

Measurement Studio Overview

Measurement Studio

Integrated development environment for ANSI C
Measurement classes for Visual C++
Measurement and automation
ActiveX controls for Visual Basic
Libraries for
User interface
Data acquisition
Instrument control
VISA
IVI
Analysis
Internet/network connectivity

LabWindows/CVI

Integrated C development environment
Built-in measurement libraries
Open environment for engineers and scientists

Visual C++

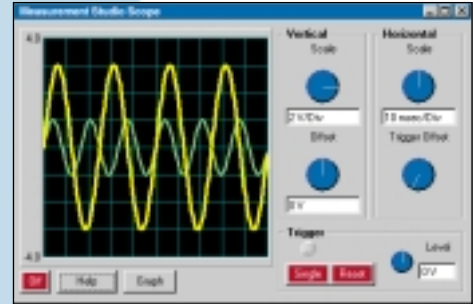
Integrated measurement tools for Visual C++
Measurement application wizard for rapid development
Integrated measurement libraries

Visual Basic

ActiveX controls for Microsoft Visual Basic
Easy-to-use property page interface to controls
Programmatic control through properties, methods, and events

Operating Systems

Windows 2000/NT/Me/9x



Introduction

With National Instruments Measurement Studio, engineers and scientists gain the Microsoft Visual Basic and Visual C++, and ANSI C package LabWindows/CVI measurement tools they need to develop test and measurement applications in the programming environment of their choice. Measurement Studio users gain data acquisition, analysis, and presentation functions to create measurement applications for stand-alone measurement systems or distributed measurements over the Web.

National Instruments leveraged more than 12 years of measurement programming expertise to create Measurement Studio. With the company's previous programming packages, LabWindows/CVI and ComponentWorks, users gained measurement capabilities for ANSI C and Visual Basic languages. To complete Measurement Studio, National Instruments added Visual C++ capabilities. With the Measurement Studio package, you have the flexibility to choose which industry standard environment best suits your application.

Flexible

With development teams and projects growing in size, more developers are using multiple programming languages. Measurement Studio provides all the tools in one package giving you the flexibility to choose the language best suited for your application and/or the language you know best. Regardless of the environment you choose, Measurement Studio provides the reusable tools to make your programming tasks easier.

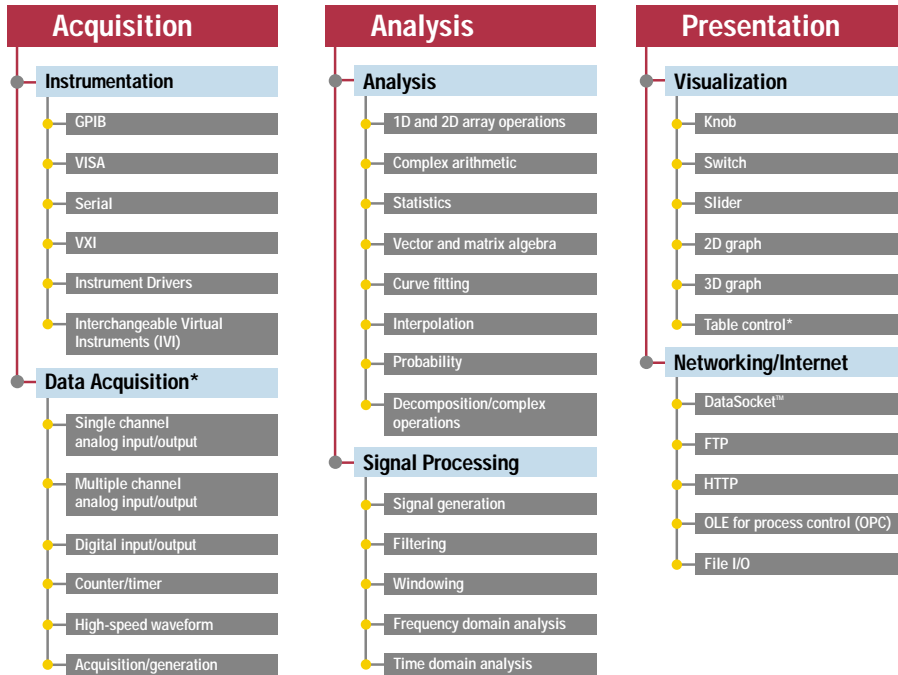
Accurate and Reliable

Measurement Studio delivers the fundamental measurement components you need to take accurate measurements and create reliable automation systems. With Measurement Studio, you gain built-in libraries for interfacing your computer to the outside world, comprehensive analysis libraries that rival those of dedicated analysis packages, and interface controls that simplify the presentation of measurement data anywhere, even in a Web page. Measurement Studio offers measurement components that take advantage of today's powerful technologies, helping you deliver higher performance solutions at a lower cost.

Alliance with Microsoft

National Instruments aims to make your programming tasks easier using today's popular development environments. With this goal in mind, we integrated measurement tools into Visual Studio – which includes Microsoft Visual Basic and Visual C++ – so you can benefit from our measurement expertise without learning a new language. To integrate more efficiently into the Visual Studio development environment, National Instruments formed an alliance with Microsoft through the Visual Studio Integration Program (VSIP). Through this program, National Instruments acquires the tools necessary to achieve more seamless integration within the environment of your choice. As a developer, you have less to learn and can start using our tools quickly.

Measurement Studio Overview



*LabWindows/CVI only

Save Time

In today's fast-paced engineering world, organizations need to design and implement test strategies for shorter development cycles and higher volume production runs. With tighter test system production schedules, test engineers want to use proven pre-existing code modules to quickly build test systems. Rather than develop code from scratch for each test system, engineers focus on code reusability for faster, more reliable software development on the production floor.

You already know how to program the Windows environment using standard tools such as Visual Basic, Visual C++, or C with the SDK. Why not use that knowledge to your advantage and combine your expertise with National Instruments measurement and automation expertise? Use Measurement Studio tools to aid in creating your revolutionary test, measurement, and automation applications.

Simplify Code

You already know how to use Visual Basic and Visual C++ to create applications that harness the power of ActiveX and object-oriented programming. With these tools, you can develop applications that provide advanced user interfaces, use the Web to extend your applications, and create applications that connect to your enterprise information. With the added capabilities of Measurement Studio, you can extend the applications you have already created to achieve multi-document interface applications that take multiple measurements simultaneously, publish your measurement findings over the Internet, or add your test data to your corporate database for viewing and analyzing.

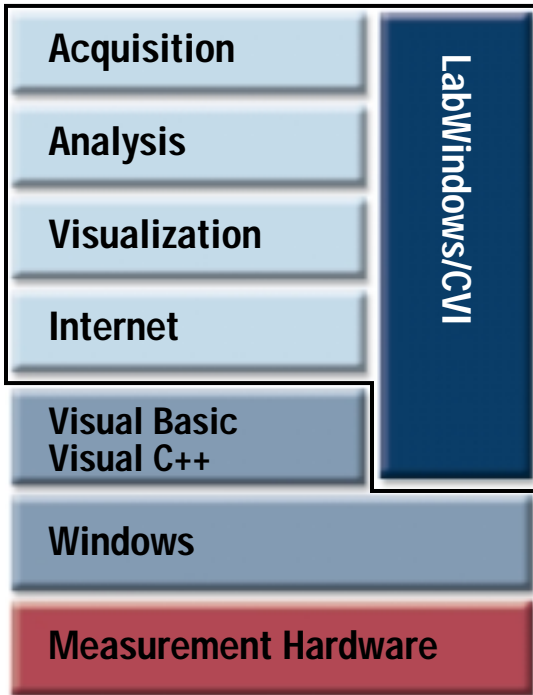
Perhaps, you prefer to program in C. As an engineer or scientist, you need to take measurements of physical phenomenon, test the functionality or mechanical reliability of your company's product, and automate processes to improve production. Combine your knowledge of C programming with the power and ease of use of LabWindows/CVI, a component of Measurement Studio, to create advanced measurement applications.

Use Off-the-Shelf Components

Do you want to spend countless hours figuring out how to interface with your measurement hardware? Do you want to create analysis routines from scratch? Do you want to try to create user interface modules? National Instruments has already spent the time creating and testing reusable code modules and tools that can turn your months of coding into minutes.

Once you have created your hardware interface, you still must create analysis algorithms and a graph widget to display the data. When you get an error from your application, do you know which module has the issue? With our proven Measurement Studio tools, there is no need to guess and waste your time. Our tools help you concentrate on the mechanics of your application and free you from frustrating tasks.

Measurement Studio Overview



Measurement Studio

Data Acquisition

Whatever you use to acquire your data – a GPIB or serial instrument through IVI, a plug-in data acquisition card, PXI hardware, National Instruments computer-based instruments, or an image acquisition device to acquire images – Measurement Studio provides the high-level interface native to your development environment. Choose ActiveX interfaces for Visual Basic, MFC-based C++ classes for Visual C++, and function panel libraries for use with the ANSI C development environment of LabWindows/CVI, a component of Measurement Studio. You select the environment of your choice to build high-speed, device-independent measurement and automation applications.

Data Analysis

Measurement Studio delivers the instrument class analysis functions you need to convert raw data into meaningful information. With Measurement Studio, you can employ a wide variety of signal processing and data analysis tools, such as curve fitting, spectral analysis, statistics, and visualization. These capabilities are required for applications involving research and development, engineering and validation, or manufacturing and service. Because you can perform your analysis inside your application, you do not need another application to do post-process analysis.

Measurement Visualization

Your measurement or automation application can have a professional looking GUI without taking many months to create. Without requiring you

to program, Measurement Studio delivers measurement-specific user interface components with which you can quickly and easily create professional looking measurement applications that mimic stand-alone instruments, such as scopes and temperature loggers. If your needs are greater than those of standard boxed instruments, Measurement Studio provides the flexibility to go beyond the norm and use its 3D graphics and OpenGL library to make a truly revolutionary measurement application.

With the Internet technology inside Measurement Studio, you can share your measurements throughout the world. National Instruments created DataSocket technology to easily share live measurements over networks, including the Web. With the new bindings feature of the user interface controls, you can connect to measurements without writing code, and you can easily turn your applications into Web pages by creating ActiveX controls out of your Visual Basic and Visual C++ projects.

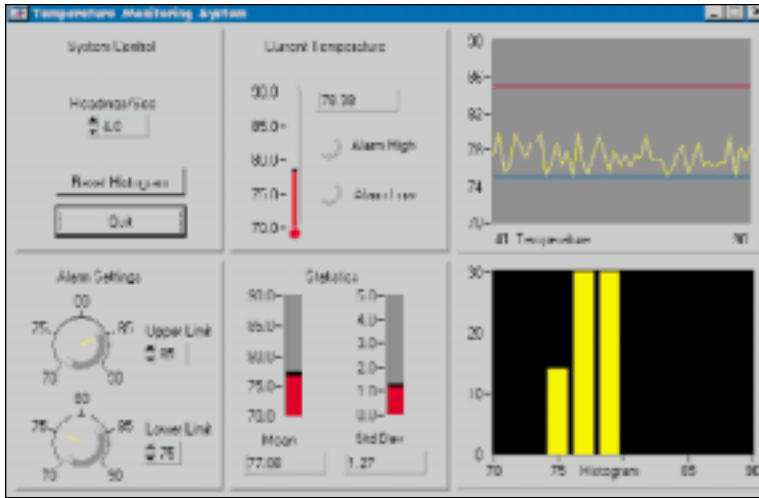
TECH TIP

Web Page Creation

Would you like to have your measurement application publish data over the Web, or control your ATE system from your desk? Learn how to turn your Visual Basic application into a Web page that communicates with your measurement system.

For more information, visit ni.com/info and enter exc86a.

Measurement Studio Overview



Measurement Tools for Text-Based Languages

Having realized that a gap exists between standard software development tools and virtual instrumentation needs, National Instruments has developed solutions to bridge the gap. We provide functionality specifically targeted at test, measurement, and automation applications. For faster development of applications, we created a suite of rapid development tools. Choose from standard environments such as LabWindows/CVI for ANSI C development, and Microsoft Visual Basic and Visual C++ to create your application, using tools specific for each language.

You can write programs quickly and easily and modify them as future needs dictate. At the same time, you lower your application development costs and decrease your time to market.

LabWindows/CVI for ANSI C

We designed LabWindows/CVI as a complete ANSI C development environment designed for creating virtual instrumentation applications with built-in libraries for acquisition, analysis, and visualization. LabWindows/CVI has a simplified drag-and-drop user interface editor and automated code generation tools so you can interactively test code before adding it to your project. With LabWindows/CVI, you can create localized user interfaces, work easily with ActiveX servers, and effortlessly create multithreaded applications. LabWindows/CVI delivers a complete measurement and automation development environment with its many powerful features and the standard C programming language.

Measurement Studio for Visual Basic

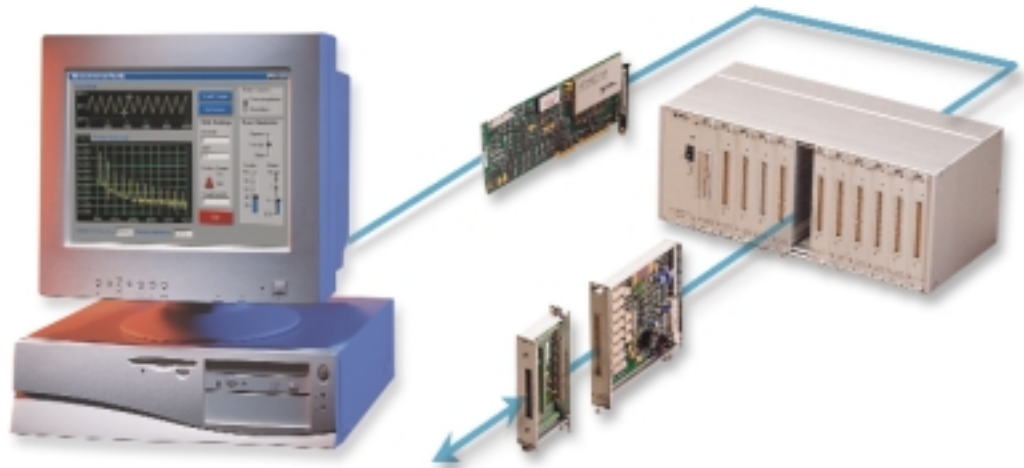
Measurement Studio provides a collection of ActiveX controls designed for engineers and scientists building virtual instrumentation systems inside Visual Basic or any ActiveX control container. With

Measurement Studio, you can configure plug-in data acquisition boards, GPIB instruments, and serial devices from property pages without having to write code. With user interface components, you can configure real-time 2D and 3D graphs, knobs, meters, gauges, dials, tanks, thermometers, binary switches, and LEDs. With powerful Internet components, you can share live measurement data between applications via the Internet. Additional tools also give you the power to add image acquisition, PID process control, and typical HMI to your application.

Measurement Studio for Visual C++

Measurement Studio delivers an interactive design approach for developing measurement and automation systems inside Visual C++. All of the tools for Visual C++ integrate into the environment so you can use them exactly as you would any of the native Microsoft tools. First, the Measurement Studio application wizard helps you start your measurement system by asking you questions about what you want to create. It then creates a project with an included code template and the measurement tools needed to design your application. These tools include C++ classes to interface with hardware, provide data analysis, and transfer data across the Internet, as well as custom COM-wrapped ActiveX controls for creating your user interface. The link between the measurement classes and interface controls are data object classes that seamlessly encapsulate and pass data from acquisition to analysis to presentation.

Measurement Studio Overview



Using the Latest Technical Standards

LabWindows/CVI Open Architecture

If you already program with C, LabWindows/CVI complements your existing efforts and streamlines your future development. Because it is built on an open software architecture, you can reuse existing programs within the LabWindows/CVI environment. You can incorporate standard ANSI C source code, object files, and DLLs within LabWindows/CVI. Or, if your organization has standardized on a general purpose C compiler from Microsoft or Borland, you can use the instrument libraries from LabWindows/CVI within these C compilers to gain productivity without changing development tools.

ActiveX/COM

Measurement Studio takes advantage of Microsoft ActiveX/COM technology, the standard for component technology, and code interchangeability and integration. Component Object Model (COM), the standard for client/server communication in Windows, creates a binary compatibility between different code from different compilers by specifying a standard interface that all code modules must support. ActiveX takes COM further, delivering an easy-to-use property page interface for configuration at design time, a user interface to the object, and flexible events and methods for programmatic control. You can use Measurement Studio ActiveX controls for data acquisition, instrumentation, analysis, and presentation within any control container, such as Internet Explorer or Excel. However, National Instruments developed Measurement Studio ActiveX controls with the Visual Basic user in mind.

If you use the tools inside Visual C++, custom interfaces wrap the user interface controls and use the same data types as the other classes. This integrates them seamlessly into your Visual C++ project so they can efficiently interact with the Microsoft Foundation Classes (MFC).

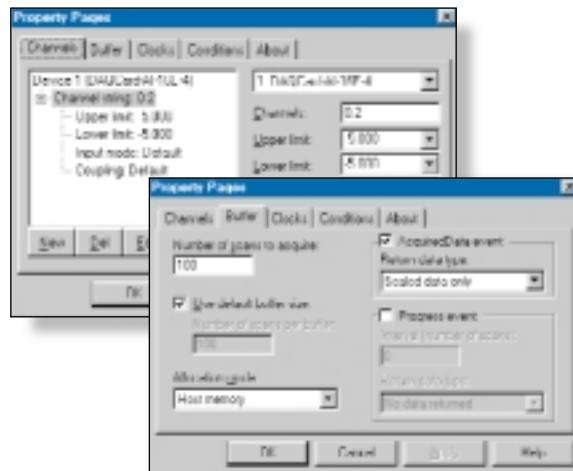
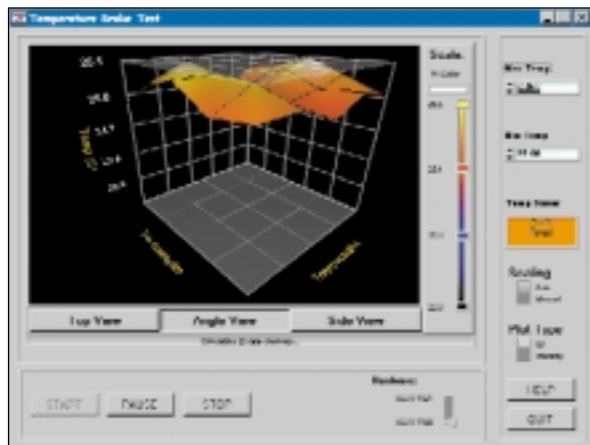
MFC

MFC is an object-oriented encapsulation of the Windows API into an easy-to-use hierarchy. Microsoft ships MFC with Visual C++ to assist developers in creating applications. MFC C++ classes, which have become the standard way to create Windows programs using the Visual C++ compiler, provide classes for creating standard user interfaces, accessing the Internet, and performing networking. MFC also can help you accomplish other tasks such as creating multidocument interfaces, serialization, and frames. Measurement Studio Visual C++ classes extend MFC to include measurement and automation functionality. Therefore, you can integrate data acquisition, instrumentation, analysis, and presentation into your MFC-based application using familiar MFC-type hierarchy and class wizard.

IVI

Wouldn't you like to use your measurement application with a multitude of instruments without rewriting your code? With the IVI standard, you can. IVI specifies standard functionality that instruments must implement in their drivers and provides a standard interface. Thus, if you use the standard class driver to write your application and your old instrument breaks or needs to be calibrated, you can use another instrument from another vendor without rewriting code.

Measurement Studio Acquisition



Easily configure analog input and output data acquisition channels within Visual Basic or Visual C++ from what is currently in your system.

Data Acquisition

Measurement Studio offers environment-specific tools for easy data acquisition. With Measurement Studio, you don't have to do low-level programming to set up your acquisition routines or transfer buffers from your computer to your data acquisition boards. Measurement Studio handles the details for you.

Functionality

- Single-point analog input – acquire a single point analog
- Waveform analog input – acquire continuous analog buffered waveforms
- Single-point analog output update – output a single-point analog update
- Waveform analog output – generate buffered waveforms
- Single-point digital input/output – input/output single-point digital updates
- Digital waveform input – acquire digital buffered
- Digital waveform output – generate buffered pattern output
- Counter/Timer – count events; measure time period, frequency and pulse width
- Pulse generation – generate single, finite, and continuous pulses
- Buffered and double buffered data acquisition and waveform generation – sample and process data or generate waveforms at maximum sampling rates
- SCXI – control channel scanning with SCXI modules and convert voltages measured from thermocouples, RTDs, thermistors, and strain gauges to appropriate units
- Self-calibration – with self-calibration circuitry hardware, adjust the gain and offset for the board within specified accuracies so you do not have to adjust trimpots to calibrate the board

TECH TIP

Hands-on Help

Get hands-on how-to help using National Instruments data acquisition hardware with the tools inside Measurement Studio. Go to the online developers community – NI Developers Zone.

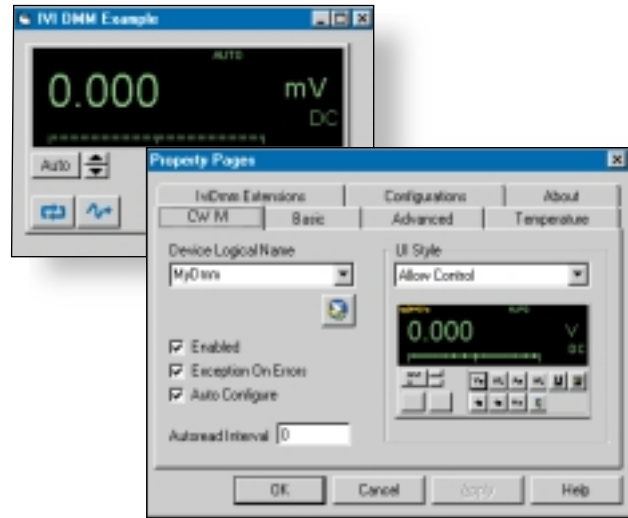
For more information, visit ni.com/info and enter `excirn`.

Measurement Studio Instrumentation

Instrumentation

Interface your application to the outside world through Measurement Studio Instrumentation functions, classes, and ActiveX controls:

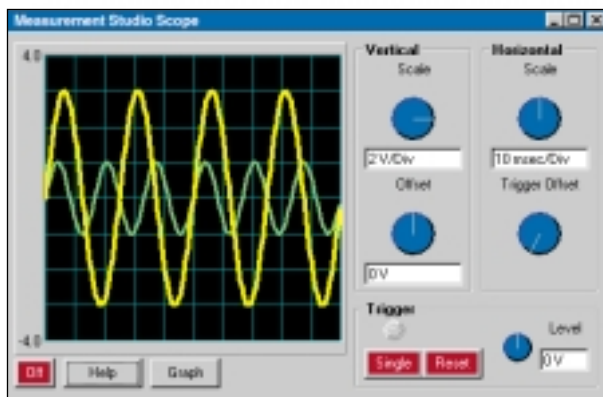
- GPIB and serial RS-232 protocols – built-in functions and ActiveX controls for communicating with instruments through these industry standard protocols
- NI VISA – built-in function libraries, C++ classes, and ActiveX controls for configuring and controlling serial, GPIB, and VXI instruments through a single interface
- NI – built-in function libraries, C++ classes, and ActiveX controls for oscilloscopes, DMMs, arbitrary waveform/function generators, switches, and power supplies. IVI, which works in much the same way as traditional instrument drivers, uses an attribute-based approach to instrument control, delivering interchangeable instrumentation, better run-time performance, and additional instrument driver capabilities, including state caching, configurable range checking, configurable status query, simple simulation, and multithread safety
- Instrument Drivers – more than 1,600 National Instruments instrument drivers are on the Web for your GPIB, VXI, and serial instruments. Use the Instrument Driver Library as your resource for finding an instrument driver. You can browse through all of our instrument drivers by instrument type, manufacturer, or development language. Or, you can search for a specific instrument driver by using the specifications most important to you – from a specific model name or manufacturer to IVI drivers or drivers supported by National Instruments. Visit the Instrument Driver Library at ni.com/idnet



Measurement Studio Instrumentation

Interactive Configuration, Testing, and Parsing

The Measurement Studio GPIB, Serial, and NI VISA ActiveX controls offer intuitive property pages for interactively configuring and testing communications with your instruments. These instrument controls also include an interactive parsing tool so you don't have to spend time parsing cryptic responses from your instruments.



TECH TIP

Make Your Instrument and Computer Communicate

Do you have an idea of how to better use that instrument on your desk by interfacing it to your computer? Learn how to get your instrument and computer communicating in no time.

For more information, visit ni.com/info and enter **exmr34** for Visual Basic/Visual C++ tips or **ex738t** for LabWindows/CVI tips.

Measurement and Automation Software

Measurement Studio Analysis

Measurement Studio

The Measurement Studio Advanced Analysis Library offers a powerful and comprehensive set of functions for analyzing your data. With these powerful analysis routines, you can convert raw data into meaningful information and build true virtual instruments.



DSP Measurement

- AC and DC Estimator
- Amplitude and Phase Spectrum
- Auto Power Spectrum
- Cross Power Spectrum
- Harmonic Analyzer*
- Impulse Response Function
- Network Functions (avg)
- Power and Frequency Estimate
- Scaled Time Domain Window
- Spectrum Unit Conversion
- Transfer Function

Signal Generation

- Arbitrary Wave
- Chirp Pattern
- Gaussian White Noise
- Impulse Pattern
- Pulse Pattern
- Ramp Pattern
- Sawtooth Wave
- Sinc Pattern
- Sine Pattern
- Sine Wave
- Square Wave
- Triangle Wave
- Uniform White Noise

Windowing

- Blackman Window
- Blackman-Harris Window
- Cosine Tapered Window
- Exact Blackman Window
- Exponential Window
- Flat Top Window
- Force Window
- General Cosine Window
- Hamming Window
- Hanning Window
- Kaiser-Bessel Window
- Triangle Window

Filters

- Bessel Filter
- Butterworth Filter
- Cascade Filter
- Chebyshev Filter
- Elliptic Filter
- Equi-Ripple Filter
- FIR Filter
- FIR Windowed Filter
- IIR Cascade Filter
- IIR Filter
- Inverse Chebyshev Filter
- Parks-McClellan Coefficients

Statistics

- 1D, 2D, and 3D ANOVA
- Chi Square Distribution
- Contingency Table
- erf(x) and erfc(x)
- F Distribution
- Histogram*
- Inv Chi Square Distribution
- Inv F Distribution
- Inv Normal Distribution
- Inv T Distribution
- Mean*
- Median and Mode
- Moment about Mean
- MSE
- Normal Distribution
- Polynomial Interpolation
- Rational Interpolation
- RMS
- Spline Interpolant
- Spline Interpolation
- Standard Deviation*
- T Distribution
- Variance

Signal Processing

- Auto Correlation
- Convolution
- Cross Power
- Cross Correlation
- Decimate
- Deconvolution
- Derivative x(t)
- Fast Hilbert Transform
- Fast Hartley Transform
- Integral x(t)
- Inverse Real and Complex FFT
- Inverse Fast Hilbert Transform
- Inverse FHT
- Peak Detection
- Power Spectrum
- Pulse Parameters
- Real and Complex FFT
- Threshold Peak Detector
- Unwrap Phase

Curve Fitting

- Exponential Fit
- General LS Linear Fit
- General Polynomial Fit
- Linear Fit
- Nonlinear Lev-Mar Fit

Array and Numeric

- 1D and 2D Array Arithmetic*
- 1D and 2D Linear Evaluation*
- 1D and 2D Polynomial Evaluation
- 1D Polar to Rectangular
- 1D Rectangular to Polar
- Quick Scale 1D and 2D Rectangular to Polar
- Scale 1D and 2D
- Find Polynomial Roots*
- Complex Number Arithmetic*
- ID Complex Array Arithmetic*

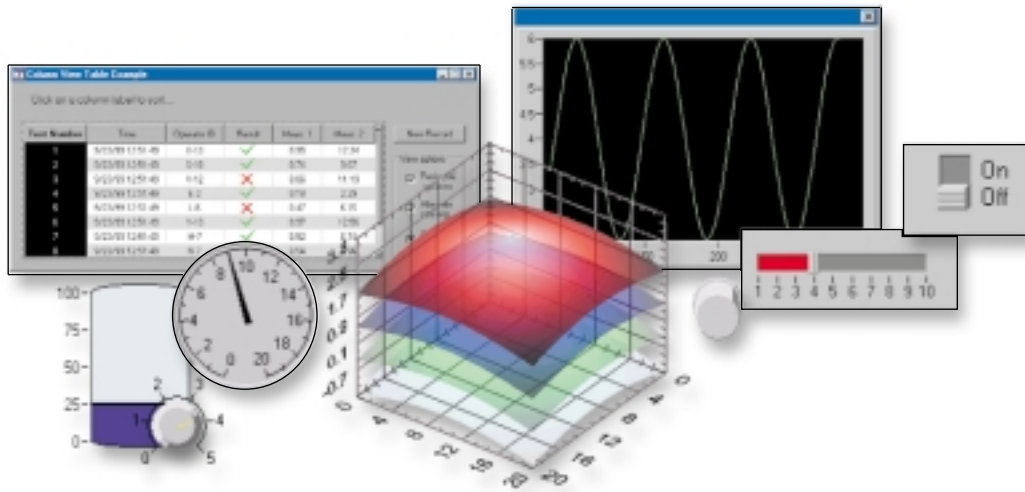
Linear Algebra

- A x B and A x Vector
- Cholesky Factorization
- Complex A x B and A x Vector
- Complex Cholesky Factorization
- Complex Determinant
- Complex Dot Product
- Complex Eigen Vectors and Values
- Complex Inverse Matrix
- Complex LU Factorization
- Complex Matrix Condition Number
- Complex Matrix Norm
- Complex Matrix Rank
- Complex Outer Product
- Complex PseudoInverse Matrix
- Complex QR Factorization
- Complex SVD Factorization
- Complex Vector Norm*
- Determinant*
- Dot Product*
- Generate a Special Matrix
- Inverse Matrix*
- Linear Equations
- LU Factorization
- Matrix Condition Number
- Matrix Multiplication*
- Matrix Norm
- Matrix Rank
- Normalize Matrix
- Normalize Vector
- Outer Product
- PseudoInverse Matrix
- QR Factorization
- Complex Linear Equations
- SVD Factorization
- Test Positive Definite Matrix
- Trace
- Transpose*

*Included in Measurement Studio Base Package

*Not included in Measurement Studio for Visual Basic

Measurement Studio Presentation/Networking



Visualization User Interface Development

Because measurement applications require real-time 2D and 3D graphs, knobs, meters, gauges, and more, Measurement Studio provides flexible measurement-focused user interface components to simplify your development and save you time:

- Knobs/meters/gauges/dials
- Binary switches/LEDs
- Sliders/tanks/thermometers
- 2D graphs
- 3D graphs
- Tables*

* LabWindows/CVI only

User Interface Controls Mimic Real World Instrument Controls

You want a user interface that is easy to learn, use, and maintain, which is why Measurement Studio provides user interface controls that mimic real-world instrument controls. Your customers can apply their existing knowledge about how buttons, knobs, switches, graphs, and tables work to understand and operate virtual instruments you build with Measurement Studio. Your customers will spend less time learning to operate a custom user interface and more time performing their job.

Easy Interactive Configuration to Design the User Interface You Need

You can configure all Measurement Studio controls through interactive property pages. In Visual C++ and Visual Basic, you can set the appearance, default state, and behavior of each control in the property pages, verify that the control looks just how you want it to in the preview window, and quickly apply the style. You can save configurations, and import and export the control styles to quickly configure new controls or apply a different configuration during runtime. In LabWindows/CVI, a component of Measurement Studio, simply double click on the control and set default properties for it. After you've created the default properties during design, you can still programmatically access the properties and attributes from LabWindows/CVI, Visual C++, and Visual Basic to customize the control during runtime.

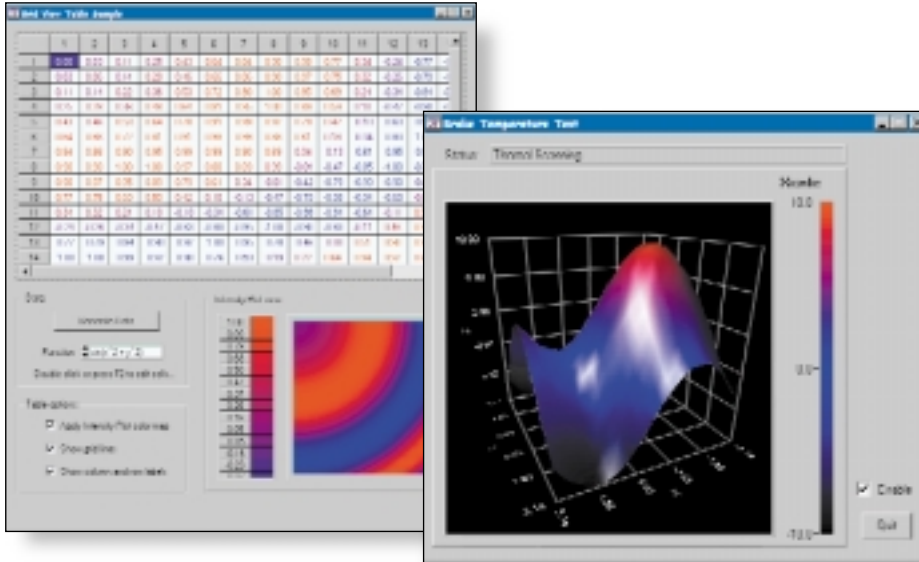
TECH TIP

Make Interfaces with Measurement Studio Tools

Find out how easy it is to make professional and intuitive interfaces for your measurement application using Measurement Studio tools.

For more information, visit ni.com/info and enter exp5j6 for Visual Basic tips and exsk6g for CVI tips.

Measurement Studio Presentation/Networking



Get the Most Out of Your Data with 2 and 3-Dimensional Visualization

Measurement Studio offers fully customizable and interactive 2D and 3D graphs, so you can effectively visualize, monitor, and analyze your data. For example, you can display waveforms acquired from DAQ boards or GPIB instruments, and chart slowly changing data such as temperature, pressure, or strain, in a scrolling strip chart. Display multiple waveforms with respect to multiple axes. Pan, zoom, and rotate graphs, or select regions of interests with cursors to identify data for further analysis.

The 2D Graph Features

- Multiple plot styles
- Multiple plots with individual properties
- Cursors to mark a specific point or region on the graph or highlight data
- Configurable axes (multiple Y axes and axis autoscaling)
- Built-in format styles for displaying scientific, symbolic engineering, scaling, time, and date labels*
- Panning and zooming at runtime

The 3D Graph Features

- Multiple plot styles
- Multiple plots with individual properties
- Configurable axes, including customizable ticks, labels, value pairs, captions, and autoscaling
- Cartesian, cylindrical, and spherical coordinate systems*
- Custom and predefined color maps
- Transparency
- Plane projections
- Orthographic and perspective viewing
- Lighting
- Built-in format styles for displaying scientific, symbolic engineering, scaling, time, and date labels*
- Rotation, panning and zooming at runtime
- 3D hardware acceleration*

*Included in Visual Basic and Visual C++ tools.

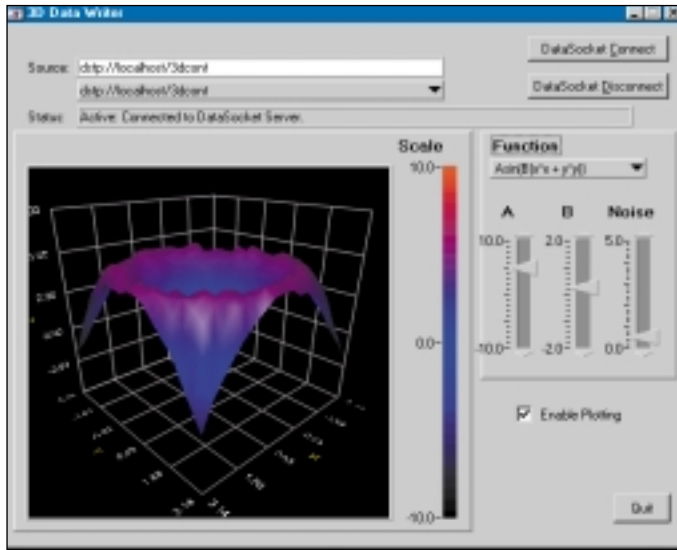
TECH TIP

Basic Interface Controls

Are you creating applications that use GPIB or DAQ and you would like to make a professional looking user interface for your application? Purchase the basic instrumentation interface controls.

For more information, visit
ni.com/mstudio/components

Measurement Studio Presentation/Networking



Networking/Internet Connectivity

Whether you are passing data between applications or passing data over the Internet, Measurement Studio makes sharing measurement data easy. With National Instruments DataSocket, a programming tool designed specifically for publishing and subscribing to live data in measurement and automation applications, you can share live data with one or more client applications on a network without worrying about data formats and network protocols.

Data Servers	Client Applications
DSTP	LabWindows/CVI applications
OPC	Visual Basic/Visual C++ applications
HTTP	LabVIEW applications
FTP	Web browsers
File	Microsoft Excel

The Measurement Studio user interface ActiveX controls include built-in DataSocket connectivity. You can connect to remote data sources over the Internet and read from, or write to, them. You can create a simple and powerful Visual Basic program to visualize measurements or publish them from your desk, and you can do it without writing code.

TECH TIP

Networking Tip

Are you connecting your application across the network? Find out how easy it is with National Instruments Tools.

For more information,
visit ni.com/catalog
and enter **exhkb**.

Measurement Studio LabWindows/CVI

LabWindows/CVI

Integrated C development environment for engineers and scientists

Rapid application development tools

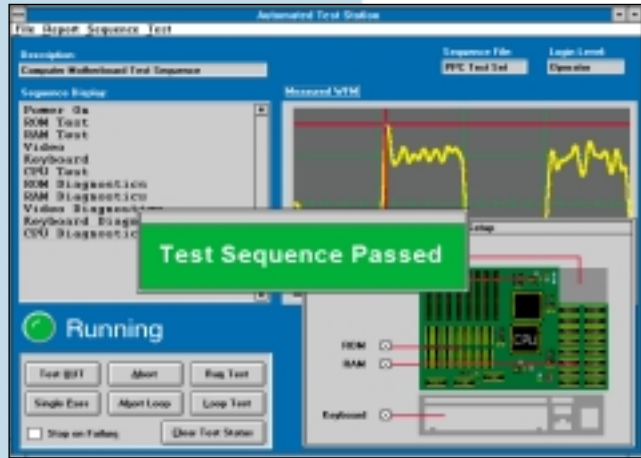
Built-in libraries for

- User interface
- ANSI C
- Data acquisition
- Instrument control
- Analysis
- Multithreading
- Internet communication
- Networking
- ActiveX automation

More than 650 instrument drivers for controlling GPIB, VXI, and RS-232 instruments

Open environment compatible with standard ANSI C code

Add-on software toolsets to accelerate your development



Better Productivity

The integrated LabWindows/CVI environment features code generation tools and prototyping utilities for fast and easy C code development. The LabWindows/CVI programming environment offers a unique, interactive ANSI C approach that delivers quick and easy access to the full power of C with the ease of use of Visual Basic.

With the LabWindows/CVI dedication to code preservation, you can save money by preserving your programming efforts. You can use the applications developed back in 1988 using LabWindows for DOS today in LabWindows/CVI.

Team Development Tools

LabWindows/CVI provides an easy-to-learn and use development environment. Educating or standardizing a team of developers or engineers on LabWindows/CVI requires very little time and effort. LabWindows/CVI interfaces with many of the most popular source code control utilities, including Visual Source Safe and Perforce, thereby providing engineers with the ability to share source files between team members. LabWindows/CVI also includes tools for sharing libraries and applications with Visual C++.

Designed for Program Reusability

With the easy-to-use LabWindows/CVI development tools, research and development engineers, designers, test engineers, service technicians, and process engineers can build PC and workstation-based virtual instruments quickly and easily. Developers can share key software components between projects and across departments, from the design labs to the production floor, using industry-standard I/O libraries and multivendor instrument driver libraries.

Integrated Development Environment

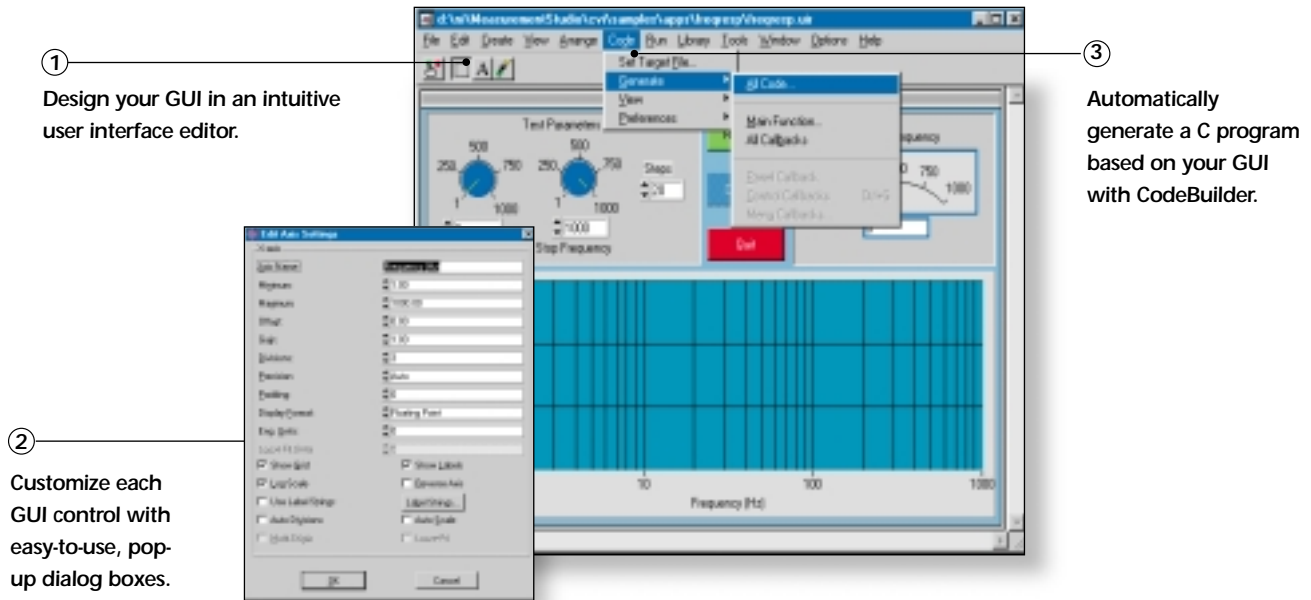
LabWindows/CVI meets the changing needs of software with an interactive development environment designed for virtual instrumentation. With easy-to-use development tools, you can quickly create, configure, and display measurements during product design and verification. LabWindows/CVI automates much of the manual coding and compiling. By hiding details found in traditional C development tools, you can focus on the instrumentation aspects of your job. The easy-to-use interactive development environment shortens the learning curve for engineers upgrading Visual Basic systems to C without sacrificing the speed or source code manageability of compiled C code.

Why Choose LabWindows/CVI?

Designed for building high-performance systems, LabWindows/CVI offers:

- ANSI C execution speed
- Small, fast executable building and distribution
- Multithreaded application development and debugging
- Faster/easier C development
- Drag-and-drop user interface development
- Automatic code generation tools
- Rapid application development process
- Easy design for test engineers
- Built-in instrumentation libraries (GPIB, DAQ, analysis, and more)
- Instrumentation-based user interface controls (graphs, knobs, and more)
- Interactive execution
- Instrument drivers
- Code reusability
- ANSI C-compatible environment
- Integrate DLLs, OBJs, and LIBs into environment

Measurement Studio LabWindows/CVI



LabWindows/CVI

Use the LabWindows/CVI programming environment to develop measurement applications in ANSI C. LabWindows/CVI includes a large set of run-time libraries for instrument control, data acquisition, analysis, and user interface. It also includes a large set of instrument drivers for controlling specific GPIB, VXI, PXI, and RS-232 instruments. The LabWindows/CVI development environment contains many measurement-specific features that make developing C-based measurement applications much easier than in traditional C development environments.

Design a Graphical User Interface

Building an application in LabWindows/CVI begins with the user interface. You use an intuitive GUI editor to interactively design virtual instruments. Select from controls designed specifically for instrumentation – such as knobs, meters, gauges, dials, graphs, and strip charts – to build your GUI. As you place each control on the GUI, you double click to customize its appearance and function to meet your needs.

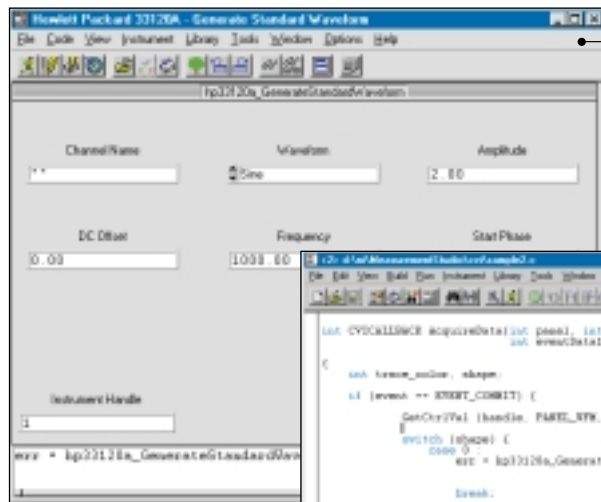
Generate Program Code

You can generate a C program using CodeBuilder that automatically generates C source code to display and respond to the controls on your user interface. CodeBuilder creates code that responds to user events such as mouse clicks, key presses, and menu selections.

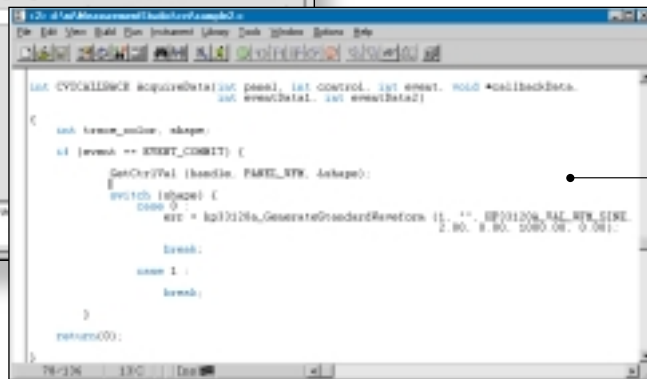
Complete the application by inserting acquisition, analysis, and control code into the program. The LabWindows/CVI function panels help you create function controls to the built-in libraries and instrument drivers. A function panel, available for every function, is a graphical representation of a LabWindows/CVI function and its parameters. You can set the values of each parameter to interactively build a function call. You can even execute the function from the function panel to test its operation, then automatically paste the function call into your source file, without the tedious process of typing and editing function calls in your program. The LabWindows/CVI development environment has an array of editing and debugging tools to streamline your programming, including a 32-bit compiler, linker, variable display, watch window, and full-function source editor.

Complete the Program with Function Panels

Measurement Studio LabWindows/CVI



4 Use interactive function panels to generate library calls, test them, and then paste them into your program.



5 Complete your program using the built-in source editor, debugger, and compiler.

Multithreading

You can easily create and debug multithreaded applications in LabWindows/CVI. The LabWindows/CVI libraries are multithread-safe, and the LabWindows/CVI Utility Library contains a large set of functions to simplify multithreaded programs. The LabWindows/CVI development environment provides full multithreaded debugging capabilities, such as setting breakpoints that can be honored in any thread and viewing the state of each thread when the program is suspended.

Automatic Run-Time Checking

When you run your LabWindows/CVI program in debug mode, the LabWindows/CVI patented User Protection feature automatically checks for program memory errors such as writing beyond the end of an array or dereferencing an uninitialized pointer. If LabWindows/CVI encounters such an error, it stops the program and points to the incorrect line of code. LabWindows/CVI also checks the calls you make to its library functions for parameter values that might cause memory errors. For example, if you pass an array to an analysis function along with a count that indicates the array is larger than it really is, LabWindows/CVI stops your program and points to the function call. Also, you can configure the LabWindows/CVI debug mode to stop your program whenever a LabWindows/CVI library function returns an error. These user protection features significantly speed up the development process.

Package Your Code for Delivery

When you finish your application, you can build an executable with a single mouse click. You also can build a DLL and incorporate your instrumentation code into external development tools or applications that work with DLLs, such as LabVIEW, Visual Basic, or other C/C++

development environments. You can package your code onto disks with the built-in LabWindows/CVI distribution kit builder and then download the code onto target computers.

The C++ tools inside Measurement Studio also provide a wizard to convert your LabWindows/CVI project into a Visual C++ project. By simply selecting your previous LabWindows/CVI project file, you insert all your source files into the project and set all necessary settings to compile and run your existing application. You can then build on your previous application by adding MFC functionality to different documents and views.

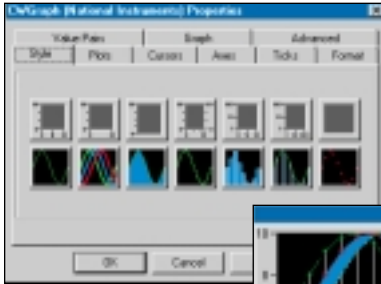
TECH TIP

Multithreading

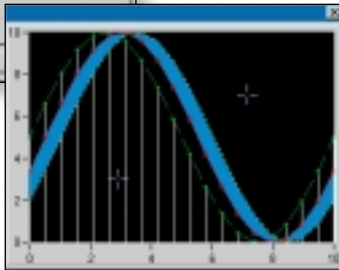
Learn all about how the LabWindows/CVI development environment provides full multithreaded debugging capabilities, such as setting breakpoints that can be honored in any thread and viewing the state of each thread when the program is suspended. Download our multithreading white paper.

For more information, visit ni.com/info and enter `exr2qt`.

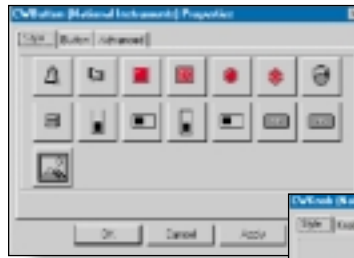
Measurement Studio Tools for Visual Basic



Choose a graph style and preset properties for axes, plots, and cursors.

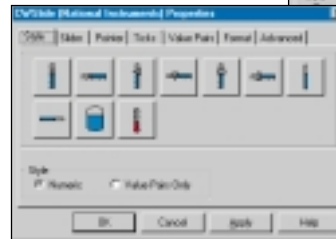


Verify your changes on the preview window before applying them.



Configure the button control as a switch or button, or use a picture of your own.

Configure the knob control as a knob, gauge, or meter.



Configure the slide control as a slide, tank, or thermometer.

Measurement Controls for Visual Basic

In 1996, National Instruments introduced ComponentWorks, a set of ActiveX controls to simplify the development of measurement and automation applications. Today, Measurement Studio incorporates these ComponentWorks controls, designed specifically for Visual Basic users.

User Interface Components for Visual Basic

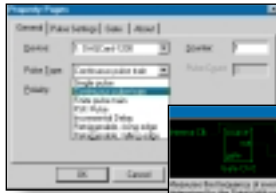
With the user interface ActiveX controls in Measurement Studio, you can configure real-time 2D and 3D graphs, knobs, meters, gauges, dials, tanks, thermometers, binary switches, and LEDs to create professional instrument front panels in your computer-based measurement applications. For example, you can display waveforms acquired from data acquisition boards or GPIB instruments. Or you can display slowly changing data, such as temperature, pressure, or strain, in a scrolling strip chart. The 2D graph displays multiple waveforms, Y axes, and interactive cursors.

Internet Components for Visual Basic

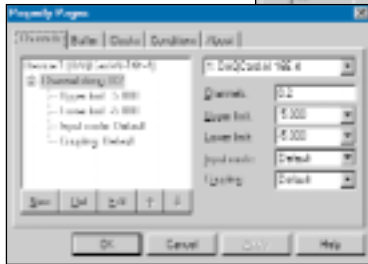
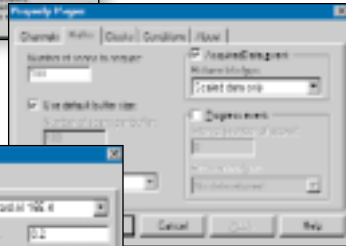
Using the DataSocket ActiveX control, you can share live measurement data between applications via the Internet. DataSocket provides a simple mechanism for interacting with DSTP, OPC, HTTP, FTP, and file servers from any ActiveX container. DataSocket delivers Plug - and - Play connectivity throughout your company by providing an easy interface for sharing live measurement data between applications separated by a network or the Internet. DataSocket delivers seamless access to live data, which empowers users throughout your company to improve productivity, reduce costs, and increase profitability. Use DataSocket to share data between Measurement Studio tools for Visual Basic, Visual C++, and LabWindows/CVI, and LabVIEW applications.

Measurement Studio Tools for Visual Basic

Measurement Controls
Tools for Visual Basic



Configure your counter to many standard signals using easy pull down menus.



Easily configure analog input and output data acquisition channels from what is currently in your system.



Measurement and
Automation Software

Instrument Control Components for Visual Basic

With Measurement Studio, you can use GPIB, serial, and VISA I/O controls and their intuitive property pages to configure communications with your instruments. You can easily send commands and receive response strings from instruments. To simplify the parsing of data strings, Measurement Studio features an interactive tool to define rules for parsing information out of instrument strings and keeping only the data you need.

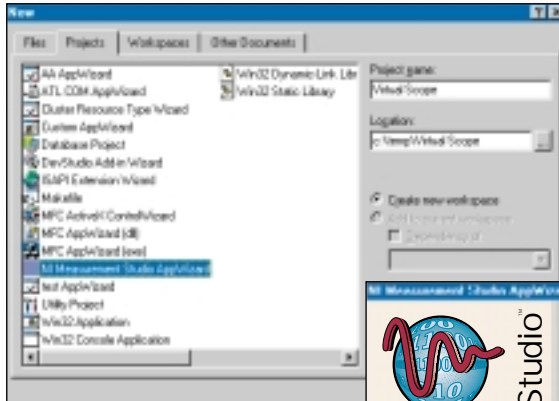
Plug-In Data Acquisition Components for Visual Basic

With the Measurement Studio DAQ controls, you can easily perform analog, digital, and timing I/O operations on all National Instruments DAQ boards. With these ActiveX controls, you configure your DAQ operations by setting properties in the intuitive property pages. There is no need for any low-level programming to set up your acquisition routines or to transfer buffers from your board to your computer – the ActiveX controls handle the details for you.

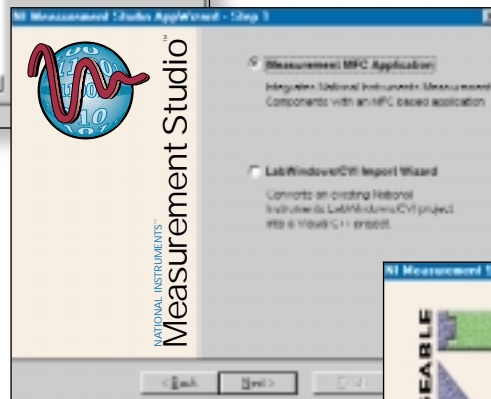
Interchangeable Virtual Instrument (IVI) Components for Visual Basic

National Instruments Measurement Studio also includes ActiveX controls for communicating with two of the most popular IVI instrument classes, oscilloscopes, and digital multimeters (DMMs). Unlike the DLL versions of the IVI drivers, these ActiveX controls increase your productivity. With the drivers, you make fewer software calls, thereby reducing configuration. The IVI components provide a less complicated programming interface to the hardware and enforce interchangeability by making sure you do not call instrument-specific functions instead of the class functions. The controls also have built-in user soft front panels so you can access the functions of your instrument without programming. Or if you prefer, turn off the soft front panel to create your own user interface.

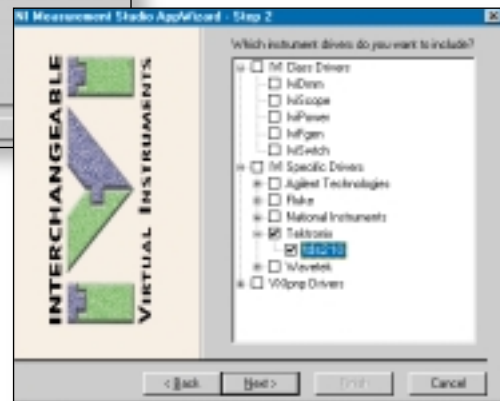
Measurement Studio Tools for Visual C++



Get a jumpstart on your application with the Measurement Studio AppWizard.



Choose between creating a new measurement application based on MFC or importing an existing application of LabWindows/CVI, a component of Measurement Studio.



Choose the instruments you need in your measurement application.

Measurement Studio Tools for Visual C++

Measurement Studio includes a Visual C++ application wizard and a set of C++ class libraries for measurement applications. Because of their object-oriented nature, class libraries are the natural way to deliver functionality to C++ users. We designed the Measurement Studio class libraries for C++ users to find it very easy to get started and complete their measurement applications quickly. Measurement Studio defines data types that simplify C++ programming for measurement applications and uses these data types across the various class libraries. Furthermore, we designed the Measurement Studio class libraries to work well with the Microsoft Foundation Class (MFC) libraries.

User Interface Display Components for Visual C++

Because measurement applications require real-time 2D and 3D graphs, knobs, meters, gauges, and more, Measurement Studio provides these flexible measurement-focused user interface

components to simplify your development and save you time. You also can programmatically modify each property during the execution of the program to give you total programming flexibility.

Internet Components for Visual C++

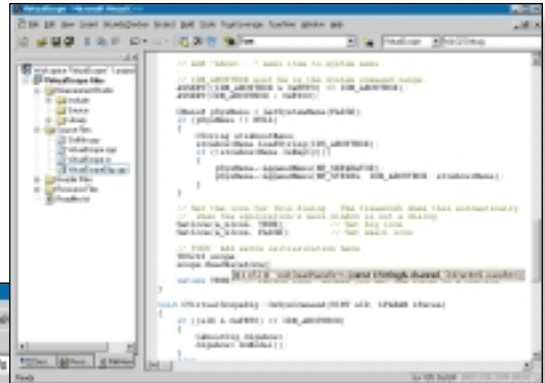
With the new DataSocket classes, you can easily share measurement data with numerous interfaces, such as OPC, HTTP, FTP, and DTSP across any network, including the Internet. By using a client/server architecture, the data transfer across the network is optimized, making user interaction to live data across the Internet a reality. You can then view test information or control your system from anywhere in the world.

Measurement Studio Tools for Visual C++

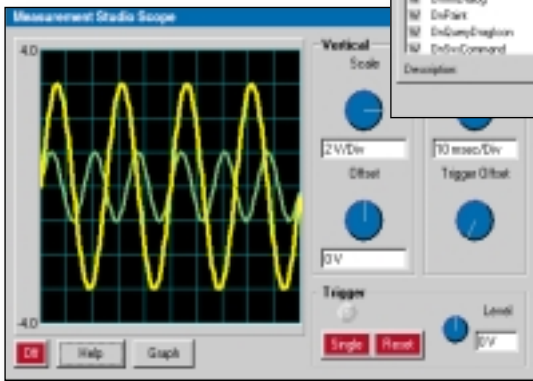
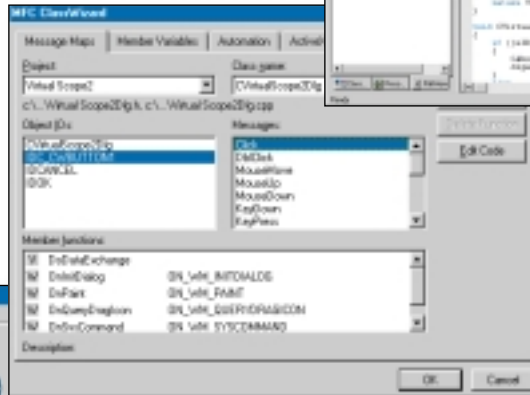
Measurement Studio Tools for Visual C++

Measurement and
Automation Software

Use intuitive IntelliSense
for all C++ classes to
complete your program.



Map user interface events
to your code using the
MFC ClassWizard.



Design your GUI using intuitive
measurement specific controls.

Analysis Components for Visual C++

Measurement Studio includes a powerful and comprehensive set of functions for analyzing data in Visual C++. You condition and transform your signal using smoothing windows, digital filters, frequency domain transforms, or measurement functions. With these powerful analysis routines, you can convert raw data into meaningful information and build robust virtual instruments.

Instrument Control Components for Visual C++

Interface your application to the outside world through Measurement Studio instrumentation classes. In addition to using the GPIB IEEE 488.2 library to send and receive commands to and from instruments, you can use VISA, an industry-standard I/O library, to communicate with your instruments. With VISA, you can control GPIB, VXI, or serial devices using the same API.

Application Wizard

To simplify the development of measurement applications in Visual C++, Measurement Studio features an application wizard. Built on the MFC AppWizard, you simply select the instrument drivers you want to include in your project and the type of measurement application you want to create, and the wizard automatically generates an MFC project with the necessary user interface, analysis, and instrumentation components.

Backward Compatibility with LabWindows/CVI

You can benefit from National Instruments 12-year record of upward code mobility by using the LabWindows/CVI import wizard to preserve your legacy code. You can port any application developed in LabWindows/CVI to Visual C++ without changing a single line of code, and add to your existing application using Visual C++ to extend your measurement application.

Measurement Studio Development Systems

	Component Starter Kit (ActiveX Controls only)	Base Package (LabWindows/CVI, ActiveX Controls, C++ Classes)	Full Development System (LabWindows/CVI, ActiveX Controls, C++ Classes)
User interface controls	Yes	Yes	Yes
Instrument control	Yes	Yes	Yes
Data acquisition	Yes	Yes	Yes
1D and 2D array operations	Yes	Yes	Yes
Statistics	Yes	Yes	Yes
3D visualization	No	Yes	Yes
Internet tools	No	Yes	Yes
Curve fitting	No	No	Yes
Signal processing	No	No	Yes
Signal generation	No	No	Yes
Filtering	No	No	Yes
Windowing	No	No	Yes
Windows standard development kit	No	No	Yes
IVI ActiveX controls	No	No	Yes
HiQ	No	No	Yes

Starter Kit

The Measurement Studio Starter Kit includes the essential set of ActiveX controls you need to build a measurement application. It includes acquisition controls (DAQ, GPIB, serial, and VISA), the base analysis library, and the basic user interface controls (knobs, switches, buttons, numerical edit, and 2D graph).

Base Package

For basic instrumentation applications, select the base package and gain the flexibility to use all the programming tools – LabWindows/CVI, a component of Measurement Studio, and tools for Visual Basic and Visual C++. The Base Package includes all the acquisition, instrumentation, user interface, and base analysis. The package also adds 3D graphing optimized with OpenGL and simplified network, and Web functionality for making distributed virtual instrumentation.

Full Development System

For high-end applications, the Full Development System (FDS) has everything that you need. The FDS adds DSP and advanced analysis capabilities, IVI instrumentation controls, and the HiQ mathematics package for additional post process analysis and report generation.



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