DC and Waveform Generation Analog Output for PCI and CompactPCI

Two new families of National Instruments data acquisition products increase the update rate and resolution for analog output applications. The 6711 and 6713 families are available for PCI and PXI/CompactPCI computers, offering 12-bit analog outputs that perform waveform generation at rates up to 1 MS/s. The 6704 family is also available for PCI computers and offers 16-bit voltage and current outputs.

1 MS/s Waveform Generation

The 6711 and 6713 families are 12-bit analog output boards with 4 or 8 channels, respectively. Each board can perform waveform generation at up to 1 MS/s per channel. In addition, each device features 8 digital I/O lines; two 24-bit, 20 MHz counter/timers; and digital triggering capabilities. Each device uses the PCI MITE ASIC and deep onboard FIFOS to achieve seamless waveform outputs up to 1 MS/s. You can control the update rate with an onboard timer or supply your own external update signal.

High-Resolution DC Analog Output

The PCI-6704 is a high-resolution voltage and current output device. With this board, you get 32 independent analog outputs. Of these, 16 outputs are voltage sources with a bipolar output range of ±10 V. The remaining 16 outputs are 0 to 20 mA current sources.

For more information on the 6704, 6711, and 6713 families of DAQ boards, go to www.natinst.com/info/news to view detailed data sheets.

Visit www.natinst.com/daq

New Timing ASIC in Latest Counter/Timer Boards

Advanced timing and synchronization capabilities are a fundamental technology for measurement and automation solutions. National Instruments developed the NI-TIO™ ASIC to improve performance for timing and counting applications. This new ASIC is an integral component of the PCI-6602 and PXI-6602, both of which deliver eight high-performance, 32-bit counter/timers.

New Timing I/O Features

Each of the eight 32-bit counters on 6602 devices has a gate, up/down, and source input that can be controlled by external or internal timing signals. In addition, each counter has one output that can be routed externally or internally to other counters. Each counter can accept source inputs up to 80 MHz – a 4 x performance improvement over our DAQ-STC counter/timers. In addition, you can enable prescalers on the 6602 devices to increase the maximum source frequency to 125 MHz.

With 6602 devices, you can set each input to pass through a digital debouncing filter to eliminate glitches on the input signal. You can choose from four software selectable filter settings to determine the cut-off frequency or use another counter to generate a custom cut-off frequency.

Each counter/timer also features the necessary conditioning for direct connection to quadrature encoders, making 6602 devices an economical choice for motion encoder measurements. The software-selectable filters described above are ideal for noisy encoders. The 6602 devices also perform Z-indexing for precision encoder measurements. Finally, 6602 devices feature eight dedicated digital I/O lines, as well as 24 shared digital I/O lines. Any of the unused 24 counter/timer lines can be configured individually as software input or output digital lines for up to 32 total digital inputs and outputs.

Buffered Counter/Timer Operations

In conjunction with the new 6602 family, our NI-DAQ driver software now performs continuous double-buffered counter operations. The 6602 family includes our PCI MITE ASIC for three channels of bus-master DMA transfers that deliver flawless high-speed transfers directly to PC memory. Now, buffered counter operations follow the same architecture as our analog input products and can be easily synchronized across multiple devices for precision-timed measurement systems.

6602 Family Specifications

Counter/Timers	8
Resolution	32 bits
Max Source Frequency	80 MHz (125 MHz with prescalers*)
Compatibility	TTL/CMOS
Digital I/O	Up to 32
Pulse Generation	✓
Buffered Operations	✓

Solve New Applications

With the new hardware and software features of the 6602 family, you can solve a wide variety of counting and timing applications, including:

- Pulse and pulse-train generation
- Single and buffered parameter measurement
- Frequency shift keying
- Two-signal edge separation measurement

For more information on the 6602 family, go to www.natinst.com/info/news to view detailed data sheets.

Visit www.natinst.com/daq

The First Portable CompactPCI Computer

The PXI-1025 MegaPAC is the world's first completely integrated portable computer, based on CompactPCI and PXI specifications. The MegaPAC brings a higher level of modularity, ruggedness, and capability to portable computing and instrumentation. National Instruments developed the PXI-1025 MegaPAC in conjunction with Dolch Computer Systems to combine the rugged modular architecture of CompactPCI and the instrumentation extensions of PXI with a proven portable platform that integrates a flat-panel LCD, keyboard, pointing device, and CD-ROM drive.

The PXI-1025 MegaPAC works with the new PXI-8150B Series of embedded controllers, which are available with processors up to 333 MHz and integrate all standard computer functions. The PXI-8150B Series controllers also provide an integrated interface for controlling the flat panel display, keyboard, pointing device, and CD-ROM of the MegaPAC. The PXI-1025 MegaPAC comes with either a 300 Watt universal AC input power supply or a special combination power supply that can accept 10 to 32 V of DC power and/or 85-265 V of AC power. The DC input power supply is also available with a battery back-up option that acts as an uninterrupted power supply.

Unlike other portable computers that use desktop PC mechanics, the PXI-1025 uses the well-defined, rugged Eurocard construction. This construction was specifically developed for demanding industrial applications and its ruggedness has been proven over decades of use. Controller and peripheral modules can be removed and replaced easily and quickly without having to remove covers. By incorporating PXI specifications, the PXI-1025 MegaPAC offers integrated timing and triggering capabilities not available on traditional desktop PC-based systems.

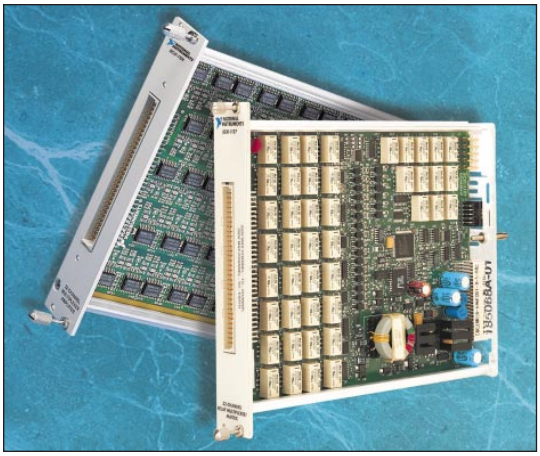
The MegaPAC is ideal for field test applications such as in-vehicle instrumentation, portable telecommunications test, transportation system monitoring, and field data acquisition. Using the wide variety of PXI and CompactPCI plug-in modules available from numerous vendors worldwide, the PXI-1025 can be customized to meet the specific demands of each application. National Instruments supplies over 30 different data acquisition, instrumentation, motion control, image acquisition, bus interface, and industrial communications modules for PXI and CompactPCI.

For more information on PXI-1025 MegaPAC, visit the 1999 online catalog to view the data sheet.

Visit www.natinst.com/pxi

New SCXI™-1127 Module Offers New Application Solutions

National Instruments is pleased to introduce the SCXI-1127, a high-voltage multiplexer/matrix module. This unique product offers exciting new application solutions for low-cost, low-speed data acquisition systems, signal routing, and system control.



Data Acquisition Systems

The SCXI-1127 can operate as a 64-channel multiplexing module for digital multimeters. The power of a digital multimeter rests in its ability to measure a variety of signal types, including thermocouples, RTDs (with current excitation provided by the DMM), low-voltage signals, and high-voltage signals. The SCXI-1127 leverages this power by expanding DMM channel count. Because the SCXI-1127 uses high-voltage armature relays with low thermal noise, you can measure test signals accurately, regardless of their amplitude. With a scanning DMM, you can acquire data at rates of up to 100 Hz. This rate provides low-speed data acquisition solutions for customers measuring a variety of signal types.

Signal Routing

The SCXI-1127 can also operate as a matrix. As a matrix, the SCXI-1127 converts its 64 I/O lines into a matrix of 8 columns and 4 rows of 2-wire signal conductors. By programmatically closing relays in the module, a user can connect any row(s) to any column(s). In typical matrix applications, test signals connect to the columns and test instruments connect to the rows. With this setup, particular test signals can be routed to multiple instruments without having to reconnect signals, reducing test time and increasing productivity.

For more information on SCXI-1127, go to www.natinst.com/info/news to view the data sheet.

Visit www.natinst.com/scxi

Encoder Quality Testing Using NI 5102 and LabVIEW

by Jonathan Robertson, Electrical Engineer, Caron Engineering, Inc.

The Challenge: Automatically quantifying and documenting the quality of an encoder on a servo motor at final assembly.
The Solution: Building an automated PC-based system using three NI 5102 plug-in oscilloscopes for PCI synchronized over the RTSI bus and controlled with LabVIEW.

When Inductive Components, Inc., identified the need to quantify and document the quality of encoders built into servo motors they manufacture, they asked Caron Engineering, Inc., to develop an automated test stand for testing a servo motor assembly. Ideally, the operator would simply wire up the servo and select the motor/encoder combination to be tested. This procedure would check for the correct motor and then determine the quality of encoder channels A, B, the index pulse, and all their complements (a total of six channels), if applicable.

Hardware

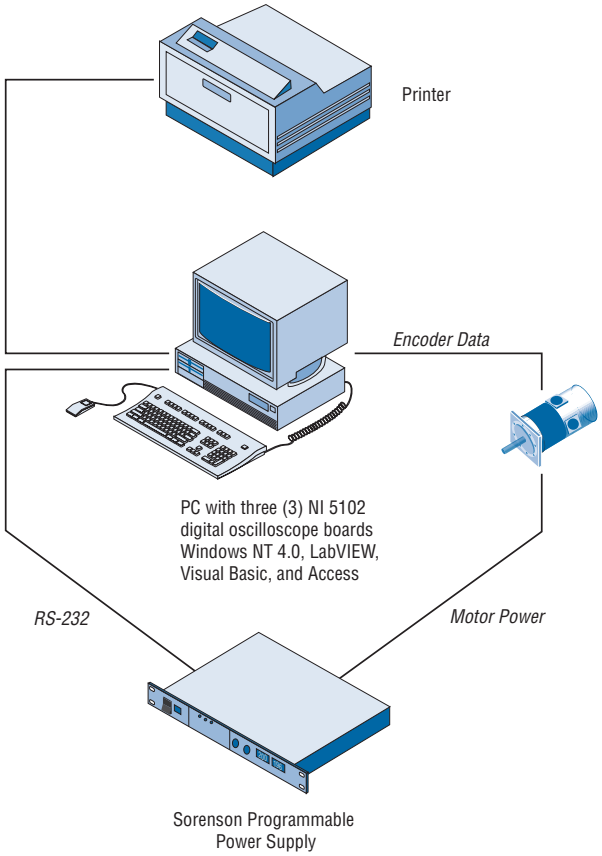
We selected the NI 5102 computer-based oscilloscope for its speed, its ability to be synchronized with other NI 5102 instruments by a common trigger, and its ease of integration with LabVIEW. We selected the Sorensen programmable power supply for its power (1,000 W at 80 VDC) and the ability to set and verify precise voltage levels and current limits via RS-232 from the PC. We used a 166 MHz Pentium PC running Windows NT.

The Process

The test stand runs the motor and tests the encoder at K_e , the "motor voltage constant." K_e for a particular DC motor is the voltage that produces a speed of 1,000 rpm. This test is used to verify that the correct unit is being tested and that the direction of motion is correct. The index pulse is used to determine actual speed of the motor. If the measured speed is 1,000 rpm, then the specified K_e matches the motor being tested. Encoder system quality is checked at 1,000 rpm. The obvious parameters are counts per revolution, amplitude, and duty cycle of each channel. Less obvious parameters that require testing are the phase jitter of the rising and falling edges of channel A, channel B, and between channels A and B. Alignment of the index pulse to channel A and its width is also critical for homing sequences of servo systems.

Software Integration

Regarding the total system integration, the initial user interface is a Visual Basic (VB) application where the user selects a motor/encoder assembly from an Access database, assigns a serial number, and begins the test. The VB application sets the voltage and current limit on the power supply. When a steady-state condition has been reached, key parameters, (such as K_e, and encoder line count) are passed via dynamic data exchange (DDE) to LabVIEW. LabVIEW then checks speed via the index pulse and executes the test. Applicable parameters are passed back to VB, where a pass/fail decision is made. The operator is alerted; the appropriate label/documentation can be printed; and the process is ready to begin again.



System layout for Encoder Quality testing.

As a testament to their quality, National Instruments products can successfully collect and analyze large amounts of data with the required synchronization in a timely manner.

Conclusion

The excellent results from our automated test stand have been manually verified in a number of ways. With the NI 5102 scope boards and LabVIEW, we can accurately test the quality of any given encoder as an assembled component of a servo motor. The ability to collect and analyze the sheer amount of data with the required synchronization in a timely manner on a PC is a testament to the quality of National Instruments products. The ability to transfer data via DDE (or any other method of data transfer) to LabVIEW gives us the capability to use any user interface, database, and power supply we choose, increasing the portability of this system to other applications as well as reducing development time and costs.

For more information, contact Jonathan Robertson, Caron Engineering, Inc.
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e-mail jrobertson@caron-eng.com

Visit www.natinst.com

First Embedded Pentium II VXI Controller Is Announced

Recently, National Instruments announced the world's fastest embedded VXI controller, the Pentium II-powered VXIpc™-870 Series. Combining National Instruments ASIC interface technology with the 450 MHz Intel Pentium II processor, the VXIpc-870 Series achieves unprecedented levels of PC and VXI performance. The VXIpc-870/450 not only exceeds the performance of the 200 MHz Pentium Pro VXIpc-860/200 – previously the fastest embedded controller – but also offers a new class of embedded computer performance by incorporating the latest PC advancements into its design. Moreover, the VXIpc-870 Series is available at less than 40 percent of the price of the VXIpc-860/200.

The VXIpc-870/450 delivers more than twice the overall performance of the VXIpc-860/200. The Intel Pentium II features a true 32-bit internal architecture, MMX technology, 16K/16K non-blocking level 1 cache, and an integrated 512 level 2 cache.

The chart illustrates the performance of the processors used on the VXIpc-800 Series embedded controllers. For the purpose of comparison, the performance of the 233 and 166 MHz Intel Pentium MMX, as well as the 200 MHz Pentium Pro, are also shown. These processors were featured on National Instruments VXIpc-850 and VXIpc-860 controllers.

The ICOMP index provides a relative measure of microprocessor performance. The chart is not a benchmark, but instead a collection of benchmarks used to calculate an index of relative processor performance. The chart is intended to help end users decide which Intel microprocessor best meets their needs.

All VXIpc-870 Models Feature:

- Ultra DMA 33 EIDE interface to storage devices
- 3.5 in. Floppy Drive
- Ultra Wide SCSI-3
- HS488 compatible GPIB port
- AGP Graphics
- 10/100 BaseT Ethernet
- USB
- PC CARD
- PS/2 keyboard and mouse
- Serial and Parallel ports
- 64 MB of SDRAM standard (192 MB maximum)

Superior VXI and GPIB Performance

All VXIpc-870 models feature MITE and TNT4882C™ custom ASICs, which deliver highly reliable, unmatched VXI and GPIB performance. Because VXIpc-870 controllers use the MITE ASIC with integrated DMA and VME64 capabilities, the controllers can achieve greater than 30 Mbytes/s VXI data transfer rates. Users can connect to GPIB instruments directly from the front panel of the VXIpc-870 to realize the fastest GPIB performance available today. The TNT4882C-backed GPIB port fully complies with the HS488 specification and can transfer data across GPIB at rates approaching 8 Mbytes/s.

About the VXIpc-870/450

The VXIpc-870 Series uses an innovative mechanical design, packaging Intel's highest performance Slot I microprocessors in a two-slot C-size unit. Because the VXIpc-870 Series is based on the Slot 1 architecture, future versions of the VXIpc-870 Series can be based on Intel's high-performance processor technology. The Slot 1 architecture also ensures that end-users can upgrade to the latest Intel technologies as soon as they are available – quickly and easily. The VXIpc-870 also employs Intel's latest Pentium II chipset technology, which provides a 100 MHz Front Side Bus and an Advanced Graphics Port (AGP) for high-performance graphics.

Choose Your Configuration

The VXIpc-870 is available in one of three different configurations. The first configuration, the VXIpc-871, includes all of the features mentioned above, but also adds an integrated 24X CDROM. The VXIpc-872 uses the same base model as the VXIpc-871, but offers one PCI/ISA expansion slot instead of a CDROM. The third option, the VXIpc-873, is targeted toward users that need solid state storage media for operation in harsh environments. The VXIpc-873 may be ordered with either an internal solid-state drive in place of the internal hard drive, or a removable solid-state drive that you can install and remove directly from the front panel.

The VXI*plug&play*-compliant VXIpc-870/450 comes with NI-VXI™/VISA and NI-488.2 installed and configured on the hard drive. Programs written using previous versions of the VXIpc-800 Series or any VXI*plug&play*-compliant controller run unmodified on the VXIpc-870/450. The VXIpc-870/450 may be ordered with either Windows 98 or Windows NT installed. VXIpc-870 Series are expected to ship to customers in the second quarter of 1999.

For more information on the VXIpc-870 Series, the world's fastest embedded VXI controller, go to www.natinst.com/vxi

Visit www.natinst.com/vxi

VXI 2.0 Specification Approved – New VME64 Doubles Throughput

On August 24, 1998, in Salt Lake City, Utah, the VXI Consortium approved Version 2.0 of the VXI-1 specification – the main system specification for the VXIbus. Version 2.0 significantly upgrades version 1.4, doubling data throughput and improving bus utilization while maintaining complete compatibility with the previous specification.

To increase data throughput, the VXI consortium incorporates key elements from the ANSI standard VME64 specification, which is the current standard for VME – the main bus specification from which VXI is based. VME64 increases the primary VXIbus data path from 32 bits to 64 bits, thereby boosting the overall VXIbus throughput from 40 Mbytes/s to 80 Mbytes/s.

The typical 32-bit read or write data transfer occurs in two phases: addressing the device and handshaking the data. During the address phase of a typical transfer, the data lines (DTB) are idle. Conversely, the address lines are idle during the data handshaking phase. To maximize the backplane resources, VME64 uses the address and data lines in tandem to expand the total address and data range to 64 bits – without needing additional backplane hardware. Because the VME64 standard requires no additional connector pins, VME64-capable devices can execute D64 transfers over existing VXI backplanes and can coexist in the same system without conflict. The slave device becomes aware of a D64 transfer by monitoring the same backplane signals as with traditional data transfers.

In the past, most VXI devices communicated using 16-bit register transfers for both message-based and register-based instruments. When performance dictated system requirements, VXI vendors responded by introducing more VXI instruments with D32 capability. Performance continues to be an important issue for VXI end-users; VXI vendors, in turn, have introduced products compatible with the VME64 specification. All of National Instruments MITE-based VXI controllers, such as the new embedded Pentium II VXIpc-800 Series, the new VXI-1394 controllers, and the MXI-2 VXI-PCI8000 Series, all have D64 capabilities built-in to take full advantage of new VXI 64-bit performance.

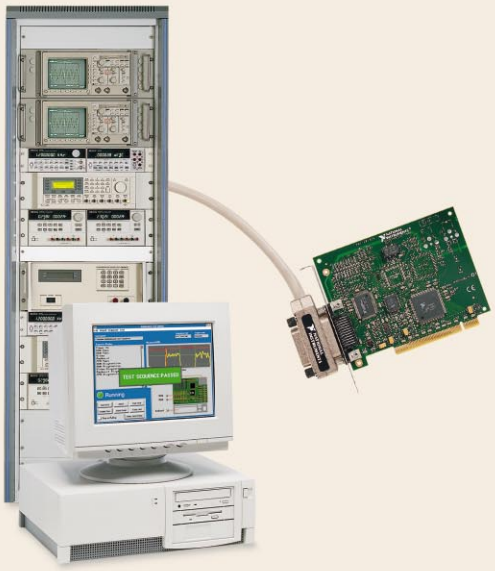
The adoption of the VXI 2.0 specification by the VXI consortium highlights the consortium members' commitment to the VXI standard. National Instruments also remains committed to VXI and continues to develop powerful and innovative VXI controllers and devices for measurement and automation.

For more information on the new VXI 2.0 specification, go to www.natinst.com/vxi

Visit www.natinst.com/vxi

Increase Your GPIB Performance

Performance is essential when building an automated measurement system. Increasing performance has clear implications for production test and GPIB-based data acquisition applications. The IEEE 488 (GPIB) bus serves as the backbone of many automated measurement systems. Thus, it makes sense to evaluate different options that can assist in increasing GPIB system performance. Test and R&D engineers continue to use GPIB because it is an easy-to-use, time-proven interface that offers the widest selection of measurement devices that you can incorporate into an automated measurement system. The application note, titled "Eight Ways to Increase GPIB Systems Performance," discusses eight options that can be used in harmony with GPIB to help increase system performance.



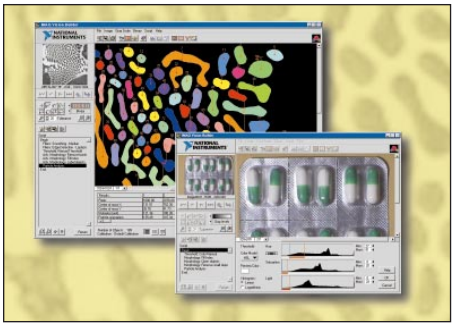
Eliminating Noise in GPIB Systems

When using rack-and-stack GPIB systems in production test or other noisy environments, eliminating the effects of noise is important for making reliable measurements. One way to eliminate noise is to use shielded GPIB cables to connect your GPIB controlled instruments to your PC. The application note, titled "Eliminate Noise in Your GPIB System," discusses sources of noise and cable specifications.

To view the GPIB application notes, go to www.natinst.com/info/news

Visit www.natinst.com/gpib

New IMAQ™ Vision Builder Accelerates Vision Software Development



Converging technologies, such as the PCI-bus and Intel MMX, have created so much bandwidth and computing power that engineers are beginning to consider PC-based vision a standard measurement and automation tool. Because of the newly available bandwidth and computing power, professionals who are controlling processes or making traditional temperature, pressure, and signal measurements are now expanding their capabilities to include machine vision. In the past, vision software solutions were relegated to a small number of vision experts. National Instruments created IMAQ Vision Builder to make vision simpler for experienced measurement and automation professionals looking to embrace vision as a new tool.

Vision Builder addresses the primary challenge a new vision developer faces when beginning a vision application – How do I use vision software to solve my application? In addition, Vision Builder appeals to the experienced vision developer because it addresses their greatest challenge – How can I reduce development time and cost?

Rapid Application Development Environment for Vision

The new National Instruments interactive vision software environment – IMAQ Vision Builder – combined with the IMAQ Vision software library and an application development environment, such as LabVIEW, BridgeVIEW, or Microsoft Visual Basic, are the foundation for a new approach to vision software development.

Overall, an interactive vision tool such as Vision Builder is a key component to rapidly developing an application. With IMAQ Vision Builder, you can: interactively test different vision functions with no programming; change an image processing control parameter and immediately visualize the resulting image; test your vision software strategy against a database of test images; and more.

Most machine vision beginners are overwhelmed by all of the slick algorithms from which they can select. With Vision Builder, you can interactively solve image enhancement, counting, sizing, gauging and measurement, color, and feature-finding applications for inspection, pharmaceutical, automotive, semiconductor, electronic, medical, and scientific applications.

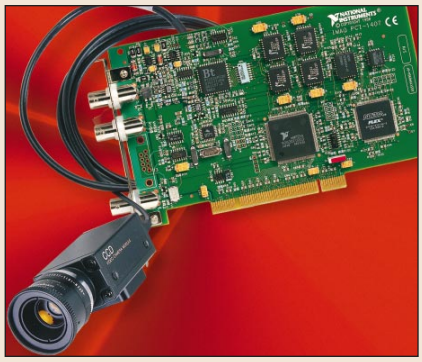
For experienced vision developers under pressure to reduce costs and time to market, Vision Builder can accelerate software development. For example, Data Science Automation, a National Instruments Alliance Program member, uses Vision Builder as a part of their vision application development process. The company uses Vision Builder to develop a piston O-ring application for an engine manufacturer.

A rapid application development approach for vision software development can save you and your company significant amounts of development time and cost. Vision Builder is a key time-saving development tool that can be used for rapid application development. With Vision Builder, you can cut overall development time by combining the time-consuming vision software strategy tests and experiments phase with the vision application development phase. Vision Builder offers a quick way for new measurement and automation professionals to learn how vision functions are used to solve applications. Plus, it offers experienced vision developers the capability of saving hours of development time in finding a solution.

For more information on Vision Builder, go to www.natinst.com/info/news to view the white paper or check this option on the reply card.

Visit www.natinst.com/imaq

New Low-Cost IMAQ Hardware



The new IMAQ PCI-1407 delivers high-quality solutions at an affordable price to vision developers.

For vision developers who are looking to reduce hardware costs, the IMAQ PCI-1407, an image acquisition plug-in board, offers a high-accuracy monochrome video input and an external trigger. Use the PCI-1407 with a single RS-170 or CCIR monochrome camera and acquire images at rates up to 30 frames/s.

The PCI-1407 has the following advanced speed-enhancing features: programmable region of interest, gain, and offset; onboard decimation; and lookup table processing. Using the programmable region of interest tools, you can configure the board to transfer only a subset of the image to PC memory for processing, resulting in fewer pixels to process. For example, a reduced image can increase processing speeds because it operates on 48 percent fewer pixels. The onboard decimation feature scales the image by removing every 2nd, 4th, or 8th pixel (powers of two only). Once again, by reducing the number of pixels (decimation) faster processing on the PC is possible. The programmable region of interest and decimation is performed on the IMAQ PCI-1407, resulting in no processing overhead on the PC.

For more information on IMAQ PCI-1407, go to www.natinst.com/imaq

Visit www.natinst.com/imaq

Streamline Prototyping Applications Using LabWindows/CVI

As plug-in technologies become more advanced, more and more measurement systems developers turn to their computers to perform data acquisition, replacing stand-alone instruments with plug-in boards. Thus, in the shift to computer-based measurement technologies, more emphasis is placed on software integration. Today, engineers spend less time dealing with hardware and more time prototyping, integrating, and deploying software. Many developers try to reduce programming time by using generic C++ compilers such as Microsoft Visual C++ and Borland C++. However, these compilers are designed to provide general-purpose tools to a wide variety of industries. Thus, simple measurement systems, such as a temperature monitoring system, often require more time and resources to develop.

The development process is multifold. First, you must test all the hardware in your system. Second, you must prototype and develop segments of the application to ensure functionality. Finally, you must piece your application together to derive the final product. Making the process more efficient in any one of these steps greatly reduces the cost of developing the measurement application. Out of the three-step process, developers can save the most time by streamlining the prototyping segment of their application development.

Incorporating measurement-specific tools into the design process greatly reduces the time spent testing and prototyping hardware I/O modules. LabWindows/CVI helps reduce development time by facilitating rapid application development.

With the LabWindows/CVI user interface (UI) editor and debugging tools, you can build even more complex prototypes. You do not need to use complicated graphics calls to build the UI; instead, use the drag-n-drop editor to build a UI that displays test data. LabWindows/CVI eliminates much of the coding process by generating skeleton code from your UI.

Because LabWindows/CVI is an ANSI C environment, you can bring all code and user interfaces developed during the prototyping stage into your generic C++ compiler to complete your application. This feature eliminates loss of time and resources. Thus, LabWindows/CVI saves development time and money.

To learn more about the benefits of LabWindows/CVI, go to www.natinst.com/cvi

Visit www.natinst.com/cvi

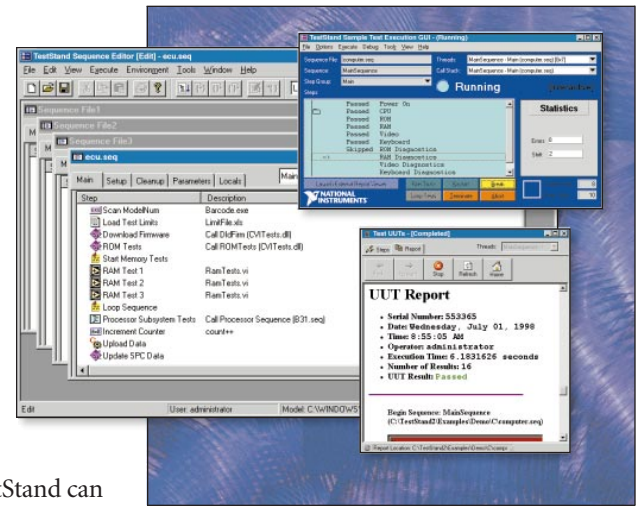
TestStand Designed for Speed and Flexibility

National Instruments recently introduced TestStand – the next generation test executive. TestStand is a speed-optimized, 32-bit test management environment that raises the bar for test executive performance. Capable of calling tests written in a variety of test languages, including LabVIEW, LabWindows/CVI, or any test compiled as a DLL or ActiveX automation server, TestStand provides unprecedented test development flexibility. With parallel sequence execution, automatic limit loading, flexible data sharing, database connectivity, and a fully customizable operator interface, TestStand is a high-performance solution for a wide variety of test applications.

Reduce Test Time

Many test applications require extremely fast test system execution. TestStand is designed for high-volume or high-complexity tests where speed and flexibility are paramount. TestStand includes a test execution engine specifically designed to execute test sequences with as little overhead as possible.

One measure of test executive performance is per-step overhead – the time the test executive takes to execute a single test step, not including the time to execute the test code itself. On a 266 MHz computer running Windows 95, TestStand can execute a DLL test step with as little as 0.3 milliseconds of overhead per step, almost 100 times faster than LabVIEW or LabWindows/CVI Test Executive Toolkits.



Low per-step overhead is not the only way in which TestStand can reduce test times. With powerful features, such as multithreading, flexible data sharing, and built-in database connectivity, the test engineer can develop test routines that make intelligent decisions during testing to optimize performance.

During testing, TestStand can use the provided Statistical Process Control (SPC) tools to monitor product yields and other statistics to determine whether certain tests should be run on every product, or just periodically. Finally, a TestStand sequence can take advantage of the built-in database components, which use the new ADO database standard from Microsoft for faster database access, to put results directly into any ODBC database.

To find out more about how TestStand can help lower test time, contact your local National Instruments representative or go to www.natinst.com/teststand

Visit www.natinst.com/teststand

Actuator Performance and Reliability Test System

by Chetan Kapoor, Chief Scientist and Seongho Kang, Research Assistant, Robotics Research Group, University of Texas at Austin

The Challenge: Automating the testing of electromechanical actuators in order to collect and analyze data regarding their performance, reliability and endurance.

The Solution: Using a dynamometer coupled with a brake and a load motor, along with a PXI industrial computer and LabVIEW software, for data collection, analysis, archiving, and display.

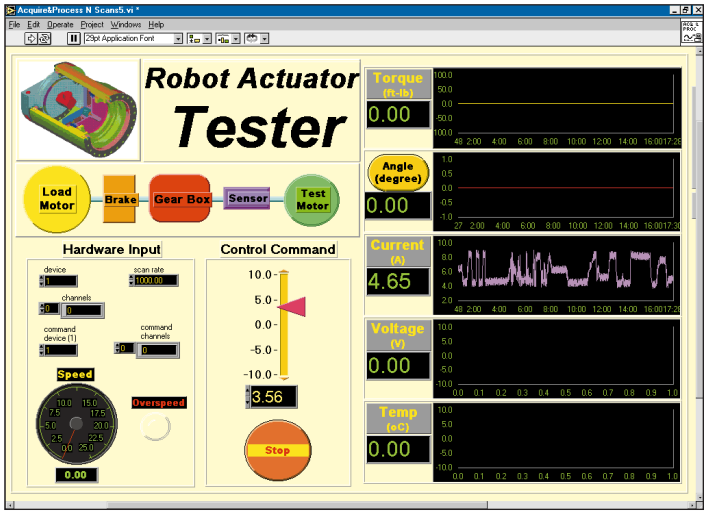
The primary focus of the Robotics Research Group of The University of Texas at Austin is the design and development of intelligent machines (primarily robotics), with emphasis on modularity, distributed control, performance, and condition-based maintenance.

The key building block of these machines is the standardized intelligent actuator, which is analogous to the microprocessor of the computer industry. These actuators are electromechanical systems that are comprised of motor, gear-train, brake, clutch, sensors (up to 10), embedded digital motion controller, and embedded control software. For these actuators to be successful, it is imperative that we characterize their endurance, reliability, and all other performance data. These specifications are necessary for better design of systems that use these actuators and also to develop control algorithms that can be used to enhance the performance of these actuators.

Two fundamental aspects that influenced the design of the testbed were support and instrumentation needs. First, the mechanical and electrical design must support the following:

- A load-motor that could be used to apply varying programmed loads on the test actuator (the dynamometer comes equipped with a brake that can apply only static loads)
- A design that allows the testing of actuators with different shapes, sizes, and capacities

Second, the actuator testbed includes instrumentation hardware and software for data gathering, analysis, and archiving. The Robotics Research Group used a National Instruments PXI industrial computer, DAQ boards, and LabVIEW software for data collection.



System Considerations

We had certain requirements for both the hardware and software used on the actuator testbed. Concerning hardware requirements, we used a PC-based operating system, a rugged platform, at least four expansion slots for interfacing hardware, and Ethernet connectivity. For data acquisition we needed at least four analog I/O channels and four digital I/O lines. We used a data acquisition card that reduced our development time.

Because of the excellent documentation and technical support provided by National Instruments, we were able to complete the project within budget.

Regarding software, we required a programming environment that supported data acquisition, graphing and charting, GUI, data archiving and analysis, and an ease of programming suitable for mechanical engineers.

The test system combines a PXI computer (PXI-1000 chassis with PXI-8156 controller) with a DAQ board (PXI-6040E with SCB-68 connector block), a dynamometer (vibrac TM1054), a dynamometer electronic controller, and servo-amplifiers that control the test motor and the load motor, which performs precise testing of the many types and sizes of robot actuators.

We chose to use LabVIEW for the testbed software development environment because it satisfied all of our requirements. We use LabVIEW data acquisition VIs for both analog input and output. The VIs gather actuator speed, torque, and temperature information and monitor voltage on the servo-amplifier modules to control the speed of the test actuator and load motor. Using LabVIEW, we also developed the graphical control panel of the testbed, which simplified experi-mentation. The GUI displays torque, speed, voltage, current, temperature values, hardware inputs, control commands, and load controls.

With PXI hardware, DAQ boards, and LabVIEW, we developed a fully automated robot actuator testbed. Because of the excellent documentation and technical support provided by National Instruments, we were able to complete the project within budget. Future work involves the development of software that support additional tests.

For more information, contact Chetan Kapoor, Ph.D., Mechanical Engineering, JJPRC/MER 1.206 A, Mail Code R9925, Austin, TX 78712-1100,
E-mail: chetan@mail.utexas.edu,
Web: www.robotics.utexas.edu/rrg

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National Instruments Offers Three New DAQ Application Notes

National Instruments now offers three new application notes. With "Tips and Techniques in DAQ Triggering" (341576A-01), you can learn how to set up a data acquisition system to start analog-to-digital conversions as soon as an external event (trigger) occurs. "Digital I/O Applications" (341631A-01) explains the different data transfer modes used in digital I/O applications so you can better select a device to meet your application needs. For information on how to use National Instruments PXI and DAQ hardware to develop easy-to-program systems that require precise synchronization and the timing of I/O functions, refer to "Advanced Synchronization Techniques for Data Acquisition" (341575A-01).

For your FREE copy, please contact National Instruments and request the application notes by title or part number.

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Design Your Own Data Acquisition System with DAQ Designer™ 99

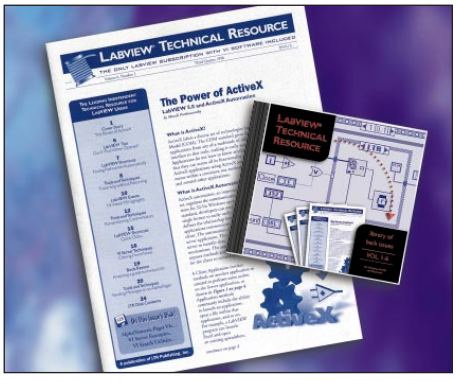
Use the new DAQ Designer 99 to interactively configure your custom measurement solution. After describing your application, DAQ Designer recommends PC-based hardware and software to use that best fits your specific needs. Use the recommended hardware and software to connect any signal to your PC, including data acquisition, signal conditioning, image acquisition, and other instruments. This free CD-ROM also recommends more than 50 new products and includes video product descriptions, tutorials, data sheets, application notes, and automatic product updates via the Web.

For more information about DAQ Designer 99, go to www.natinst.com/daq

LabVIEW Technical Resource Back Issue Upgrade Available

LabVIEW Technical Resource, the quarterly journal written by and for LabVIEW users and developers, recently released the 1999 upgrade to the library of back issues available on CD.

The LabVIEW Technical Resource Library of Back Issues CD Vol. 1-6 includes the contents of each of the 20 issues and resource disks published by LTR Publishing since its inception in 1993. Using an online LTR search Engine, you can easily browse through more than 150 articles and virtual instruments for specific topics about LabVIEW programming.



For more information, contact LTR Publishing, Inc. at 214-706-0587 or visit www.ltrpub.com to download a sample issue.

1999 Catalogue Available Online

The National Instruments 1999 Measurement and Automation Catalogue is now available online. The catalogue, which features more than 800 pages of industry-leading software and hardware products, can be accessed directly through our Web site at **www.natinst.com/catalog**

Check out the National Instruments catalogue online at www.natinst.com/catalog

Engineer of the Year Nominee

Scott Doerr, who used LabVIEW and BridgeVIEW based systems in conducting tests, has been nominated as Engineer of the Year for his contributions to the X-33 project and EM Pump testing. The X-33 project dealt with aerospike rocket engine control support and data acquisition.

Worth Reading

"Continuous Monitoring of Internal-Combustion Engines Using LabVIEW," by Alden Cramer and Greg Beshouri, User Solutions article, July 1998. **A1030-02**

"Designing a Virtual Sound-Level Meter in LabVIEW," by Dean Capone and Gerald Lauchle, User Solutions article, July 1998. **A1130A**

"Encoder Quality Testing Using NI 5102 Digital Oscilloscopes and LabVIEW," by Jonathan Robertson, User Solutions article, December 1998. **A1296**

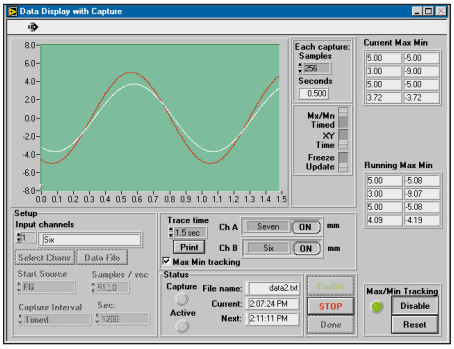
"Environmental Surveys for Electron Microscopes Using LabVIEW, " by John Sackett, User Solutions article, December 1998. **A1370**

"Measuring Internal Combustion Engine In-Cylinder Pressure with LabVIEW," by William Doggett, User Solutions article, November 1998. **A1574**

Servohydraulic Mechanical Test System

MTS Systems Corporation, an Alliance Program member, offers a National Instruments-based system for high-precision electromechanical and servohydraulic test applications. The MTS GPA, based on LabVIEW and National Instruments hardware, is a multichannel signal generator and data acquisition system that offers test profile generation and continuous or scheduled applications. The GPA provides multichannel output waveforms. You can set channels to have independent frequencies, synchronized phases, or a user-defined, non-cyclic waveshapes. Data acquisition options include a simple onscreen scope, continuous, timed acquisition, and flexible data capture based on time, cycle count, digital input, or amplitude of captured signals.

To ensure that all specimens experience identical loads and stresses, you can easily define and save multi-block profiles. With the user-defined waveform, you can repeatedly load waveforms that cannot be defined as simple sinusoidal or triangular waves. With the data acquisition options, you can monitor feedback signals



continuously and record and save test information to disk for reporting and comparing multiple specimen performance. Analog output provides external signal input to most controllers. Data capture is compatible with most high-level and low-level conditioned signals.

For more information, contact MTS Systems Corporation, 14000 Technology Drive, Eden Prairie, MN 55344, tel (612) 937-4632, fax (612) 937-4515, e-mail: al.gale@mts.com, web www.mts.com

Automated Recorder Test System (ARTS)

Vektrex, an Alliance Program member, offers a LabVIEW-based system designed to test DTR6/8-type wide-band recorder/reproducers. The system verifies that the units operate in accordance with manufacturer specifications in stand-alone mode and when configured with accessories such as the Time Division Multiplexer. All tests are performed according to the Range Commanders Council (RCC) 118-89 testing methods and the manufacturer's recommendations.

The automated recorder test system (ARTS) is designed for facilities where the Datatape DTR6/8 recorder is used in wide-band recording applications. ARTS consists of a roll-around desk that is easily portable to different facilities to support recorder maintenance. Self-test and calibration routines ensure tester integrity and guarantee one volt RMS at recorder input. In addition, manufacturer specifications used to determine pass/fail status are maintained in a database.

ARTS captures proven test methodology, allowing reproducible and repeatable testing in an automated mode and leveraging in-house expertise developed over time. Thus, tests and procedures and the interpretation of test results do not vary from one technician to the next. The graphical user interface reduces the learning curve associated with the maintenance and calibration of mission-critical recorders such as the Datatape DTR6/8. And, the system includes a manual trouble-shooting mode for quick verification and fault identification.

For more information, contact Vektrex Electronic Systems, Inc., tel (619) 578-6787, fax (619) 578-6873, e-mail vektrex@vektrex.com, web www.vektrex.com

Strain Gauge Data Acquisition System

Stress Engineering, an Alliance Program member, is introducing an enhanced version of the SES Strain Gauge Data Acquisition System. This system, based on the National Instruments PXI-1010 combination chassis, is an industrial-grade unit designed for both field and laboratory use. The system features 32 channels of strain measurement and can expand to 128 channels without the need for additional chassises. In addition, the PXI platform provides a wide selection of additional data acquisition and analysis capabilities.

The system includes "SES DAQ" ready-to-run DAQ software. You can set up channels to: identify input type – voltage, current, or thermocouple; define automatic two point calibrations – zero and span; display and plot a list of channels; and store the data as comma-delimited ASCII compatible files. Other options include settings for Rosette panels, Wheatstone bridge nonlinearity corrections, temperature-induced apparent strain, transverse sensitivity, and stress reduction.

Stress Engineering provides design, analysis, and testing services in laboratories located in Houston, Texas, and Cincinnati, Ohio. The laboratories currently have tensile load frames with capacities up to 10,000,000 lb. Stress Engineering provides both laboratory and in-field testing, and applies more than 3,000 strain gauges annually for temperature ranges up to 1100 °F.

For more information, contact Stress Engineering Services, Inc., 13800 Westfair East Drive, Houston, TX 77041, tel (281) 955-2900, fax (281) 955-2638, e-mail jem@hou.stress.com, web www.stresseng.com

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In-Vehicle Data Acquisition Systems for Noise, Vibration, and Harshness

Dateppli, Inc., an Alliance Program member, has created two National Instruments-based systems for vehicle dynamics and tire testing. The systems use LabVIEW and National Instruments DAQ hardware to acquire vehicle data under any road conditions. The systems offer customized anti-aliasing filters, rugged design, portability, in-seat form factor, and easy-to-use software.

For vehicle dynamics testing, the DRIVE™ system performs standard tests consistently, learns new tests quickly, and includes the full spectrum of capabilities required to conduct testing successfully. Its modular architecture and multi-option software also makes the DRIVE system an open-ended solution for a variety of applications.

DRIVE is designed for non-technical drivers who run prescribed tests configured by the project engineer. From the simple user interface to the voice-recorded notes that drivers can add to each test file, DRIVE makes it easy to document all relevant data for each test. Because of its portability, simple localized connectivity, and single-unit design, set up and tear down of the DRIVE system is done quickly, making it possible to test multiple vehicles in a single day. DRIVE has already become a standard in many vehicle dynamics facilities.

The other system, nvDAQ™, is suited for professionals looking for a cost-effective in-vehicle data acquisition and analysis solution for performing tire vibration tests. With the nvDAQ system, drivers can perform tests consistently and quickly analyze test results. nvDAQ acquires vibration data for vehicle tire testing and also provides a powerful tool for automotive noise and vibration engineers who are developing smoother and quieter vehicles. With nv-DAQ, drivers can plan and conduct tests and quickly assess results. Prior to starting a test drive, the tester can create an experimental plan, preparing all run conditions. The driver's data acquisition screen identifies deviations from target conditions, plus the occurrence of abnormal signal conditions such as overloads, underloads, and tachometer pulse train errors. In addition, the tester can perform unattended analyses and export all test series data to a spreadsheet or other analytical software.

For more information, contact Dateppli, Inc., 3333 East Patrick Road, Midland, MI 48642, tel (517) 839-1040, fax (517) 839-1042, e-mail niteam@dateppli.com, web www.dateppli.com

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Temperature Chamber Monitoring System

T.e.s.t., a Canadian Alliance Program member, has developed a Temperature Chamber Monitor using LabVIEW and FieldPoint. The development of the monitor addresses the needs of a large number of companies that possess temperature-monitoring equipment in their test laboratories. The chamber monitoring system is independent of the type and make of other chambers used by these companies. Moreover, it provides flexibility and functionality at a very competitive price. With the system, you have complete control over system monitoring while maintaining the tracking control essential to today's stringent process requirements.

You can set test and measurement configurations for each chamber. The base system permits independent monitoring control of up to four temperature chambers, with up to eight thermocouple channels per chamber. In addition, you can monitor up to four analog input channels per chamber, including Gain and Offset constants for each channel. You can also control up to four digital output channels per chamber, based on two associated thermocouple channels and multiple delays for each channel.

Using Execution Operations, you can control the execution of the program. The system acquires all data and configuration parameters as well as logging identification of the chamber. All generated files are titled, stored automatically in the applicable directory, and made available for printing. Stored reports are formatted as tab-delimited text for simple incorporation into documents and summary reports. You can also change configurations remotely via network connections, even if the applicable chambers are in operation.

For more information, contact t.e.s.t., 313 Sunnyside Ave., Suite 101, Toronto ON M6R 2R3, Canada tel (416) 530-4088, fax (416) 530-4219, e-mail jaiello@t-e-s-t.com web www.t-e-s-t.com

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UPCOMING EVENTS

NIWeek 99 – The Worldwide Conference on Measurement and Automation

August 18-20, 1999 • Austin Convention Center • Austin • Texas

Building Your Future – Today!

There is a revolution underway concerning how you develop systems. Join us for NIWeek 99, the measurement and automation event of the year, to learn about the latest PC-based technologies and techniques, so you can build your future – today!

Conference Overview

NIWeek 99 is the annual National Instruments technical conference. Each year, we pack the sessions with in-depth training on our hardware and software products, and you hear from your colleagues and industry experts about the latest technologies and their applications. At the exhibition, you see these products in action.

NIWeek is a must for:

- Engineers and scientists involved in test, measurement, data acquisition, and automation
- Alliance Program members, developers, systems integrators, and consultants
- Instrument manufacturers and strategic partners

Alliance Day

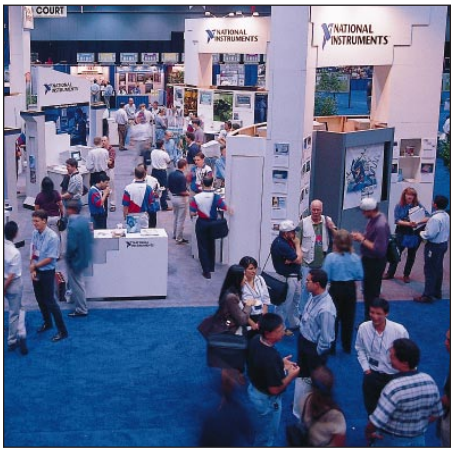
The day before the conference (August 17) is dedicated to the particular needs of the developers, consultants, and systems integrators of our Alliance Program.

Best Applications Contest

We invite you to participate in the NIWeek 99 Best Applications Contest. Share your experience with your colleagues on your innovative use of PC-based measurement and automation and get a discount on your registration fee. The abstract deadline has been extended to March 31, 1999.

Make Your Reservations Now!

The NIWeek 99 registration fee is $595 before June 1, 1999, and $695 thereafter. The Alliance Day registration fee is $100.



To register on-line, go to www.natinst.com/niweek, check NIWeek information on the reply card, or contact us at NIWeek 99 Registration. National Instruments, 11500 N Mopac Expwy, Building B, Austin, TX 78759-3504, tel (512) 794-0100, fax (512) 683-9300, e-mail niweek@natinst.com

This newsletter represents a commitment from National Instruments to the environment.

Trade Shows

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

Industriële Electronica	Netherlands	Mar 2-5
Int'l Automation & Control Technology Exposition	China	Mar 7-9
Scada Systems	Netherlands	Mar 9-10
ISA Monterrey	Mexico	Mar 9-11
Nat'l. Manufacturing Week	Chicago, IL	Mar 15-18
Drives and Control	U. K.	Mar 16-18
KOFA 99	Korea	Mar 30-Apr 2
99 Guangzhou Industrial Control & Automation Exposition	China	Mar 31-Apr 3
ISA Alberta	Calgary, AB	Apr 7-8
Taiwan Automation Trade Show	Taiwan	Apr 9-12
Sensor & Control Expo Japan 99	Japan	Apr 14-16
Hannover Industrie 99	Germany	Apr 19-24
Interphex	New York City, NY	Apr 20-22
Rocky Mountain Technology Expo	Denver, CO	April 21-22
Asia Industrial Technology Congress	Hong Kong	Apr 26-29
Computer 99	Switzerland	Apr 27-29
Offshore Technology Conference	Houston, TX	May 3-6
Sensors Expo	Baltimore, MD	May 4-6
Mido '99	Italy	May 7-10
ISA Instrument Expo	Toronto, ON	May 11-12
Automated Mfg.	Greenville, SC	May 11-13
C&I 99	U. K.	May 11-13
Automation	Finland	May 20-22
Kaoshung Machine Tool Show	Taiwan	May 21-25

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