



The Real-Time ReportTM for Data Acquisition and Control

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TECHNOLOGY UPDATE

Trends in Data Acquisition and Control

by Paul G. Schreier, Consultant

To meet the needs of a competitive marketplace, PC manufacturers continually introduce models whose capabilities far overshadow the dream system of just last year. Fortunately for scientists and engineers, the advances these systems bring also allow us to create far more powerful and reliable data acquisition applications—and with less effort than ever before.

An obvious area of improvement is in CPUs, whose horsepower allows today's machines to overcome several historical barriers to reliable, accurate data collection. As mundane as it might sound, one main limitation in

earlier PCs concerned the CPU resources needed to redraw the screen, especially when trying to keep up with real-time displays. Today processors can refresh the screen with nary a skip in the cursor, yet most of their power remains free for housekeeping tasks as well as running user apps at blazing speeds.

Next consider what today's PCs can accomplish with this processing power. For example, when run on a 500-MHz Pentium III, a LABTECH function block typically executes in < 10 μsec—more than 30X faster than what was possible just a few years ago. Also note that LABTECH NOTEBOOK has supported symmetri-

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INTERNET

Net-Based Sensing and Control

by Frederick A. Putnam, PhD,
President, LABTECH

Almost as soon as the Internet was launched, scientists asked, "Wouldn't it be great if one could access sensor readings remotely via the Internet?" And, in fact, this capability was first made available, albeit in a rudimentary form, as early as the 1970s! Since then the industry has made much progress. Today, Internet-based sensing is a mature technology that is readily available commercially, though its application has been limited.

Web browsers

State-of-the-art methods of Internet-based sensing and control involve direct sensor data viewing from Web browsers. Here, the viewer or "client" is most often a PC with an Internet connection. The sensor is wired to a "server" computer, which may be a PC, instrument, even a microprocessor integrated into the sensor (see Figure 1).

The key information that allows the server and client to send and receive information is their Internet address. The address is analogous to phone numbers for telephone com-

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OPEN DATA ACQUISITION ASSOCIATION

Why ODAS and not OPC?

The Open Data Acquisition Standard developed by the Open Data Acquisition Association (www.opendaq.org) has a lot of similarities to the OPC (OLE for Process Control) standard. Both are software APIs for interfacing sensor I/O devices to software applications, and both are based on Microsoft's COM objects. So, why was ODAS created when OPC already existed? The reason: ODAS and OPC are designed for different types of devices. ODAS devices are primarily PC plug-in (PCPI) boards,



while OPC devices are primarily PLCs (programmable logic controllers) and other traditional factory-floor devices such as single-loop controllers that "look like" PLCs in the way they perform I/O tasks.

A good object-oriented device I/O standard API is really a model of the class of devices that it addresses. The OPC model does this by using register I/O, which maps nicely onto PLC type devices. This model doesn't fit well for PCPI devices, however. As an example, most PCPI devices have multiplexed converters that are located right on the PC's bus, and therefore can stream data directly to and from the PC's memory. OPC does

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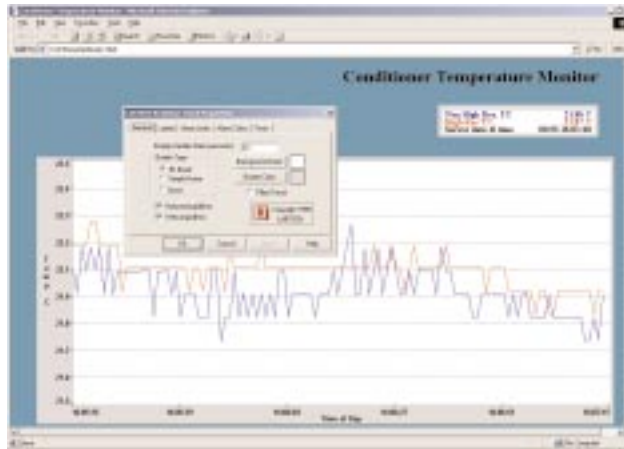


Trends
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cal multiprocessing for years, and with multiprocessor systems becoming mainstream just imagine what's becoming feasible at a reasonable price.

Today's PCs also pack incredible amounts of RAM—64M bytes isn't unusual. In the old days where several megabytes were a luxury, it was impossible to load all the data structures needed for even a modest application all at once, a prerequisite for real-time performance. It's clear that today users can undertake the most ambitious systems knowing they can inexpensively supply all the memory needed.

screen" that accompanies a system crash. Extra reliability in applications software also comes about because now it's possible for LABTECH's developers to load an entire source-code debug image into RAM, thereby taking advantage of the latest debug and software analysis tools.



ial- and parallel-port devices have been around for years, but they all involve major tradeoffs in terms of throughput or the complexities of hardware and software setup. However, USB-based data acq peripherals are starting to arrive, and they eliminate all user worries about configuration or setup. Instead, users can plug in new peripherals even while the system is powered up and start using them immediately.

Internet

With the Internet becoming so pervasive and web browsers emerging as a universal user interface, data acq systems will be able to spread out not only across several feet but literally thousands of miles. Major

instrument suppliers have predicted that all their standalone units will incorporate web servers within the next ten years, so users will be able to set up tests and read measurements from anywhere in the world. But such capability is available today: every PC running LABTECH software is capable of serving data over the web. Indeed, we're poised for the massive adoption of this technology, and it will have an enormous impact on the way we design and use data acq systems. As fast as things have changed over the past few years, technology is only starting to show what it can do! ♦

The Real-Time Report for Data Acquisition and Control

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The Real-Time Report for Data Acquisition and Control provides news, technology articles, and product updates of interest to the scientific, engineering, and manufacturing automation communities.

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Windows NT

What good's all this RAM if the OS can't use it? Only with Windows NT did we get a true 32-bit OS that can support large data structures. Furthermore, NT comes with its own prioritization scheme so programmers no longer have to go outside the OS to gain true real-time performance. And one of the most significant benefits of Windows 2000 is reliability, which we've experienced first-hand: In several man-years of development time with that OS, our programmers have never once seen the dreaded "blue

Let's not forget improvements on the backplane level. For years Intel and Microsoft have touted plug-and-play for function cards, but until recently results were disappointing. However, with the broad adoption of the PCI bus we're finally getting there. With a PCI system and Windows 95 or better, when a user plugs in a new card and powers up the PC, the machine recognizes the new hardware and automatically assigns system resources. That's certainly a far cry from the days where users had to set jumpers or DIP switches on plug-in cards and sometimes the motherboard, as well.

It's now getting to the point where users don't even have to open the PC's case to add industrial-strength data acq hardware. True, ser-

Open Data Acquisition Standard
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not offer this high speed continuous data streaming feature. Also, PCPI devices are by now quite mature, and they all have similar feature sets. An API that models just these features is the best object design for this class of devices, in the sense that there is nearly a 1:1 mapping between the devices and their software model. So, we need two different object models and, hence, two different standards.

ODAS and OPC are not competitive, however -- they are complimentary. From the start, ODAS was designed so that a universal OPC-to-ODAS interface layer could be written that would allow OPC compliant applications to communicate with ODAS devices. This will benefit users in that it will expand the number of devices OPC applications can talk to. It will also benefit PCPI manufacturers by increasing their market and lessening the amount of software they will need to write. ♦

The Significant Benefits of Deterministic Data Acquisition

by Paul G. Schreier, Consultant

When examining the leading data acquisition packages, you'll find they fall into two general categories: those that work with a deterministic scheduler, and those that rely on a dataflow mechanism. Few users, though, understand the underlying differences and the enormous performance benefits one brings over the other.

As an example, LABTECH's software employs the deterministic approach, whereby the application's scheduler runs all function blocks at a steady rate determined by a system clock (see Figure 1). On each clock tick, the program executes each function block that makes up the user application.

With LABTECH software users can also specify the order in which these blocks execute. On today's fast CPUs, the typical execution time for a function block is 10 μ sec, so large applications made up of hundreds of blocks can execute without slowing down other PC tasks such as screen refreshes, tracking mouse/cursor movements smoothly and other housekeeping duties. You also know in advance exactly when and how fast an application runs.

Sophisticated triggering

What's also significant is that each function block can vary its operation based on the results of one or more previous steps in the execution flow. In this way, the software enables fast, sophisticated real-time triggering. For instance, a user program can close a control loop in the next 10 μ sec step following the reading of a process variable. Certainly, other more sophisticated analysis and feedback loops might require the evaluation of several variables, but this feat is possible in one or two function blocks. Again the

delay in taking action based on their values is minimal.

You might be thinking, "Well, this is how I expect any data acquisition software operates." In reality, very few do. Most other packages are based on a nondeterministic dataflow scheme. Again refer to Figure 1 where you can see that the inputs from Blocks 1, 2 and 3 all feed into Block 4.

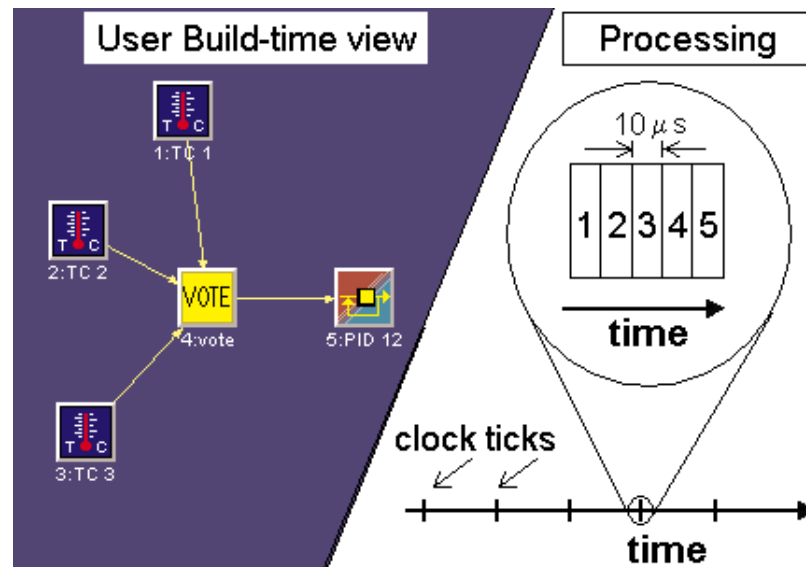
Dataflow scheme

In a dataflow scheme, the application program periodically examines the blocks in a round-robin fashion. As soon as all the inputs to a given block are present, it can then start its own work. In this case, only when Blocks 1, 2, and 3 have run to completion and send their results to the next block in the flow diagram can Block 4 execute the next time the round-robin scheduler gets to it. The same holds for any further blocks that accept any inputs from Block 4.

Obviously, there's no way to predict when the conditions for the execution of Block 4 will be satisfied. There's also no way to predict how long it might take the scheduler to get to the block after all its inputs are satisfied because it must also allow Windows' to take care of its own housekeeping tasks, which inevitably vary in length.

In addition, you can't know in advance the order in which function blocks will execute. Being nondeterministic in this sense isn't a big problem if an application is controlling a slow process or doesn't have to close control loops very quickly. But what happens if you need the fastest possible loops? What if you want to set up sophisticated triggering based on results from multiple other operations? There's really only one choice: a deterministic real-time scheduler. ♦

Figure 1. A user looking at the screen of a data acquisition application program typically sees a group of interconnected function blocks. What the OS sees can be quite different depending on the type of scheduler. Most applications examine all the blocks in a round-robin fashion, executing them only when all the input conditions are satisfied. In contrast, LABTECH's software executes each function block deterministically on every tick of the system's real-time clock.



NEW PRODUCTS

Update: I/O Hardware

The following is a list of the 51 A/D board vendors that are currently supported by LABTECH's family of data acquisition and control software, including LABTECH NOTEBOOK and LABTECH CONTROL.

The types of boards that are supported in this list include ISA, PCMCIA, PCI, GPIB, as well as some RS-232 devices. Operating Systems that are supported in this list include DOS, Win-3.1, Win-95, Win-98, and Win-NT. Those vendors for which we currently have Win-NT drivers (9 vendors currently) are denoted by an asterisk (*).

There are approximately 1,000 drivers in this list of which approximately 300 drivers are supported under Win-NT. Some, although not all, of the remaining 700 drivers will be ported to Win-NT at a later date.

Hardware vendors

Action Instruments
ADAC
Addi-Data
ADE
Advanced Peripherals
Advantech
Analog Devices *

Analogic
Axiom Technology
Azonics *
B & C Microsystems
Beckman Industrial
Bioanalytical Systems
Burr-Brown
Capital Equipment
Computer Boards *
Contec Microelectronics
Coulbourn Instruments
Cyber Research *
Cyborg
Data Electronics
Data Translation *
DGH
DI-AN Micro Systems
DuTec
Dynalog Micro-Systems
Fluke *
Hewlett-Packard
Honeywell
IBM
Industrial Computer Designs
Industrial Computer Source
Intelligent Instrumentation
Intelligent I/O
IOTECH
Keithley MetraByte *
Measurement Systems
Microstar
Modicon
National Instruments
Omega Engineering *
Opto-22 *
Quatech
Scientific Solutions
Siemens
Sensoray
Soltec
Square D
Strawberry Tree
United Electronic Industries
Validyne ♦

Windows NT/2000 Software
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savings in labor when you move from five line operators to one and the user is looking at savings in the six figure range.

Multiprocessing also allows each module of the LABTECH software (e.g. Build-Time, Run-Time, VisionPro) to run on separate parallel processors. This way each processor can be configured for optimal handling of the particular software module's function. In addition, multiprocessing allows users to assign LABTECH software a priority when running with other software packages.

Open architecture

The lack of interoperability among products in today's data acquisition market makes it difficult for a system designer to mix and match from multiple vendors. This often leads to conflicts between performance and ease of use. By taking advantage of Microsoft's COM technology and ATL (Active Template Libraries), LABTECH has come up with an innovative solution to this problem in the latest version of its software.

COM is a mature specification that allows for the development of modular, component software. This is ideal for data acquisition and control software products like LABTECH NOTEBOOK and CONTROL as they must include drivers for dozens, if not hundreds, of I/O boards. Using COM technology, LABTECH is able to offer an open interface and true interoperability between data acquisition devices. This provides new levels of application design flexibility, allowing them to pick and choose from among a wealth of I/O.

For more information, see pages 7-10 or visit www.labtech.com. ♦

A Sampling of LABTECH Firsts

Apr-81	LABTECH incorporated, first company completely focused on personal computer data acquisition and control
Mar-84	LABTECH NOTEBOOK, first IBM PC-compatible menu derived software for data acquisition and control introduced
Sep-87	Real Time Access, first real-time universal streaming of data into any other PC application software (patented)
Mar-89	CONTROL-FT, first PC control software with continuous automatic failover protection
Mar-96	First Internet World Wide Web remote real-time data viewing, first Netscape plug-in for data acq and control
Sep-97	First PC based data acquisition and control software with Microsoft's OLE/Active-X technology
Aug-98	NetTrender, first OEM component product for Internet and Intranet web-based remote real-time data trending and process control
Jun-99	First Windows 2000 ready software for PC data acq and control

TECHNOLOGY UPDATE

Buses Serve as Gateway to Higher Performance

by Frederick A. Putnam, PhD

Everyone, it seems, is upgrading to Pentium machines with tons of memory and a huge hard disk. Concerning prices, you can spend almost as much for a high-performance data acquisition card as for an amazingly powerful PC. Given this situation, it's certainly tempting it to pick up that ISA data acq card that's performed so well for the past several years and drop it into your new system. Doing so, though, could degrade or cripple your performance or, even worse, could lead to where you log incorrect data without knowing so.

First realize that both Intel and Microsoft strongly urge users to abandon ISA cards. Here's an interesting quote from the *PC 99 System Design Guide* that those two firms issued, "Perhaps the most interesting aspect of PC 99 is its elimination of ISA option slots...ISA's low speed, connected protocol, lack of power management, and gluttony for critical system resources, position it as a poor team player in today's balanced system design."

So aren't PCI plug-and-play cards supposed to cure these problems? Indeed. Now the OS can distribute its resources automatically, assigning base addresses, IRQ lines, and DMA channels without user intervention. What many people don't realize, though, is that plugging in just one ISA card essentially makes a system non-plug-and-play. That one card defeats any automatic resource allocations. The user must manually set the ISA card's address, IRQ and DMA lines—but unless you're sophisticated enough to tell the OS that these resources are now reserved, it could try to reuse them for other cards with disastrous results.

Assuming you can get ISA and PCI cards to coexist in the same backplane, your troubles aren't necessarily

over. One issue pertains to bus throughput. Recall that the ISA bus was originally designed for the IBM PC with a 4.77 MHz 8088 processor. It was limited to 8 data lines and 20 address lines and so could address only 1MB of memory. Next-generation 80286-based PC/AT systems then added a connector using 16 data lines and 24 address lines. The maximum throughput is 8MB/sec, and it requires two CPU cycles for every read or write. It supports neither burst transfers nor bus mastering.

Now compare those specs to PCI. It's a processor-independent 33 MHz bus, 32 bits wide, with a maximum burst throughput of 132MB/sec; the bus definition also includes 64 MHz and 64-bit addressing, which in the future could drive 524MB/sec through the bus. PCI also has full bus-master support for peer-to-peer bus access without the need to involve the CPU. Further, its hidden bus arbitration reduces latency to increase efficiency. In other words, one bus-master component can request the bus while another card is transferring data.

So what happens when you install an ISA data acq card into a system with a mixed ISA/PCI backplane? When PCI peripherals are talking to each other, they can zip data back and forth. However, as soon as the ISA card gets involved, all bus transactions slow down to a comparative crawl until the device releases the bus. When you realize that a typical data acq setup loads the bus to move real-world data into system memory or onto the hard disk, you can see how total system performance drops.

Another aspect to be concerned with is actually quite insidious—without knowing it, you might be working with bad data from an I/O card that can't keep up with the system's speed. Many ISA cards were designed with the assumption that the system clock driving their operation wouldn't

exceed certain limits. As noted, the first PCs ran at 8 MHz whereas today's speedsters can have clock rates in excess of 500 MHz. The card's creators might have designed it with what they thought was plenty of headroom, expecting a maximum clock of perhaps 100 MHz. At this rate, the PC can clock another A/D conversion yet be assured that the input multiplexer has plenty of time to settle to within the converter's resolution. But as you've just seen, system clocks are much higher. In fact, software developers, including LABTECH, spent considerable effort adding delays into

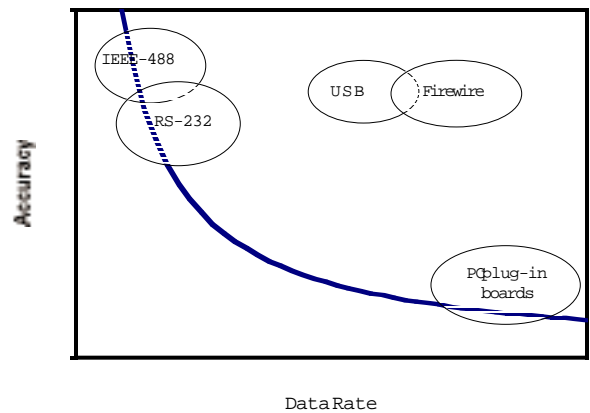


Figure 1. Until recently, all PC-based data-acq devices fell onto a curve that trades off accuracy (the highest level coming with electrically-isolated external devices connected over IEEE-488, serial links, the parallel port or proprietary bus schemes) with throughput (the fastest way to bring data into PC memory today being over the PCI bus). Emerging technologies such as USB and Firewire are jumping off this long-established curve to bring users the best of both worlds at an affordable price.

their application's acquisition routines to ensure cards would always deliver valid data. However, with an ISA card in today's fast machines you still could be gambling on reliability.

Finally, note how buses are distributing our data acq systems. With USB, you can hot-plug an I/O device and it doesn't suffer from signal degradation that arises from digital noise in a PC chassis. Firewire will soon extend this concept with extremely high throughput. Before long, users won't suffer any physical limitations due to buses—think of TCP/IP as a bus. Whether running on 100Mbit/sec Ethernet or the Internet, a data acq device can function virtually anywhere and act like it's plugged into your system's backplane. ♦

Net-based Sensing and Control
continued from page 1

munication. They can usually be expressed in two equivalent forms, the host name and the TCP/IP address. The easiest of these to use is the host name. This is an alphanumeric string, which makes it a lot easier to remember than the TCP/IP address. For example, the host name of our company's sensor data server is `ltsrver.labtech.com`. The last part of this string, `labtech.com`, identifies the domain name of our company on the Internet. The TCP/IP address corresponding to this host name is `209.61.86.107`. This is the low-level form of an Internet address. On the Internet, a network of domain name servers performs the task of translating host and domain names into their TCP/IP addresses as required.

Web-based servers

Hewlett Packard pioneered an interesting approach to Net-based data acquisition (www.hp.com/news/101998/index.html) by embedding of a small Web server in a microprocessor that is connected directly to a sensor. The Web server creates a Web page that contains sensor readings; the data can be collected each time there is new data or on a periodic basis. Whenever a client requests this web page, it is sent out over the Internet to that client, who can see the data

values. This elegant technique is now incorporated into many products. Unfortunately, the Web server approach is limited in terms of flexibility and efficiency. This is because a Web page with the sensor data needs to be entirely constructed by the small Web server that is attached to the sensor. This server is an embedded system with limited processing power and a small amount of read-only memory. The result is that the Web page layouts are difficult to change.

Also, while the Web pages served are fine for viewing the data, they are not well-suited if the client wishes to parse the data values and perform additional processing and/or local storage of the data. Finally, the Web server approach is inefficient, because it requires an entire Web page to be sent every time the data needs to be updated; this means that it is sending much more data than necessary.

Application servers

A more efficient and versatile approach to direct sensor data viewing is a system where we separate the serving of the sensor data from the serving of the Web page. Here, there are two separate data streams. The sensor microprocessors send only the actual sensor data across the Internet. They do not serve any Web pages, so they are not Web servers, but specialized application servers—sensor data servers.

The Web page is served separately from any corporate Web server, or even from the local hard disk in the client PC. This is good because the Web pages will be served from the same server that all the other non-sensor corporate Web pages are served from.

This approach uses a web page plug-in to receive and render the sensor data. (A plug-in is a small, simple software component that runs on the client PC when loaded by a Web page.) There are several different ways of implementing plug-ins: Microsoft ActiveX controls,

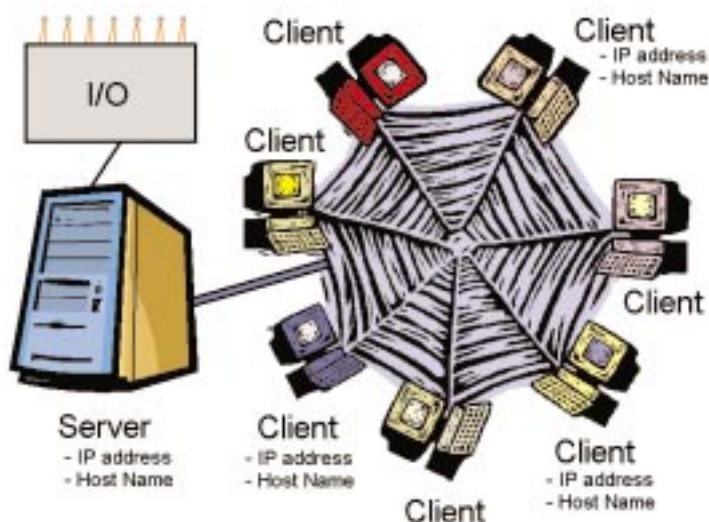
Netscape plug-ins, and Java applets. Any one of these can be used to retrieve the sensor data from the server and render the data in the Web page, as well as provide any other processing or storage of the data that might be necessary.

This application server architecture was pioneered by LABTECH in March 1996, and now commercially available in the NetTrender™ product and bundled with the software packages LABTECH NOTEBOOKpro and LABTECH CONTROL (www.labtech.com).

The future

Looking into the future, one can see great potential in wireless Internet-based data acquisition and control with hand-held devices like the Palm Pilot and Handspring Visor (www.handspring.com). Also, expect to see actual closed-loop control over the Internet shortly. Such technology is here today, and research and pilot programs are underway. Security and reliability concerns will gradually be solved as the Internet becomes more hardened and mission-critical capable. The developers of these ultra-reliable extensions to the Internet will be the new e-commerce industry. ♦

Figure 1. The viewer or "client" is most often a PC with an Internet connection. The sensor is wired to a "server" computer, which may be a PC, instrument, even a microprocessor integrated into the sensor



TECHNICAL SEMINARS

LABTECH Seminar Schedule, 2000

LOCATION	DATES
Los Angeles, CA	February 8-11
Houston, TX	March 7-10
Boston, MA	April 4-7
Atlanta, GA	May 16-19
Boston, MA	June 6-9
Atlanta, GA	Sept 19-22
Boston, MA	October 3-6
Houston, TX	Nov 7-10

Note: Final registration is one month prior to beginning of seminar, e.g. January 9 for the February 9 seminar.

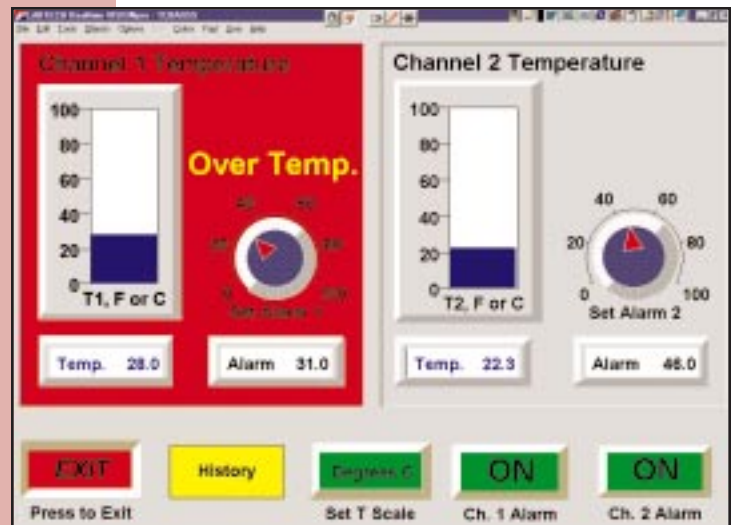
LABTECH NOTEBOOK™

Real-time Data Acquisition, Analysis,
& Control Software for Windows®



FEATURES

- Easy-to-use, object-oriented software environment;
no programming required
- Real-time, multitasking data acquisition, data display, data logging, and process control
- Open architecture design supports over 1000 I/O devices from more than 50 manufacturers
- Remotely view real-time data across any TCP/IP-based network, including intranets and the World Wide Web
- Fast Pentium support for both new and old data acquisition and control devices
- On-line mathematics, statistics, and logical calculations
- High-speed DMA, Ramp and Soak, and Cascade Control (NOTEBOOKpro)
- High accuracy thermocouple measurements via digital filtering
- High speed data transfers using *LT-Speedway* or custom Visual Basic or C/C++ code
- Year 2000 compliant



GENERAL DESCRIPTION

LABTECH NOTEBOOK software turns your PC into a powerful data acquisition and control system, ideal for such applications as product testing, environmental monitoring, materials research, medical instrumentation, and chemical research. NOTEBOOK handles a variety of analog and digital inputs and outputs, including thermocouples and counter/timers, and provides fast Pentium support for over 1000 I/O devices.

With over 100,000 copies of its software in use around the world, you can rely on LABTECH to meet your data acquisition and control application needs.

PRODUCT DESCRIPTION

It all starts with NOTEBOOK's easy-to-use, icon-driven interface. You can begin collecting data immediately...NO PROGRAMMING REQUIRED! Simply attach your instruments to an I/O device/ board connected to your computer. NOTEBOOK takes care of the rest—collecting real-time data from the instrument, analyzing and displaying data as it is collected, recording data to disk, and transferring data across the Internet.

NOTEBOOK and NOTEBOOKpro

LABTECH NOTEBOOK is available in two versions: NOTEBOOK and an enhanced edition, NOTEBOOKpro. As shown in the features chart on page 2, the software supports up to five screen displays, IEEE-488 and RS-232 communications, a C-icon development kit, and an I/O driver toolkit for custom drivers. LABTECH software also provides high speed DMA capabilities, and PID, Ramp and Soak, and Cascade Control.

Leveraging the Internet

Designed for programmers and non-programmers alike, LABTECH has designed a number of state-of-the-art technologies into its software. NOTEBOOKpro, for instance, allows you to leverage the power of the World Wide Web for real-time remote access to any part of your application. From across the street or around the world, you can create dynamic Web pages using NOTEBOOKpro's *Real-time Remote*; this allows you to monitor application parameters from any attended or unattended location.

Real-time Remote pushes Web data directly from the PC-based host system. This bypasses the need for a separate Web server, as is required by most other data



LABTECH NOTEBOOK and NOTEBOOKpro

acquisition and control software. Web browser viewer objects are automatically installed on client PCs. The software then instantly displays real-time data in Netscape Navigator, MS Internet Explorer, or virtually any PC-based application, including Excel, Word, and AutoCAD. A single browser page can show data from several locations and provide historical trends of real-time data.

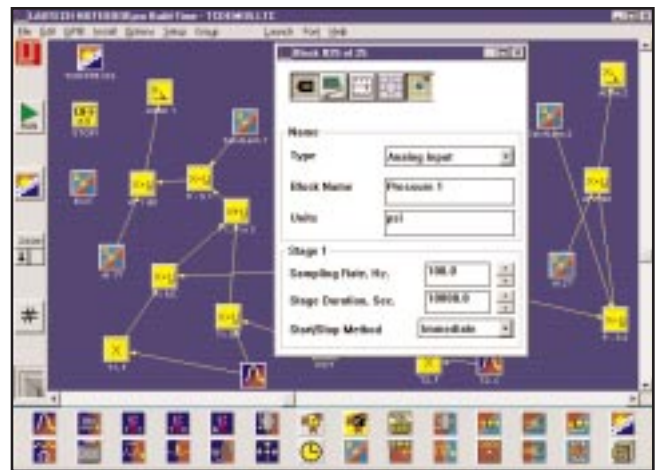
Developed by LABTECH as a standard for passing real-time data between applications, *LT-Speedway* is able to attain very high speeds, transferring data between Windows processes more than 1000 times faster than DDE, and with reliably predictable transfer times. On a Pentium-90 PC, for example, messages are transferred every 38 μ s, with each message containing an unlimited amount of data.

LABTECH NOTEBOOK & NOTEBOOKpro KEY FEATURES

	NB	Pro
• Blocks	100	300
• Screens	1	5
• <i>Real-time Remote</i>		•
• High Speed DMA		•
• GPIB/IEEE-488, RS-232		•
• C-Icon Development Kit		•
• I/O Driver Toolkit		•
• Year 2000 compliance	•	•
• Ramp/Soak/Cascade Control	•	•
• Password security	•	•
• Iconic GUI	•	•
• Icon edit/copy, edit/paste	•	•
• Collapsible meta icons	•	•
• Real-time data acquisition	•	•
• Real-time data display	•	•
• Universal driver	•	•
• On-line math, stats, logic	•	•
• Real-time multitasking	•	•
• Real-time data logging in standard formats	•	•
• Input Types:		
- Analog input, resistance	•	•
- Digital input, strain gages	•	•
- Thermocouple, counter	•	•
- Thermistor, frequency, RTD	•	•
• High resolution thermocouple	•	•
• Trigger from analog input, calculated values, digital inputs	•	•
• Different sampling rates/channel	•	•
• Open or closed loop control	•	•
• Analog signal scaling & calibration	•	•
• Pretriggering	•	•
• Replay stored or theoretical data	•	•
• Display types: waveform plots, X vs Y, T vs Y, horiz/vert bar graphs, analog/digital panel meters, user customizable	•	•
• Control objects: knobs for variable data, on/off buttons, sliders, user customizable	•	•
• Drawing features:		
- Import bitmaps	•	•
- Background picture bitmaps	•	•
- Line segments, arcs, freehand lines, rectangles & squares, filled/unfilled	•	•
- Ovals & circles, filled/unfilled	•	•
- Polygons & freehand shapes	•	•
• Animation:		
- Multiple animations/object	•	•
- Move, rotate, change color, shrink/grow in response to data	•	•
• Alarm logging	•	•

Fast, Flexible User Interface

NOTEBOOK allows the creation of sophisticated user interfaces from within its setup pages or by using *BUILDTIME*. A graphical user interface (GUI), *BUILDTIME* lets you move and connect icons to create data acquisition and control setups. You can easily configure, view, and manipulate setups with just a few mouse clicks. *BUILDTIME* presents all setup functions (I/O Channels, Calculations, Traces, and Files) on the *BUILDTIME* drawing board.



From this one place, you can structure an application graphically, using the icons as building blocks and connecting them to show the relationships and data flow between NOTEBOOK functions.

To quickly create a customized display, ideal for your application, NOTEBOOK's client/server operator interface, *Real-time VISIONpro*, provides you with all the tools you need. Trend charts, meters, and bar charts display data in real-time. Knobs, switches, and sliders add real-time control and adjustments. *Real-time VISIONpro's* drawing and animation functions allow you to create a "true-to-life" display of your application.

High Speed Data Collection

Once you've developed your setup and designed your interface, NOTEBOOK "hot links" to data sources through *LT-Speedway*, a high speed, real-time interprocess communication (IPC) link, or custom code written in VisualBasic or C/C++.

SYSTEM REQUIREMENTS

Microsoft Windows NT/2000, Windows 95, Windows 3.1, or DOS, IBM compatible Pentium PC, 16 MB RAM, VGA graphics or better. For DOS users, DOS 6.22, PC/XT/AT/ 486 or better, 640 kB RAM, EGA or VGA.

A free, 14-day trial version of LABTECH NOTEBOOK is available for download from the company's Web site at <http://www.labtech.com>.

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ORDERING GUIDE

- LABTECH NOTEBOOK
 - LABTECH NOTEBOOKpro
- (both include 60 days FREE tech support and a 30 day money-back guarantee)

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LABTECH CONTROL™

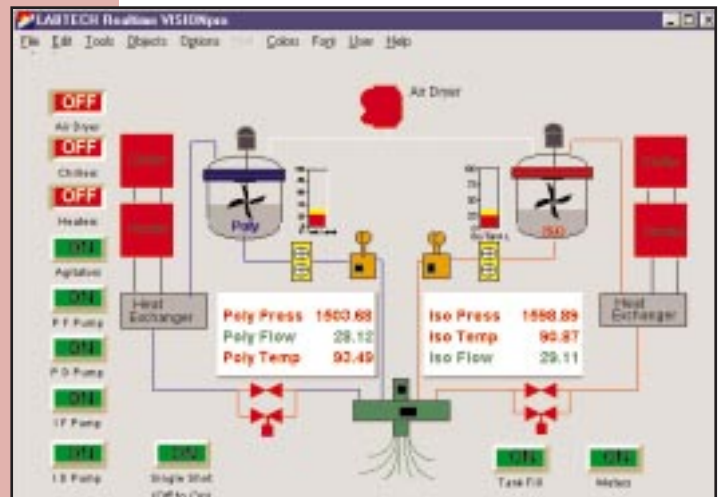
CONTROL and CONTROLpro

Real-time Process Control Software



FEATURES

- Real-time, multitasking data acquisition, data display, data logging, and process control
- Easy-to-use, object-oriented software environment; no programming required
- Open architecture design supports over 1000 I/O devices from more than 50 manufacturers
- Remotely view real-time data across any TCP/IP-based network, including intranets and the World Wide Web
- Advanced PID loop tuning; high speed DMA, Ramp and Soak, and Cascade Control
- Real-time process diagrams support multiple display types, including trends, bar graphs, digital meters, and faceplates
- On-line calculations for mathematical, statistical, and logical functions in real-time
- High accuracy thermocouple measurements via digital filtering
- Year 2000 compliant



GENERAL DESCRIPTION

LABTECH CONTROL instrumentation and control software is a complete, integrated environment for pilot plants and factory floor operations. The system provides comprehensive capabilities for process monitoring and control, real-time operator interface and display, on-line data analysis, and open architecture networking. An intuitive, graphical program, CONTROL gets you up and running quickly...NO PROGRAMMING REQUIRED.

With over 100,000 copies of its software in use around the world, you can rely on LABTECH to meet your process monitoring and control application needs.

PRODUCT DESCRIPTION

LABTECH CONTROL provides flexible and powerful process monitoring and control capabilities, allowing you to configure applications with a variety of sampling rates, sensor types, and control functions. Acquisition rates from hundreds of thousands of points per second to a few points per day can be scheduled, with each I/O point having its own sampling rate and trigger.

As data is collected, values, tag names, and alarm conditions can be time-stamped and stored directly to disk, allowing you to save the results from an almost unlimited number of process runs. Data can be written to disk either continuously or in response to an event/alarm trigger or operator command. Pretriggering allows for the display and logging of data just prior to the occurrence of an event.

Process Control

LABTECH CONTROL provides PID and bang-bang control features for closed-loop control and indication of alarm conditions. PID loops allow for closed-loop control of constant or variable setpoints. Control loops have a block-structured architecture; each block implements individual control algorithms for specific variable inputs and control outputs. Support for cascade control provides an added degree of freedom when configuring a control strategy.

Real-time VISIONpro

CONTROL's Real-time VISIONpro Man Machine Interface (MMI) allows non-programmers to create sophisticated graphical depictions of process flows and



LABTECH CONTROL and CONTROLpro

LABTECH CONTROL & CONTROLpro KEY FEATURES

	CTL	Pro
• Blocks	600	2000
• Screens	50	No limit
• Real-time Remote	•	•
• High Speed DMA	•	•
• GPIB/IEEE-488, RS-232	•	•
• C-Icon Development Kit	•	•
• I/O Driver Toolkit	•	•
• Year 2000 compliance	•	•
• Ramp/Soak/Cascade Control	•	•
• Password security	•	•
• Iconic GUI	•	•
• Icon edit/copy, edit/paste	•	•
• Collapsible meta icons	•	•
• Real-time data acquisition	•	•
• Real-time data display	•	•
• Universal driver	•	•
• On-line math, stats, logic	•	•
• Real-time multitasking	•	•
• Real-time data logging in standard formats	•	•
• Input Types:		
- Analog input, resistance	•	•
- Digital input, strain gages	•	•
- Thermocouple, counter	•	•
- Thermistor, frequency, RTD	•	•
• High resolution thermocouple	•	•
• Trigger from analog input, calculated values, digital inputs	•	•
• Different sampling rates/channel	•	•
• Open or closed loop control	•	•
• Analog signal scaling & calibration	•	•
• Pretriggering	•	•
• Replay stored or theoretical data	•	•
• Display types: waveform plots, X vs Y, T vs Y, horiz/vert bar graphs, analog/digital panel meters, user customizable	•	•
• Control objects: knobs for variable data, on/off buttons, sliders, user customizable	•	•
• Drawing features:		
- Import bitmaps	•	•
- Background picture bitmaps	•	•
- Line segments, arcs, freehand lines, rectangles & squares, filled/unfilled	•	•
- Ovals & circles, filled/unfilled	•	•
- Polygons & freehand shapes	•	•
• Animation:		
- Multiple animations/object	•	•
- Move, rotate, change color, shrink/grow in response to data	•	•
• Alarm logging	•	•
• Sensor voting	•	•
• Anti-Reset Windup	•	•
• Tune PID & Setpoint	•	•

plant layouts. Pre-defined objects include knobs, dials, slide bars, and buttons for creating graphical front-ends; and trend charts that depict changes as they occur. Combine these object graphics with *VISIONpro's* powerful drawing and animation tools and you can quickly design and implement process displays of any complexity.

Leveraging the Internet

Taking advantage of state-of-the-art technology, CONTROL allows you to leverage the power of the World Wide Web for real-time remote access to any part of your application. From across the street or around the world, you can create dynamic Web pages using CONTROL's *Real-time Remote*; this allows you to monitor application parameters from any attended or unattended location.

Real-time Remote pushes Web data directly from the PC-based host system. This bypasses the need for a separate Web server, as is required by most other control software. Web browser viewer objects are automatically installed on client PCs. The software then instantly displays real-time data in Netscape Navigator, MS Internet Explorer, or virtually any PC-based application, including Excel, Word, and AutoCAD.

High Speed Data Collection

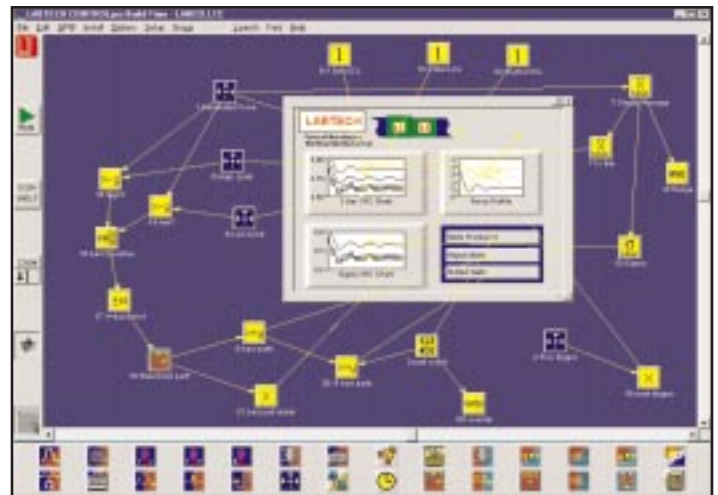
Once you've developed your setup and designed your interface, CONTROL "hot links" to I/O points through *LT-Speedway*, a high speed, real-time interprocess communication (IPC) link, or custom code written in Visual Basic or C/C++.

Developed by LABTECH as a standard for passing real-time data between applications, *LT-Speedway* is able to attain very high speeds, reliably transferring data between Windows processes more than 1000 times faster than DDE. On a Pentium-90 PC, for example, messages are trans-

ferred every 38 μ s, with each message containing an unlimited amount of data.

Security

LABTECH CONTROL includes many levels of security to protect sensitive data. The software supports several layers of password protection, secure blocking of information by a corporate firewall, and protection against unauthorized remote control.



SYSTEM REQUIREMENTS

Microsoft Windows NT/2000, Windows 95, or Windows 3.1, IBM compatible Pentium, 32 MB RAM (64 MB preferred), and VGA graphics or better.

A free, 14-day trial version of LABTECH CONTROL is available for download from <http://www.labtech.com>.

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ORDERING GUIDE

- LABTECH CONTROL
- LABTECH CONTROLpro (both include 60 days FREE tech support and a 30-day money-back guarantee)

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No thank you. I am not ready to order at this time.

DESCRIPTION	PRICE	SUPPORT & UPGRADE*	UPGRADES	UPGRADES: SUPPORT & UPGRADE*
<i>Software Systems *</i>				
<i>(Please Circle Your Choice)</i>				
NOTEBOOK	\$695	\$985	\$250	\$480
NOTEBOOKpro	\$1195	\$1640	\$395	\$740
CONTROL	\$2495	\$3315	\$695	\$1340
CONTROLpro	\$3495	\$4640	\$995	\$1890

* All LABTECH software systems include 60 days of free technical support and are unconditionally covered by our 30-day Money-Back Guarantee. Support and Upgrade Combo includes 1 upgrade plus an introductory half-price addition of 1 year of both free upgrades and technical support.

Step-ups	<i>(Please Circle Your Choice)</i>			
NOTEBOOK to NOTEBOOKpro	\$500	\$945		
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CONTROL to CONTROLpro	\$1000	\$2145		

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IMPORTANT INFORMATION

Media (choose one): CD-ROM Floppy Disks
 Both disks and CD-ROM (\$50 extra)
 Serial No (required for upgrade or step-up)

 Platform: Windows NT Windows 95/98 Windows 3.1
 Shipping & Handling (for one product): USA Standard, \$10
 2-day, \$15 Overnight, \$35 Int'l, please call

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NOTE: I/O hardware compatibility varies by operating system. Please check the Supported Hardware List on our web site to assure I/O hardware support.

Year 2000 Compliance Statement: LABTECH has tested Version 10.1 and higher of its software and has found that it fully meets the Year 2000 conformity requirements of the British Standards Institute DISC PD2000-1. These tests have been conducted based on the code of practice for Year 2000 management as defined by the British Standards Institute. LABTECH will not be testing any versions of its software prior to Version 10.1.

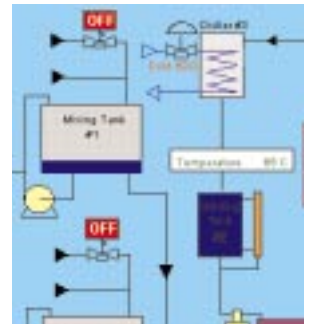
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NEW PRODUCTS

New Windows NT-based Software Provides Full Multiprocessing and Priority-based Scheduling

LABTECH, pioneer in the field of high performance data acquisition and process control software, has announced the Windows® NT/Windows 2000 version of its software family: LABTECH NOTEBOOK™, NOTEBOOKpro™, CONTROL™, and CONTROLpro™. This latest release of the company's instrumentation and control software features a number of major innovations, including true multiprocessing capabilities, priority-based scheduling, and a new open architecture design.

LABTECH's new multiprocessing feature allows multiple copies of NOTEBOOK and CONTROL to run on the same system, saving users significant resources, both in terms of finances and labor. The new priority-based scheduling capability, unavailable with packages based on DOS or Windows 95/98, provides users with a deterministic design that delivers predictable performance—at the application and I/O level. In addition, the new LABTECH software takes advantage of Microsoft's COM technology, offering users the advantages of a universal, open standard that allows interoperability between the company's software and the largest number of I/O devices of any data acquisition software developer.

These new features are all part of LABTECH's easy-to-use, object-oriented software environment that requires NO PROGRAMMING. LABTECH software also includes real-time remote access to data via the World Wide Web. Also known as "Internet Hot

Links," this technology was invented and first introduced by LABTECH in March 1996; it is now a part of all the company's software as the LABTECH NetTrender module.

Multiprocessing capabilities

LABTECH NOTEBOOK and CONTROL for Windows NT are unique among PC-based data acquisition and process control software packages in that they provide full multiprocessing capabilities. All LABTECH software is architected for multiple processes, such as data acquisition and data display. But with its new multiprocessing capabilities, LABTECH is able to provide true, real-time multiprocessing, much like the old real-time minicomputers of the 1980's (albeit at a much lower price as users are now able to leverage the power of the PC).

Multiprocessing provides a number of advantages, including the ability

to run multiple copies of NOTEBOOK and CONTROL on the same PC. The software can run independently, yet share the same hardware. This saves users significant amounts of money on hardware purchases, both at the PC and I/O levels, as well as labor. As an example:

- For 5 test stands, in the past, you would need 5 copies of LABTECH CONTROL software, 5 PCs, and 5 multi-point I/O systems, for a total cost of \$23,500.
- Taking advantage of the new multiprocessing capabilities of LABTECH CONTROL, you would need 1 copy of LABTECH CONTROL, 1 PC, and 1 multi-point I/O system, for a total cost of \$6,500.

That's a difference of \$17,000, saving 72% of the system cost! Add in the

continued on page 4

The Real-Time Report

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