of magnetic bearings in three-dimensional space. Explains Drain, "We use LabVIEW and HiQ to gather our data and convert it to useful information. The analysis and visualization capabilities of HiQ help us transform our data into knowledge." Anyone using Microsoft Excel for their data analysis will also find HiQ an excellent tool for large data sets and advanced 2D and 3D visualization.



Revolve Technologies gains valuable insight into the behavior of their 3D magnetic bearings by using the high-resolution, 3D color spectrum visualization in HiQ 3.0.

Developing Applications the Modern Way – Interactively

With HiQ 3.0, you create your technical report as you perform your analysis; together, in a single document. Unlike many other math and data analysis software tools, you do not have to write programming code to create your notebook, import your data, and create 2D and 3D graph objects. HiQ performs these operations interactively, so you can focus on your analysis results. If, however, the power of a high-level scripting language is what you want, HiQ also includes a math-oriented programming language called HiQ-Script™. This scripting language gives you access to hundreds of built-in analysis and visualization functions that you can use to customize and automate your HiQ applications.

Importing Your Data

Why is importing data so difficult in many analysis software packages? We asked ourselves the same question during the development of HiQ 3.0 and concluded that a better way to import data exists, regardless of the data set size or format. In response, we created the HiQ Import Wizard. Using the Import Wizard, you can import a data set of any size in a variety of formats, including, binary numeric, text, tab delimited, IEEE real, Microsoft Excel (.XLS) format, and many others.

What if you don't know or don't care about the format of your data? This is when the power of intelligent importing capabilities from the Import Wizard comes to the rescue. Using this feature, the Import Wizard loads a portion of your data and inspects it for the best method to import. Then, your data imports and displays automatically, so you can verify the import choice. You can even modify the automatic selections to customize your importing. All of this is done interactively, so you don't have to write any programming code to bring your data into HiQ.

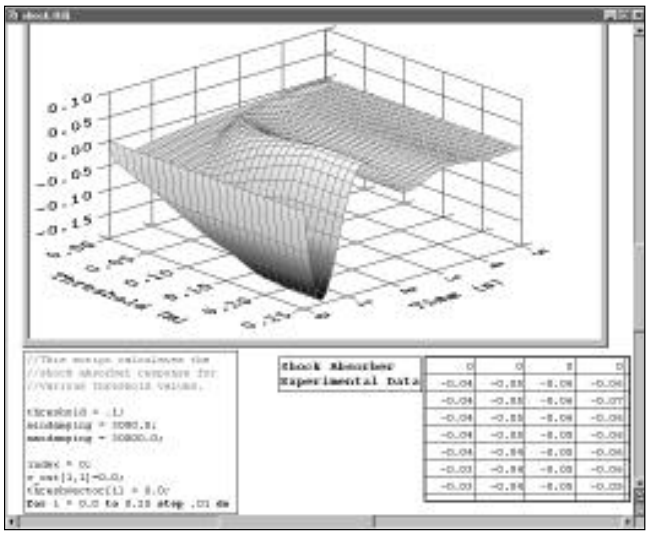
"We use LabVIEW and HiQ to gather our data and convert it to useful information. The analysis and visualization capabilities of HiQ help us transform our data into knowledge."
– Barrie Drain,
Revolve Technologies Inc.

Analyzing Your Data

Data analysis can be as simple as a calculation of a statistical mean or as sophisticated as modeling and simulating a nonlinear dynamic system. Regardless of the complexity of your analysis, your tools should remain simple and easy to use so that you can focus on what is important – your results.

The new release of HiQ 3.0 for Windows 95/NT provides analysis tools beyond the traditional set of built-in math algorithms. You not only have access to the many built-in analysis functions but also have the power to create your own functions and programs using the HiQ-Script programming environment. Any HiQ-Scripts you create can use the existing functions within HiQ and can be used by other scripts in the future.

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The powerful analysis and visualization capabilities of HiQ combine to produce an interactive solution for simulating and modeling a nonlinear dynamic system.

However, you can perform much of your analysis and visualization in HiQ without programming at all.

Visualizing Your Data

Analysis of your data includes more than just number crunching. It is often more meaningful to analyze your data visually. The 2D and 3D graphical visualization tools in HiQ provide an interactive means of viewing your data. Using these tools, you can interact with your data with features such as panning, zooming, and rotating. You can even create multiple plots, plane projections, color maps, lighting, shading, animation, and transparency. Drain notes, "Spatial relationships are difficult to visualize and even tougher to explain. Through the use of the HiQ 3D color spectrum visualization, we can express the four dimensions of position and speed easily."

The graphical technology of HiQ is based on the advanced OpenGL standard established by Microsoft and Silicon Graphics. By using this technology, HiQ benefits from years of advanced graphical technology. We, in turn, can provide this powerful rendering engine to our customers. Using HiQ 3.0, you can now graphically render data sets that were previously only possible on high-powered workstation computers.

Generating Your Technical Report

With HiQ 3.0, analyzing your data and preparing your technical report are no longer two separate tasks. In HiQ, you are creating your technical report as you perform your analysis. The interactive document that you create serves as the interface to your technical application and the high-quality, hard copy document. So, if you want to change your analysis later, your report automatically changes as well.

Leveraging Microsoft Office

Annotating your document is easy in HiQ using the newly supported ActiveX technology available in HiQ 3.0. While creating your HiQ analysis, you can embed other ActiveX objects, such as Microsoft Word, Excel, and PowerPoint, into your HiQ document. These embedded objects are active components that you can edit directly within the HiQ environment. This ActiveX capability means you can leverage what you already know about other software tools. For example, if you are already familiar with Microsoft Word and Excel, you can embed these components into your HiQ document to make technical calculations, presentations, and reports more informative and intuitive.



This rotating globe, which also appears on our web page, was created using HiQ 3.0.

HiQ – the Modern Data Visualization Package

HiQ 3.0 uses many advanced technologies to provide a powerful data visualization and report-generation environment to the world of instrumentation. These technologies include interactive OpenGL 3D visualization, Microsoft's ActiveX technology, and full support for Microsoft's 32-bit multitasking operating systems. HiQ uses these technologies to provide a fully interactive environment – an environment where you can run your analysis programs while simultaneously editing your graphs and text.

HiQ easily integrates with Microsoft Excel, LabVIEW, and LabWindows/CVI, giving users of these software tools some of the most advanced tools for data visualization and report generation.

As a leading developer of technical software products, National Instruments is committed to your success with HiQ. Just as we have evolved the development and vision of products such as LabVIEW and LabWindows/CVI, we will continue to improve the HiQ environment for you.

HiQ 3.0 is available now to solve your analysis, data visualization, and report generation needs. After an extensive and successful beta testing program with HiQ 3.0, we at National Instruments would like to thank the thousands of registered HiQ 3.0 beta users that assisted in the direction of this product.

– Greg Wells, Market Development Manager

For more information on HiQ, circle this option on the reply card. To see HiQ, download a demo version from our web site at www.natinst.com/HiQ. You can also order HiQ directly from our web page!

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In-Vehicle Testing for Saturn Using ComponentWorks™ and SCXI

by Dave Robins, President, Intrepid Control Systems, Inc.

The Challenge: Measuring numerous parameters within a moving automobile with a system that is cost-effective, efficient, and easy to use.

The Solution: Building a comprehensive PC-based virtual instrumentation system using SCXI signal conditioning and acquisition, custom circuitry, and ComponentWorks software.

With its team-oriented mind-set, Saturn Corporation partnered with Intrepid Control Systems, a National Instruments Alliance Program member, to help them fulfill their demanding needs for in-vehicle data acquisition. Their DAQ system needs to perform low-speed analog measurements of temperatures, pressures, vehicle parameters, frequencies, and duty-cycle.

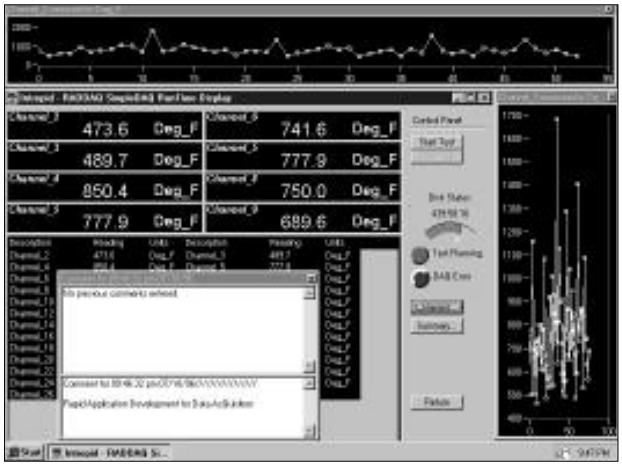
ComponentWorks and Windows 95 offer new possibilities for virtual instrumentation. These technologies can be used to build applications that are more efficient, more organized, and more capable of meeting data acquisition challenges.

We built a comprehensive test system for Saturn that included SCXI signal conditioning and acquisition and custom microprocessor measurement circuits controlled by ComponentWorks and Visual Basic under Windows 95. The resulting system was more cost-effective, more efficient, and easier to use than any other systems that Saturn has previously used.

Tightly Integrated Hardware

Because of its relatively low cost, small size, flexibility, and customizability, SCXI was the best choice for collecting the analog measurements. Compared to other signal conditioning methods considered, SCXI was an extremely cost-effective choice for the large number of measurements required. Because it was an in-vehicle application where only DC power was available, we used a SCXI-1000DC chassis.

To digitize our signals, we used the SCXI-1200 DAQ module, which interfaces to the PC parallel port. We found the parallel port transfer to be most convenient because it was useful for either desktop or laptop computers. It is a clean solution to have everything packaged neatly in the small four-slot SCXI chassis. We used the SCXI-1100 for 32 high-level transducer measurements and the SCXI-1102 for 32 thermocouple measurements. The SCXI-1303 and SCXI-1300 terminal blocks were used with the SCXI-1102 and SCXI-1100 modules, respectively. The SCXI-1303 is particularly convenient for the thermocouples because of the isothermal block and the input bias current resistors.



The software takes advantage of the Windows 95 nonpreemptive operating system. By dividing the data acquisition into two programs, one a user interface program and the other handling data collection, continuous data acquisition operations are managed more efficiently.

In response to special Saturn requirements, we chose to build a custom microcontroller-based circuit to measure two frequencies and the duty cycle. The microcontroller makes the measurements and outputs results to a digital to analog converter. These analog voltages are then sampled by the SCXI-1100 module. To make the system seamless, the custom circuit is built into an SCXI-1181 prototyping module. Now, this circuit plugs into the SCXI chassis like any other off-the-shelf module.

Advanced Software Techniques

The software end of the system was built with ComponentWorks and Visual Basic 4.0 under Windows 95. Our primary goal was to make the software hassle free. Saturn wanted their engineers to expend effort solving automotive problems, not measurement problems. To achieve this goal, we stretched the user-interface capabilities in Visual Basic to the limit. This was done by capitalizing on the Visual Basic user-interface features, such as drag and drop and unique mouse response. For example, when the user double clicks on a digital display, a floating resizable strip chart appears for that measurement.

ComponentWorks makes the data acquisition and the strip charting almost effortless. We simply point and click the data acquisition setup though familiar Windows 95 property sheets. The ComponentWorks analog input control is simple to set up for SCXI; just enter the channel strings and the sample rate and you are off and running. A Visual Basic event was generated every second with an array of measurements for the software to calibrate and send off to disk. Also, the ComponentWorks graph is very powerful without any software effort.

The software has features you expect from a general-purpose DAQ system, including linear and thermocouple scaling, SCV data files, statistical summaries, run-time comment files, analysis package header file generation, run-time configurable strip charts, and user-configurable test setups.

For more information, contact Dave Robins, Intrepid Control Systems, Inc., 14536 Four Lakes Drive, Sterling Heights, MI 48313, tel (810) 247-1050, fax (810) 247-1088, e-mail raddaq@aol.com.

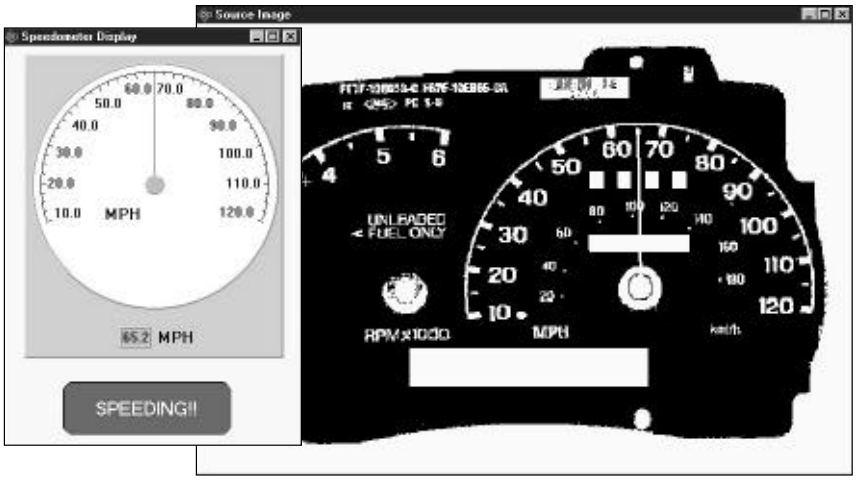
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IMAQ Vision Available for LabWindows/CVI

Driven by several converging technologies, machine vision and image processing applications are now possible with your desktop computer. Now, LabWindows/CVI users can join LabVIEW users in developing sophisticated, PC-based imaging applications with IMAQ products.

The bandwidth of the PCI bus plus the throughput power of the MITE DMA controller found on the IMAQ PCI-1408 image acquisition board give sustained data transfer rates of 100 Mbytes/s; the result is real-time display of 30 frames/s. In addition, IMAQ Vision software for LabWindows/CVI delivers the image processing tools for end-users, OEMs, and systems integrators to solve a wide range of machine vision, medical imaging, and image analysis applications. This software provides a general-purpose scientific and 32-bit machine vision for LabWindows/CVI using Windows 95 and Windows NT. It includes an extensive set of optimized functions for image processing, morphology, pattern matching, blob analysis, and gauging. Plus, IMAQ Vision includes an extensive library of functions for display and integrating with the image in an image window.

By integrating IMAQ Vision with DAQ hardware and LabWindows/CVI, machine vision applications can move beyond go/no-go decisions to provide process monitoring, information gathering, and feedback control to correct factory floor problems on the fly.



LabWindows/CVI users can now join LabVIEW users in developing sophisticated, PC-based imaging applications with IMAQ vision products.

IMAQ Vision and the new IMAQ PCI-1408 image acquisition hardware fill the needs of many industrial automation, scientific, and medical applications, particularly applications that include electronics, semiconductors, and parts inspection. Specific applications include part inspection, robot guidance, bottle/can inspection, product position inspection, packaging control, pharmaceuticals inspection, PCB inspection, component inspection, and motion detection.

An example of a machine vision application that uses IMAQ products is calibrating dashboard speedometer and revolutions per minute (RPM) gauges. The manufacturer of the dashboard panel meters and dial gauges needs to quickly and accurately calibrate the pointer or needle positions scaled to the dial face of the speedometer or RPM gauge. IMAQ Vision for LabWindows/CVI provides a custom graphical user interface (GUI) to simplify testing and setup. Within the curved region of the speedometer, the user fits a line to the pointer or needle to determine the calibration accuracy. The result is high-speed pointer measurements used to test speedometer accuracy, provide offsets for automated calibration, and test response time and jitter of the needle.

For an IMAQ kit, circle this option on the reply card.

LabWindows/CVI Run-Time Libraries Available for HP-UX

HP-UX users can now add LabWindows/CVI to their list of virtual instrumentation software tools. Using the Run-Time Libraries for HP-UX, you can now port your Windows and Sun LabWindows/CVI programs to powerful HP-700 Series workstations.

The Run-Time Libraries for HP-UX are standard shared libraries that you can use with any ANSI C compiler compatible with the shared library format, such as the HP-UX CC and GCC compilers. You can build or port existing programs that use the LabWindows/CVI User Interface, TCP, Utility, GPIB, RS-232, and VISA libraries as well as in-strument drivers.

Organizations using HP workstations as their production test controller can use cost-efficient, Windows PCs for desktop development. They can then move these test programs to the powerful HP PA-RISC architecture for lightning-fast response with high-performance graphics.

The addition of the LabWindows/CVI Run-Time libraries provides test organizations with a wider selection of controllers and options for long-term test development. The LabWindows/CVI Instrument Driver Library now contains more than 600 drivers for instruments from more than 65 different vendors. The driver libraries include C source code, so you can easily modify the instrument drivers to optimize or extend their capabilities within test systems. The entire library of instrument drivers is available for HP-UX as a key building block for any rack-and-stack test system.

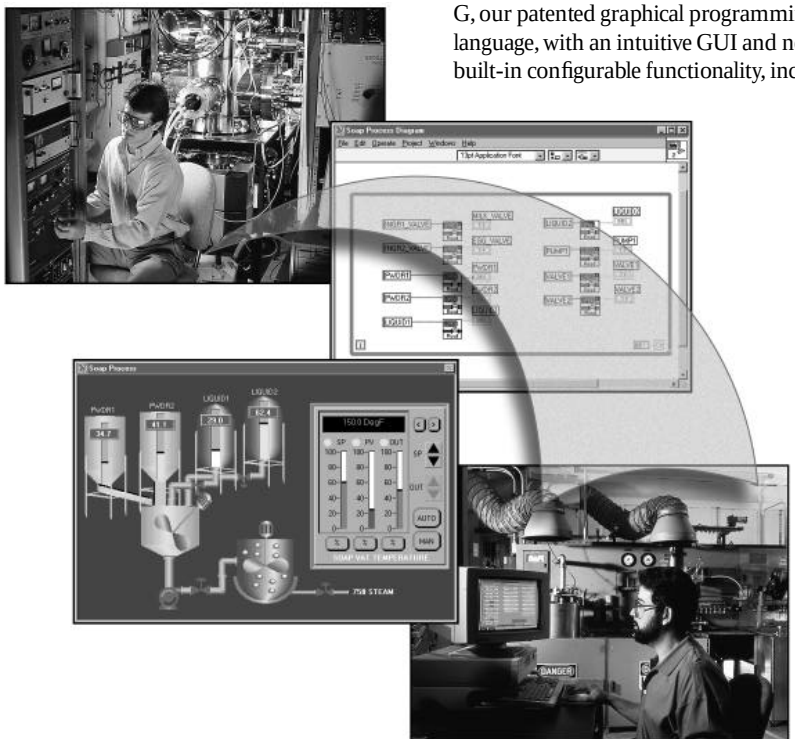
For a LabWindows/CVI brochure, circle this option on the reply card.

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Special BridgeVIEW Offer for Current LabVIEW Users

If you are currently using LabVIEW, the industry-leading graphical programming software, you already know the benefits it offers over more traditional software development tools. Since LabVIEW was introduced 10 years ago, engineers, scientists, technicians, and researchers have developed millions of applications ranging from research to production testing.

Now, with BridgeVIEW, it is easier than ever to use graphical programming to develop applications for process monitoring, process control, and factory automation. BridgeVIEW combines the power of G, our patented graphical programming language, with an intuitive GUI and new built-in configurable functionality, including a real-time database, historical trending, event logging, system security, and industrial device connectivity.



BridgeVIEW can help you solve your diverse automation challenges, shorten your development times, and make you more productive. You can easily migrate graphical software developed with LabVIEW to a BridgeVIEW system.

National Instruments would like to make a special offer to all LabVIEW users. For a limited time, LabVIEW users can purchase BridgeVIEW at a special introductory price. Note that this is not an upgrade of your existing LabVIEW Development System software.

The BridgeVIEW Special Offer for LabVIEW includes the BridgeVIEW Development System software on CD. During this limited time, LabVIEW customers can purchase a copy of the BridgeVIEW Development System at a reduced price. This special offer expires July 31, 1997. LabVIEW users must furnish their product serial number to verify that they own a valid copy of LabVIEW.

Your success is important to us! For the tools you need, contact your local National Instruments sales office for pricing and ordering information.

For more information on this special offer, call (512) 794-0100 or your local branch office.

LabVIEW Available on Concurrent Computer's Real-Time Systems

LabVIEW is now available for all of Concurrent Computer Corporation's real-time computer systems, including the newly released PowerStack™ and PowerMAXION™ as well as Night Hawk™ and Power Hawk™ systems. Concurrent Computer Corporation is a leading provider of high-performance, real-time computer systems, solutions, and software for commercial and government markets.

LabVIEW software for Concurrent's systems consists of the standard LabVIEW Development System, advanced analysis libraries, code interface tools, TCP/IP, and serial I/O. Scientists and engineers working on Concurrent's real-time systems can use LabVIEW software as a development tool for hardware-in-the-loop simulation projects, product testing, process control, and supervisory control and data acquisition (SCADA) projects. Concurrent has also integrated LabVIEW with a real-time database for large SCADA process control and data acquisition projects.

In addition, Concurrent has integrated LabVIEW as part of its Integrated Data Acquisition and Control System (IDACS). IDACS is a real-time computing platform (such as the PowerStack, PowerMAXION, Power Hawk, or Night Hawk) and software tools (such as Concurrent's PowerWorks environment and LabVIEW) integrated with several leading modeling and simulation tools for product and process development. IDACS delivers a complete multivendor solution that helps manufacturers reduce their product's time to market.

All Concurrent hardware platforms incorporate PowerMAX OS™, a Unix-based, SVR4.2, real-time operating system. PowerMAX OS is POSIX, SVID, and XPG3-compliant. The Power Stack, Power Hawk, PowerMAXION, and Night Hawk are compatible with VME64, PCI, and VXI bus interfaces. Users can arrange these systems in multibus configuration for large I/O count projects to give LabVIEW complete access to all I/O.

For more information, circle LabVIEW brochure.

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ComponentWorks 1.1 Delivers Full ActiveDAQ™ and Internet Tools

ComponentWorks 1.1 delivers a complete set of ActiveX controls for building more advanced DAQ systems in Visual Basic, Visual C++, or any other ActiveX-control container application.

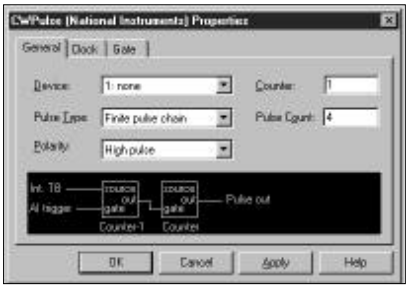
Introduced in early 1996, ComponentWorks 1.0 performs analog waveform acquisition in Visual Basic using an intuitive fill-in-the-blank property sheet approach for DAQ programming. As a complete set of 32-bit ActiveX controls, ComponentWorks is a key technology for building Internet-based virtual instruments. With ComponentWorks, you can download and execute complete virtual instruments applications over the web using Microsoft Internet Explorer. This technology was recently discussed at the Microsoft Site Builders Conference. Paul Maritz, Microsoft Vice President of Platforms, featured ComponentWorks in his keynote address. For more information, visit www.natinst.cworks.

The new version of ComponentWorks expands this easy-to-use programming model to include more advanced DAQ operations, such as counter/timer measurements, pulse generation, and analog waveform generation. ComponentWorks 1.1 also includes an enhanced user interface and an easier-to-use analysis library.

The new DAQ ActiveX controls in ComponentWorks 1.1, known as ActiveDAQ controls, reduce complex DAQ operations to simple property sheets, events, and methods. For example, the Counter/Timer Measurement control has a simple property sheet from which you can select a variety of measurements, such as event counting, frequency measurement, period measurement, and so on. ComponentWorks 1.1 features the following new controls and enhancements:

DAQ

- Analog waveform output control
- Digital waveform I/O control
- Counter/Timer control
  - – Event-counting, frequency measurement, and period measurement
- Pulse generator control
  - – Single-shot, continuous, frequency shift
- Single-point analog input



ComponentWorks 1.1 improvements include more advanced DAQ operations, an enhanced user interface, and an easier-to-use analysis library.

User Interface

- Numeric edit control
- Time value labels on graph axes

Analysis

Variant data type added for compatibility with Visual C++, Delphi, and Internet Explorer.

For a ComponentWorks brochure, circle this option on the reply card.

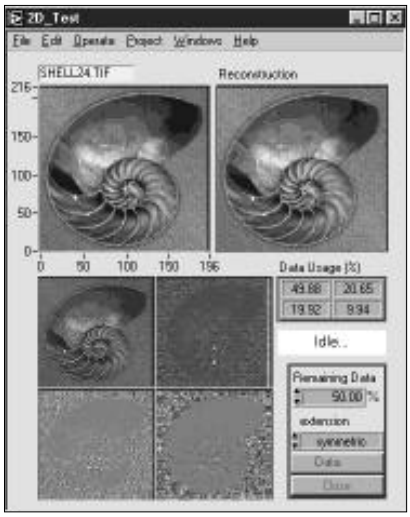
Wavelets Offered for LabVIEW and LabWindows/CVI

Wavelets are changing how engineers process signals. In many cases, a wavelet transform outperforms the conventional Fast Fourier Transform (FFT) in applications that require speed, feature extraction, and noise reduction. With the new Wavelet and Filter Bank Design software, you can use wavelets as well as filter banks in many application areas, including data compression, pattern recognition, and edge detection. This software includes an application for interactively designing wavelets.

This multipurpose package for wavelet and filter bank design and analysis works with LabVIEW, BridgeVIEW, LabWindows/CVI, and C. The package includes Wavelet VIs, LabWindows/CVI function panels; plus, C source code examples so you can implement wavelets in your custom application in Windows.

Wavelets have applications in many diverse applications. You can use them to:

- Compress signal and image data with virtually no degradation of data



Wavelet techniques deliver added insight and performance in data analysis areas where Fourier techniques have previously been used.

- Discover trends in noisy data
- Extract features for use in classification and pattern recognition applications
- Restore noise signals and images

Wavelet methods provide powerful tools for analyzing, encoding, compressing, reconstructing, and modeling signals and images. For example, performing wavelet analysis in geophysical applications has resulted in signals compressed by as much as 100 times with no loss of significant frequency and time data. Compare this reduction to JPEG, which may achieve only a five-to-one compression with a loss of information. Overall, wavelet techniques deliver added insight and performance in data analysis areas where Fourier techniques have previously been used.

For a Wavelet and Filter Bank Design software flyer, circle this option on the reply card.

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