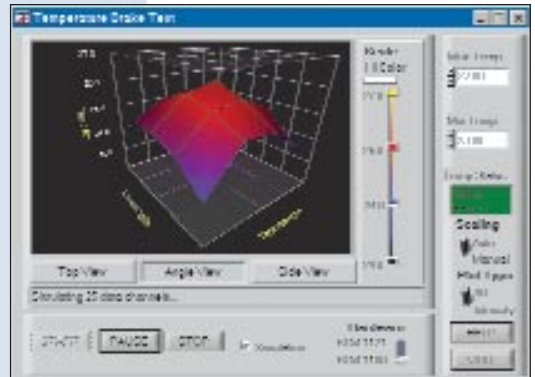


LabWindows/CVI – Development Tools for ANSI C

NI LabWindows/CVI

- Fully integrated workspace
 - Integrated ANSI C development environment
 - Built-in measurement libraries for I/O, analysis, and presentation
 - Interactive user interface, instrument drivers, and code creation
 - Advanced ActiveX and multithreaded capabilities
- Open system architecture
 - Innovative task creation and code generation
 - Vision development
 - Signal processing
 - Comprehensive debugging tools

Operating Systems
Windows 2000/NT(SP6)/XP



LabWindows/CVI

A History of Innovation

August 2003	Fully Integrated Workspace/Enhanced Hardware Support • Version 7.0
August 2001	ActiveX/Improved Presentation • Version 6.0
February 2000	Multithreaded Libraries/Debugging • Version 5.5
March 1998	VXIplug&play and IVI Compatibility • Version 5.0
May 1996	External C/C++ Compiler Compatibility • Version 4.0
July 1995	Automatic Program Generation • Version 3.1
March 1994	Multiplatform for Windows and Sun • Version 3.0 for DOS
April 1991	GUI Tools and Memory Extender • Version 2.0 for DOS
January 1989	Introduction • LabWindows 1.0 for DOS

Figure 1. LabWindows/CVI began a history of innovation in 1987 and has grown from DOS to Microsoft Windows XP. During this evolution, NI continues to maintain easy migration and backward compatibility.

Overview

National Instruments LabWindows/CVI is a proven test and measurement ANSI C development environment that increases the productivity of engineers and scientists. NI LabWindows/CVI streamlines development with robust debugging, DAQ Assistant, Instrument I/O Assistant, built-in libraries to simplify multithreading, and interactive execution to run functions at design time. By integrating ActiveX controls and standard ANSI C modules into LabWindows/CVI applications, you can reuse components for advanced development. The flexibility and customization of LabWindows/CVI optimizes test and measurement applications through acquisition, analysis, and presentation.

A variety of industries use LabWindows/CVI, including military and defense, manufacturing, telecommunications, and aerospace. Whether you are measuring network transmitter signal strength or developing a telecom manufacturing test system, NI virtual instrumentation and LabWindows/CVI can help you achieve your goals – faster, better, and under budget.

Features

LabWindows/CVI is a fully integrated development environment for building measurement systems based on DAQ, GPIB, PXI, VXI, serial, and Ethernet-based devices. LabWindows/CVI combines an interactive development approach with the programming power and flexibility of compiled ANSI C code. The interactive development tools and libraries are specifically designed for developers of automated test systems, benchtop experiments, DAQ monitoring projects, verification tests, and control systems.

LabWindows/CVI – Development Tools for ANSI C

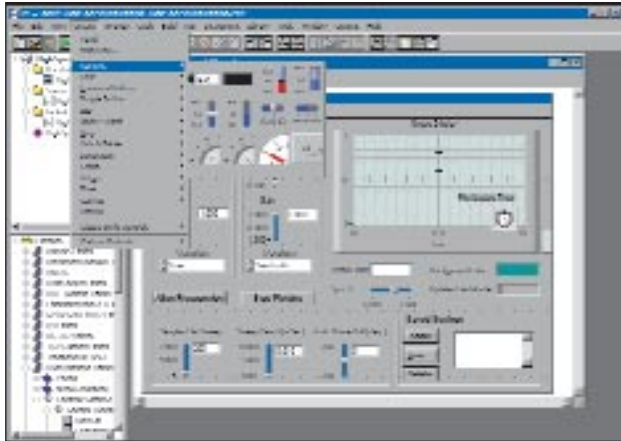


Figure 2. Design your GUI in an intuitive user interface editor. Select from controls designed specifically for instrumentation.

Program Development

Building an application in LabWindows/CVI begins with the user interface. To interactively design virtual instruments, use the intuitive graphical user interface (GUI) editor to select controls designed specifically for measurement applications. You can customize the appearance and function of each control to meet your needs. LabWindows/CVI automatically generates C source code that responds to the controls on your user interface.

To complete the application, insert measurement libraries such as hardware integration and signal analysis into the program using simplified code generation tools called function panels. A function panel is an intuitive graphical way to set the values of each parameter, view help, execute the function from the function panel to test its operation, and insert the function call into your source code.

LabWindows/CVI also provides tools to catch common programming mistakes. When you run your 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, de-referencing an uninitialized pointer or variable, or accessing uninitialized variables. When such an error occurs, LabWindows/CVI stops the program, points to the error, and provides a meaningful error message.

Measurement-Specific Functionality

LabWindows/CVI provides user interface controls such as knobs, switches, sliders, thermometers, graphs, tables, and tree controls to give your application a professional, intuitive interface. With libraries for data acquisition, GPIB, serial, NI-VISA, VXI, Motion, Vision, and Interchangeable Virtual Instruments (IVI), you have many choices for instrumenting your measurement system. To turn raw data into useful information, LabWindows/CVI includes robust inline analysis tools. With the LabWindows/CVI Advanced Analysis Library, you can easily make sophisticated measurements. LabWindows/CVI includes

the NI DataSocket networking architecture to publish information over the Internet or create distributed applications with minimal network traffic. LabWindows/CVI also includes lower level libraries, such as TCP/IP, that you may need to further customize the way you transfer your data.

Advanced Features

LabWindows/CVI interfaces with many of the most popular source code control utilities, including Microsoft Visual Source Safe and Perforce, providing you the ability to share source files between team members.

With the LabWindows/CVI ActiveX Controller Wizard, you can create a set of function panels from any registered ActiveX component on your machine. You can include ActiveX controls in your user interface to create advanced applications, such as video conferencing. You also can create custom ActiveX server applications or test modules so other developers can easily find and reuse the ActiveX servers in many different development environments.

With LabWindows/CVI, you can easily create and debug multithreaded applications using the Utility Library, which contains a large set of functions to simplify multithreaded programming.

LabWindows/CVI also includes the Instrument Driver Development Wizard, which you can use to create a driver for controlling an instrument. Using this wizard, you can generate source and include files and function panels.

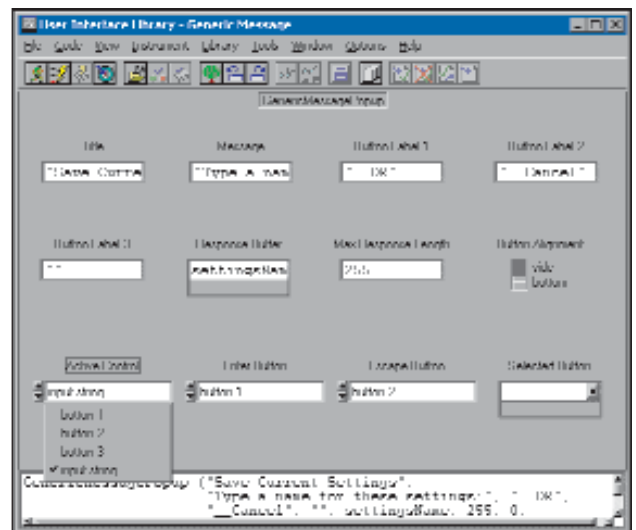


Figure 3. Use interactive function panels to generate library calls, test the calls, and insert them into your program. A function panel is a graphical representation of an LabWindows/CVI function and its parameters.

LabWindows/CVI – Analysis

LabWindows/CVI Analysis

The LabWindows/CVI Analysis Libraries offer a comprehensive set of functions for analyzing your data. With these powerful analysis routines, you can convert raw data into useful information and build true virtual instruments. For more complete analysis information, visit ni.com/analysis

Measurement

AC and DC estimator
Amplitude and phase spectrum
Autopower spectrum
Cross-power spectrum
Total harmonic distortion
Impulse response
Network functions (avg)
Power frequency estimate
Scaled time-domain window
Spectrum unit conversion
Transfer function

Signal Generation

Arbitrary wave
Chirp pattern
Gaussian noise
Impulse pattern
Pulse pattern
Ramp pattern
Sawtooth wave
Sinc waveform
Sine pattern
Sine wave*
Square wave
Triangle pattern
Triangle wave
Uniform noise
White noise*

Windowing

Blackman window
Blackman-Harris window
Tapered cosine 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
Butterworth
Cascade
Chebyshev
Elliptic
Equiripple
FIR
FIR windowed
IIR cascade
IIR
Inverse Chebyshev
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
Mode
Moment about mean
MSE
Normal distribution
Polynomial interpolation
Rational interpolation
Root mean squared value (rms)
Spline interpolant
Spline interpolation
Standard deviation*
T distribution
Variance

Signal Processing

Autocorrelation
Convolution
Cross power spectrum
Cross correlation
Decimate
Deconvolve
Derivative x(t)
Fast Hilbert transform
Fast Hartley transform
Integral x(t)
Inverse real and complex
Fast Fourier transform (FFT)
Inverse fast Hilbert transform
Inverse fast Hartley transform (FHT)
Peak detection
Power spectrum
Pulse parameters
Real and complex FFT
Threshold peak detector
Unwrap phase

Curve Fitting

Exponential fit
General LS linear fit
Polynomial fit
Linear fit
Nonlinear Lev-Mar fit

Array and Complex Operations

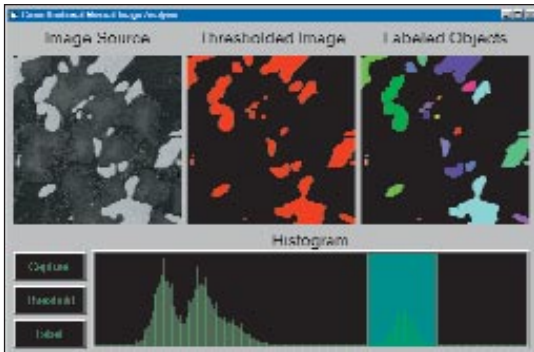
1D and 2D array arithmetic*
1D and 2D linear evaluation*
1D and 2D polynomial evaluation
1D polar to rectangular
1D rectangular to polar
Quick scale 1D and 2D
Scale 1D and 2D
Find polynomial roots
Complex number arithmetic*
1D complex array arithmetic*

Linear Algebra

Cholesky factorization
Complex Cholesky factorization
Complex determinant
Complex dot product
Complex eigenvectors and eigenvalues
Complex inverse matrix
Complex LU factorization
Complex matrix
Complex matrix norm
Complex matrix rank
Complex outer product
Complex pseudoinverse matrix
Complex QR factorization
Complex SVD factorization
Complex vector norm
Condition number
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 LabWindows/CVI Base Package

LabWindows/CVI Modules and Add-On Tools



Vision Development Module

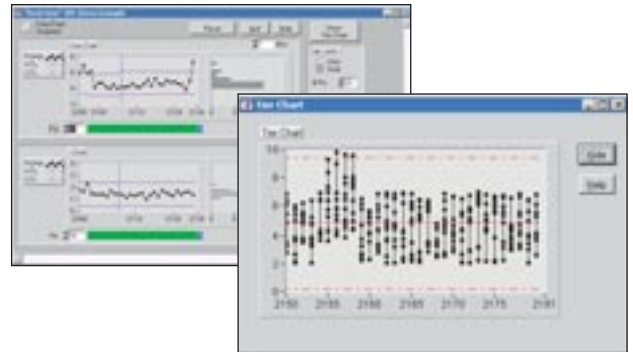
The National Instruments Vision Development Module includes NI Vision, a library of native LabWindows/CVI function panels, and NI Vision Assistant, an interactive environment for configuring vision applications. The Vision Development Module is designed for scientists, automation engineers, and technicians who build machine vision and scientific imaging applications. NI Vision Assistant is for developers who need to quickly prototype vision applications without programming.

IMAQ Vision

- Inspection and pattern matching
- Blob analysis and morphology
- Measurement and gauging
- Image enhancement and quantitative analysis
- Color image processing and frequency-domain processing

NI Vision Assistant

- Interactive environment
- Scripting and batch processing
- Visually managed image

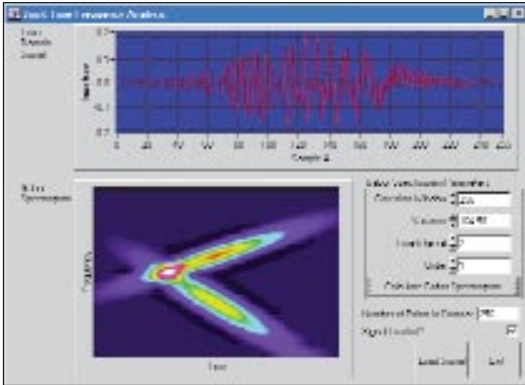


Enterprise Connectivity Toolset

As your business grows, you need enterprise connectivity tools to help you monitor your progress from research and development to the production, test, and service of your product. The LabWindows/CVI Enterprise Connectivity Toolset provides integrated tools for structured query language (SQL) database operations, statistical process control (SPC) quality control, and Internet-enabling technology to give you the access and networking you need for business operations.

- Database Connectivity
- Statistical Process Control
- Internet Connectivity

LabWindows/CVI Modules and Add-On Tools



Signal Processing Toolset

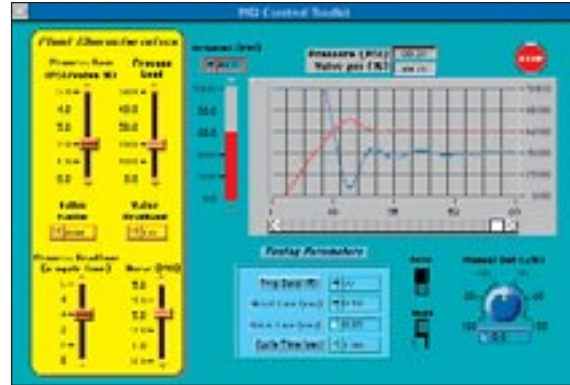
With the LabWindows/CVI Signal Processing Toolset, you can build software to analyze and process signals that include transient (short duration) components. Functions packaged as 32-bit DLLs are available through standard LabWindows/CVI function panels. With these functions, you can design and use wavelet-based filter banks, model-based (super-resolution) spectral analysis, joint time-frequency analysis (JTFA), and digital filters.

IVI Driver Toolset

Instrument drivers are an integral component in modern automated test systems. They perform the communication and control of the instrument hardware in the system, as well as providing a high-level and easy-to-use programming model that turns complex instrument measurement capabilities into simple software function calls.

Interchangeable Virtual Instruments, or IVI, is a standard for instrument driver software technology. IVI builds on the *VXIplug&play* specifications and incorporates new features that address issues such as system performance, development flexibility, and instrument interchangeability. IVI drivers also take advantage of the power of the VISA I/O library defined by *VXIplug&play* to seamlessly communicate with instruments across different I/O buses such as GPIB, VXI, PXI, Serial, Ethernet, and USB.

- Standard class and instrument-specific drivers
- Advanced debugging capabilities
- Advanced instrument simulation capabilities
- Executable soft front panels
- Interchangeable virtual instruments (IVI)



PID Control Toolkit

The PID Control Toolkit adds sophisticated control algorithms to LabWindows/CVI. With this package, you can quickly build data acquisition and control systems for your own control application. By combining the PID Control Toolkit with the math and logic functions in LabWindows/CVI, you can quickly develop process control applications.

With the PID control tools, you also can add advanced process control algorithms to your application. In addition to implementing the standard PID algorithm, these tools include the Autotuning Wizard to help you optimize the PID parameters for your specific system. You can use PID tools with any kind of physical input and output options, including DAQ devices and PLCs.

LabWindows/CVI Ordering Information

Full Development System

The LabWindows/CVI Full Development System (FDS) provides everything you need to develop powerful measurement applications. The FDS adds report generation capabilities; advanced analysis capabilities such as curve fitting, signal processing, signal generation, and filtering; NI Measurement Studio – add-in components for Microsoft Visual Studio; and the Windows Software Development Kit (SDK) to the LabWindows/CVI Base Package features.

Base Package

The Base Package includes libraries for acquisition, instrumentation, user interface development, and base analysis. The package also has 3D graphing optimized with OpenGL and the simplified network and Web functionality of DataSocket for developing distributed virtual instrumentation systems.

NI Developer Suite

NI Developer Suite is a subscription program that includes the software tools you need to build a complete measurement system. From making measurements to analyzing and presenting results, NI Developer Suite brings you the latest industry-standard software and provides you with regular quarterly updates of NI application and driver software as well as other software resources to keep you up to date with the very latest development tools.

NI TestStand

National Instruments TestStand 3.0 reduces test development time and simplifies maintenance. National Instruments designed TestStand to automate a wide variety of test systems. Out of the box, TestStand is a ready-to-run test executive that organizes, controls, and executes your automated prototype, validation, or production test systems.

LabWindows/CVI Development Packages

	Base Package	Full Development System
User Interface Controls	✓	✓
Instrument Control	✓	✓
Data Acquisition	✓	✓
IVI Driver connectivity	✓	✓
3D Visualization	✓	✓
Networking Tools (DataSocket)	✓	✓
ActiveX capabilities	✓	✓
Statistics	✓	✓
DAQ Assistant	✓	✓
Instrument I/O Assistant	✓	✓
XML capabilities	✓	✓
LabVIEW Real-Time connectivity	✓	✓
NI TestStand Integration	✓	✓
Curve Fitting		✓
Signal Processing		✓
Signal Generation		✓
Report Generation		✓
Filtering		✓
Windowing		✓
Windows Software Development Kit		✓
NI Measurement Studio for Microsoft Visual Studio		✓

Services and Support

As a complement to your LabWindows/CVI product, consider the following options:

LabWindows/CVI Software Subscription Program (SSP) – Software upgrades and priority support for one year – ni.com/ssp

Technical Support – FREE through Applications Engineers worldwide, Web resources, and Premier Support – ni.com/support

LabWindows/CVI Training – Instructor-led courses – ni.com/training

Professional Services – Feasibility, consulting, and integration through our Alliance Program members – ni.com/alliance

For more information about NI services and support, visit ni.com/services

Ordering Information

NI LabWindows/CVI for Windows 2000/NT (SP6)/XP	
Development systems	
Full Development System	776800-03
Base Package	776801-03
Vision Development Module	777860-03
Add-on tools	
Enterprise Connectivity Toolset	777875-03
Signal Processing Toolset	777136-01
PID Control Toolkit	776991-01
IVI Driver Toolset	777855-03
SPC Toolkit	777209-01
Software subscription service	930001-02

NI Developer Suite offers many of these products bundled with other NI software tailored for test or control applications. See page 39 for more information.

NI LabWindows/CVI for Sun

Full Development System	776820-03
SPC Toolkit	777209-11

Training

Basics I Course	910019-xx1
Basics II Course	910512-xx1
Instrument Driver Development Course	910556-xx1
VXI Course	910504-xx1

Please refer to Training and Certification (page 758) to complete part number.

BUY ONLINE!

Visit ni.com/info and enter *labwindowscvi*