
NATIONAL
INSTRUMENTS™

A brief introduction to

NI LabVIEW

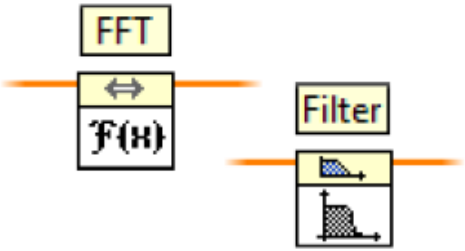
NATIONAL INSTRUMENTS

NATIONAL INSTRUMENTS

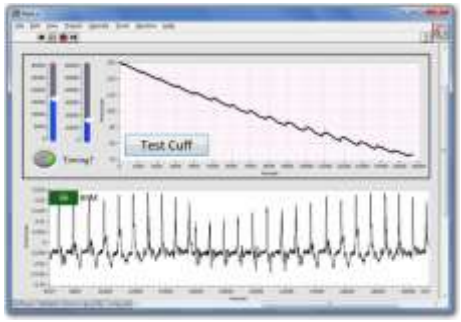
LabVIEW™

A Highly Productive Graphical Development Environment for Engineers and Scientists

Hardware APIs

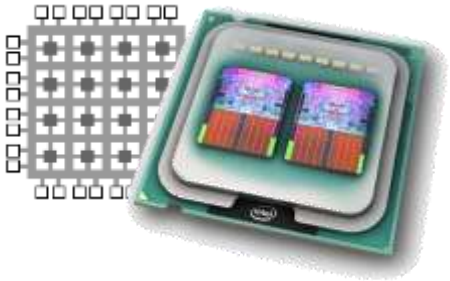


Built-in Libraries

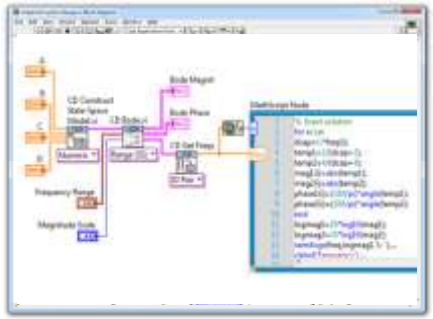


Custom User Interfaces

Deployment Targets



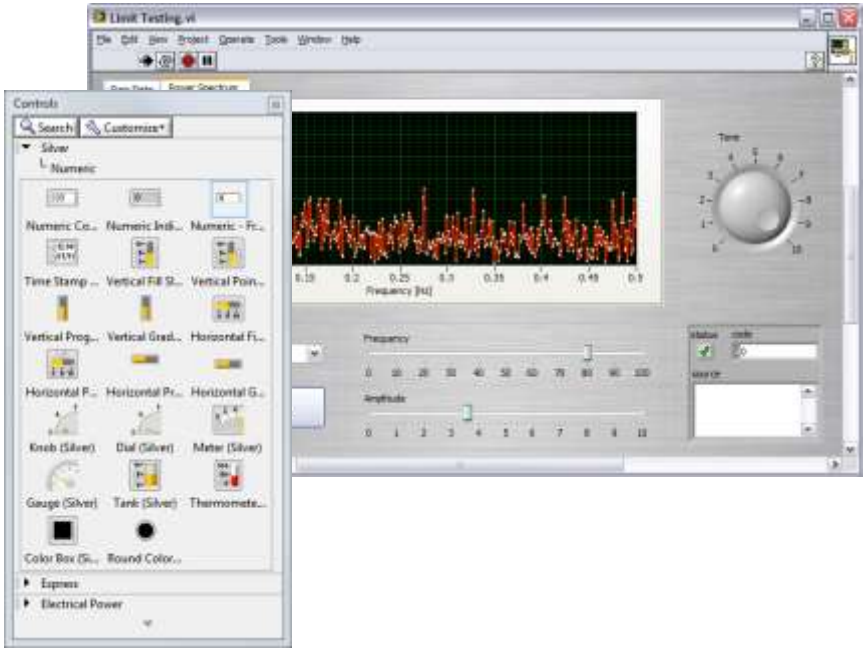
Technology Abstractions



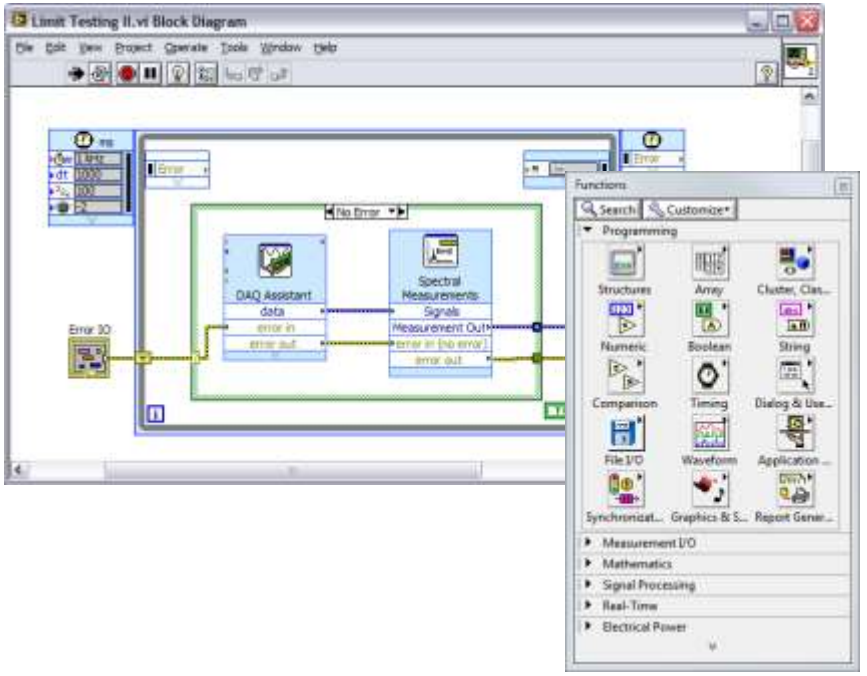
Approaches

NI LabVIEW Development Environment

Front Panel



Block Diagram



"An intuitive graphical programming for engineers and scientists to acquire, analyse, present, and log real-world data"

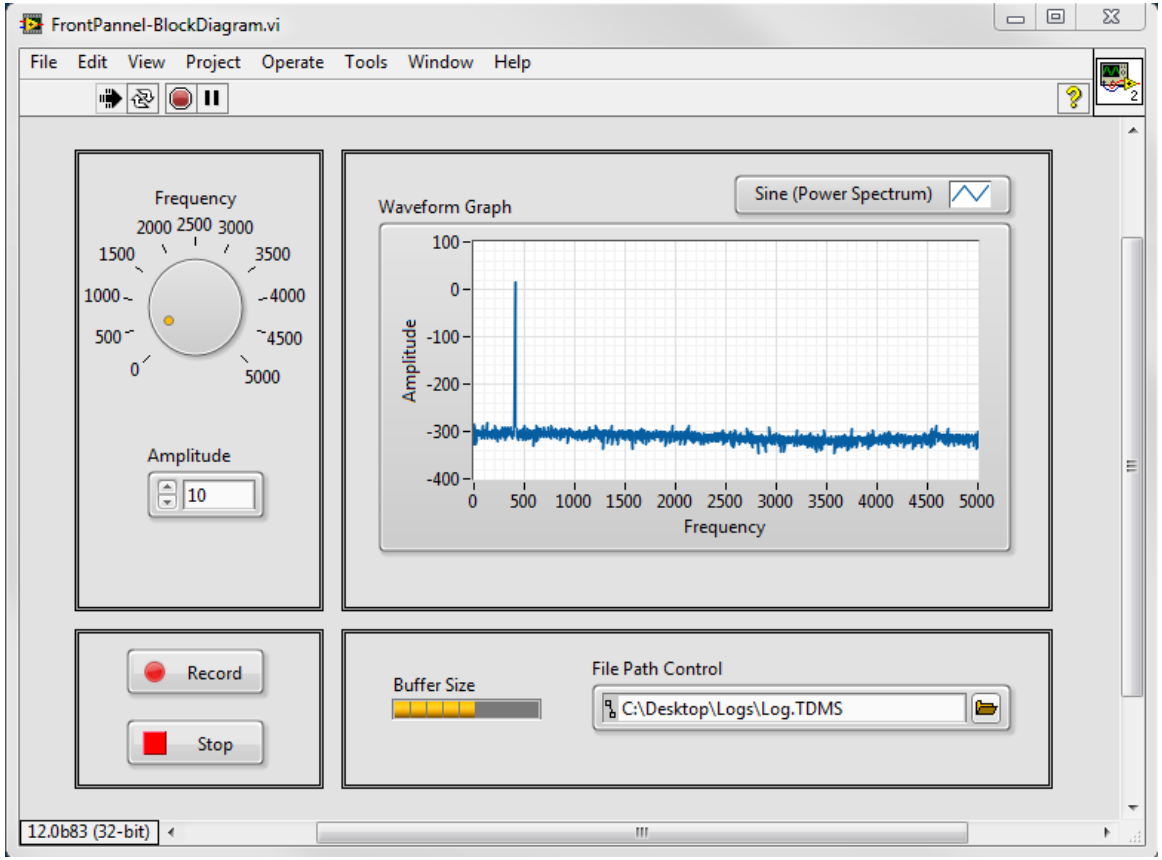
uk.ni.com
ireland.ni.com

NATIONAL INSTRUMENTS

Controls & Indicators

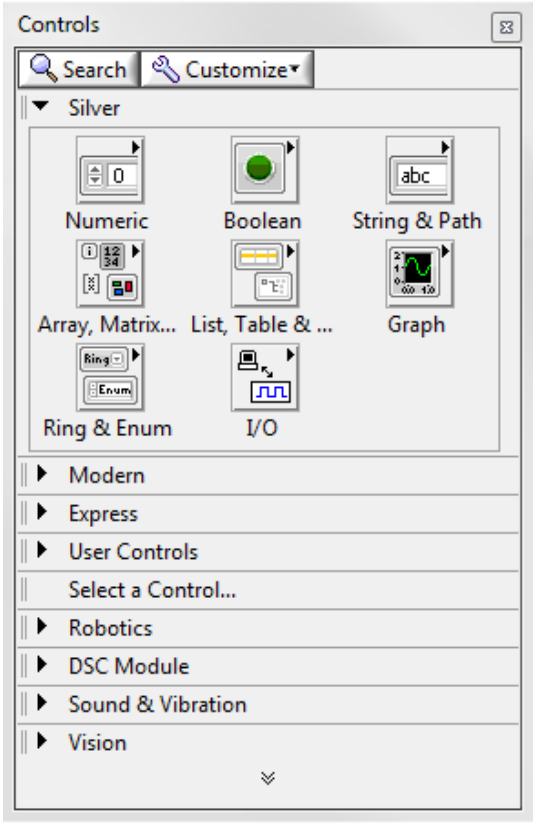
Front Panel

- Knobs/Dials
- Graphs/Charts
- Buttons
- Digital Displays
- Sliders
- Thermometers
- Customise and create your own



Finding Front Panel Objects

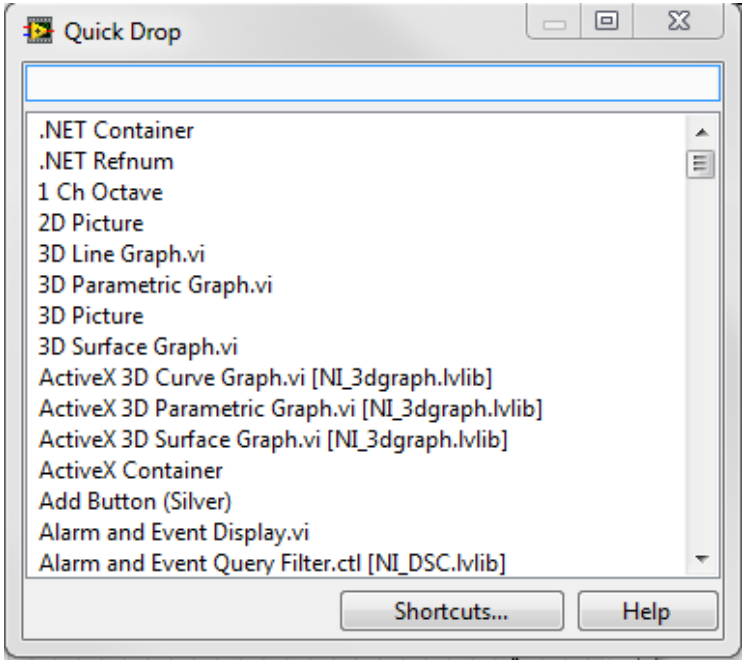
Controls Palette



- Right-click on Front Panel
- Browse by object hierarchy

or

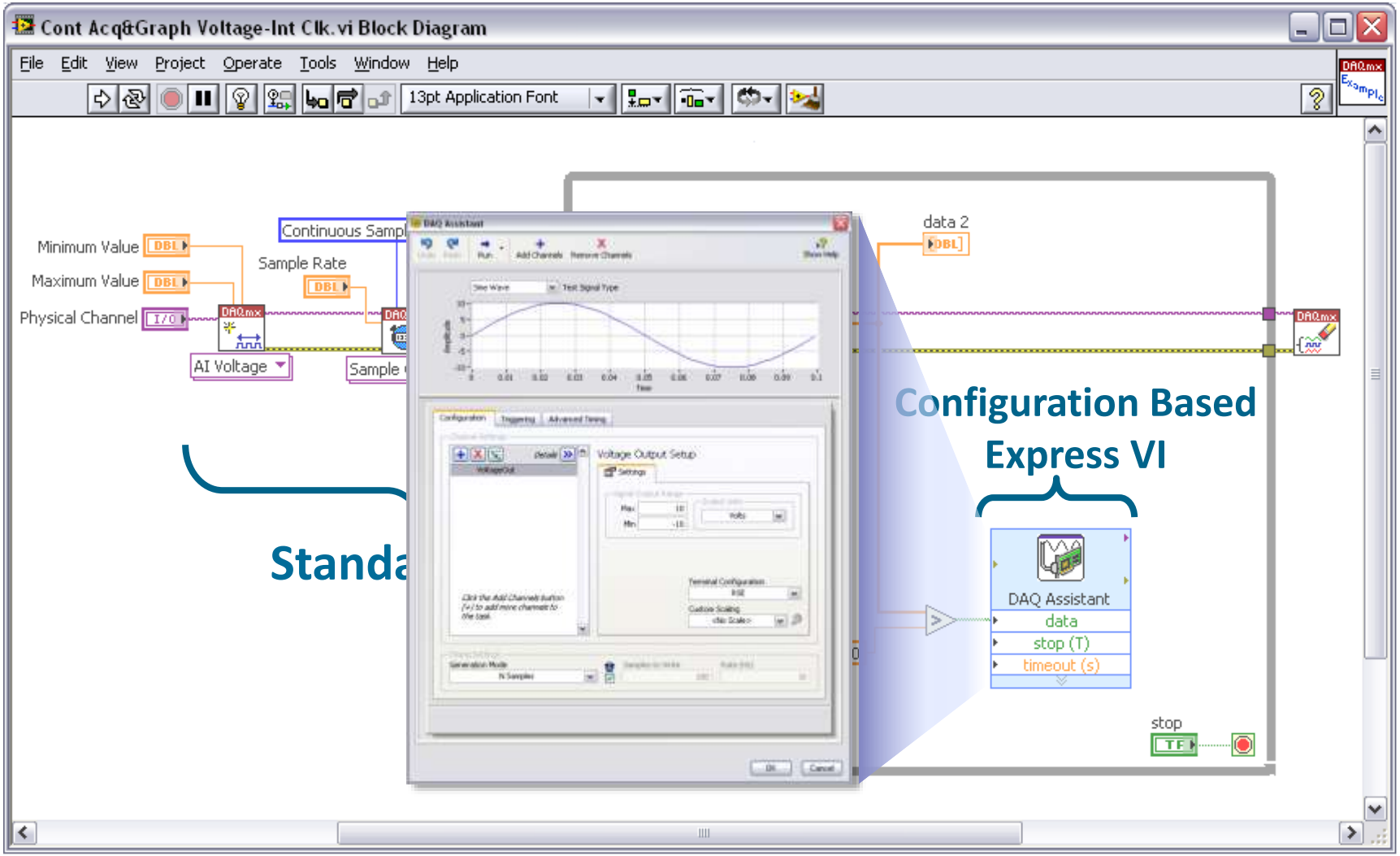
Controls Quick Drop



- Press <ctrl + space> to bring up
- Search by object name

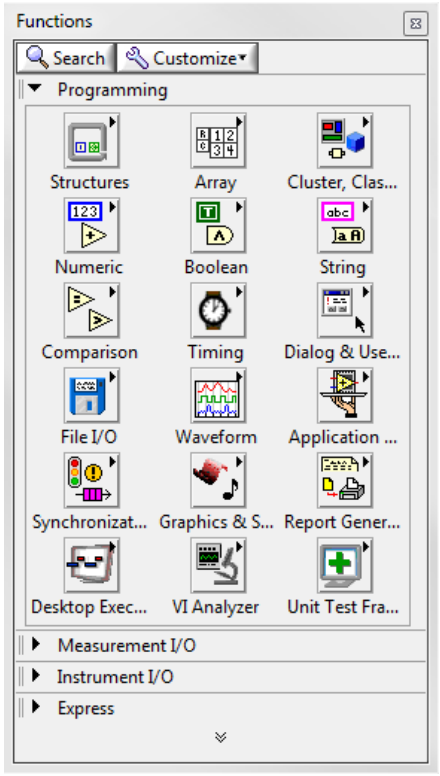
Functions and Express VIs

Block Diagram



Finding Block Diagram Functions

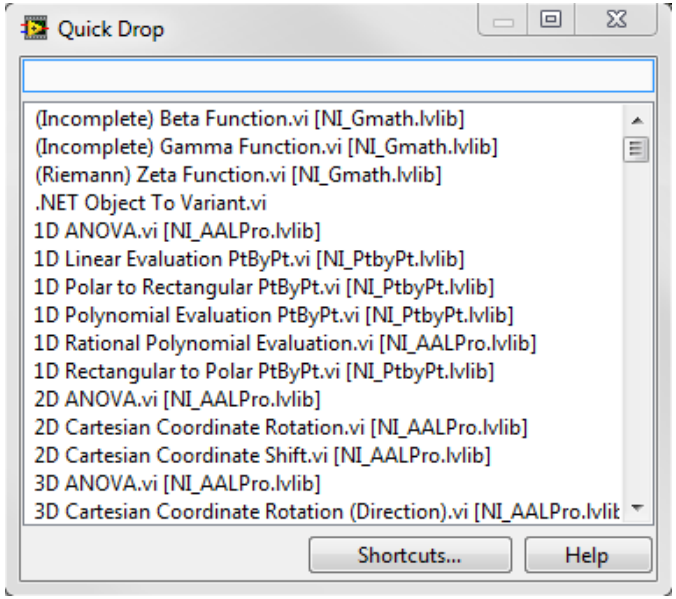
Functions Palette



- Right-click on Block Diagram
- Browse by object hierarchy

or

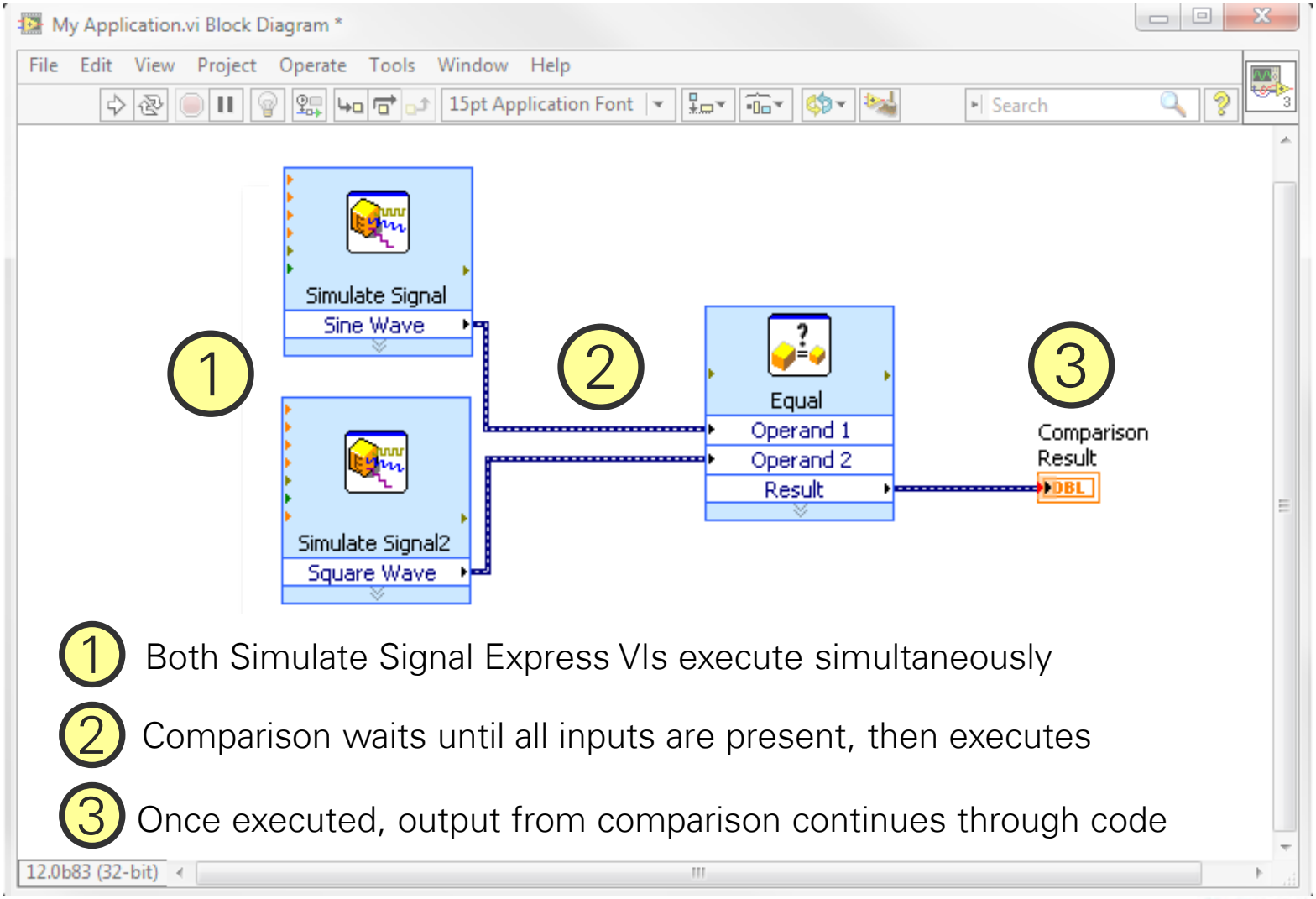
Functions Quick Drop



- Press "ctrl + space" to bring up
- Search by object name

Dataflow Programming

Block Diagram

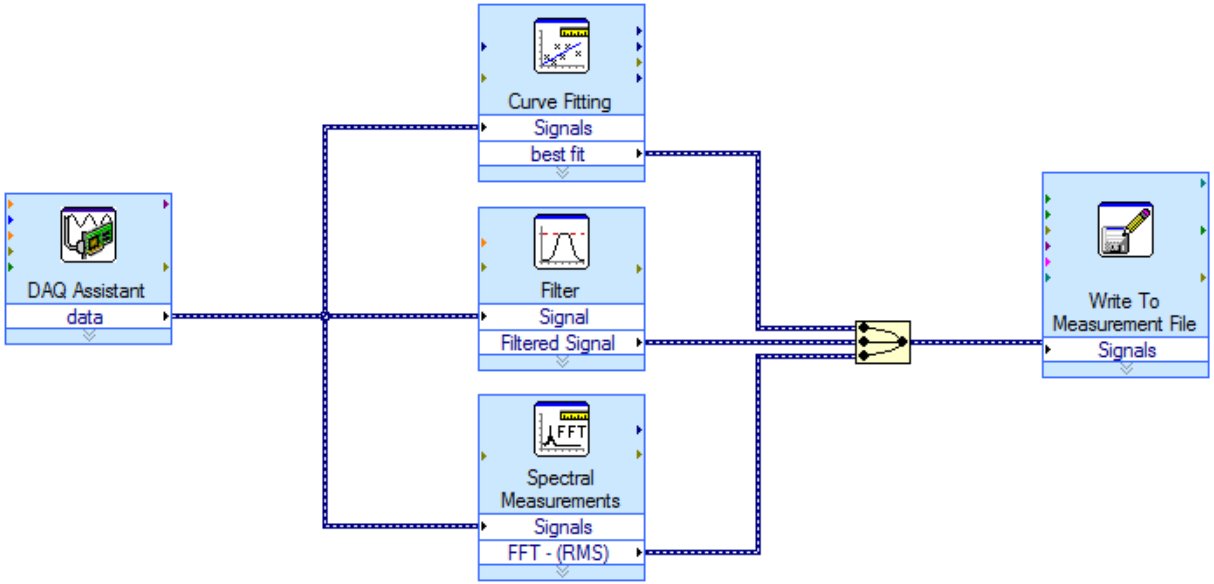


1. Both Simulate Signal Express VIs execute simultaneously
2. Comparison waits until all inputs are present, then executes
3. Once executed, output from comparison continues through code

Block Diagram

Automatic Multithreading in LabVIEW

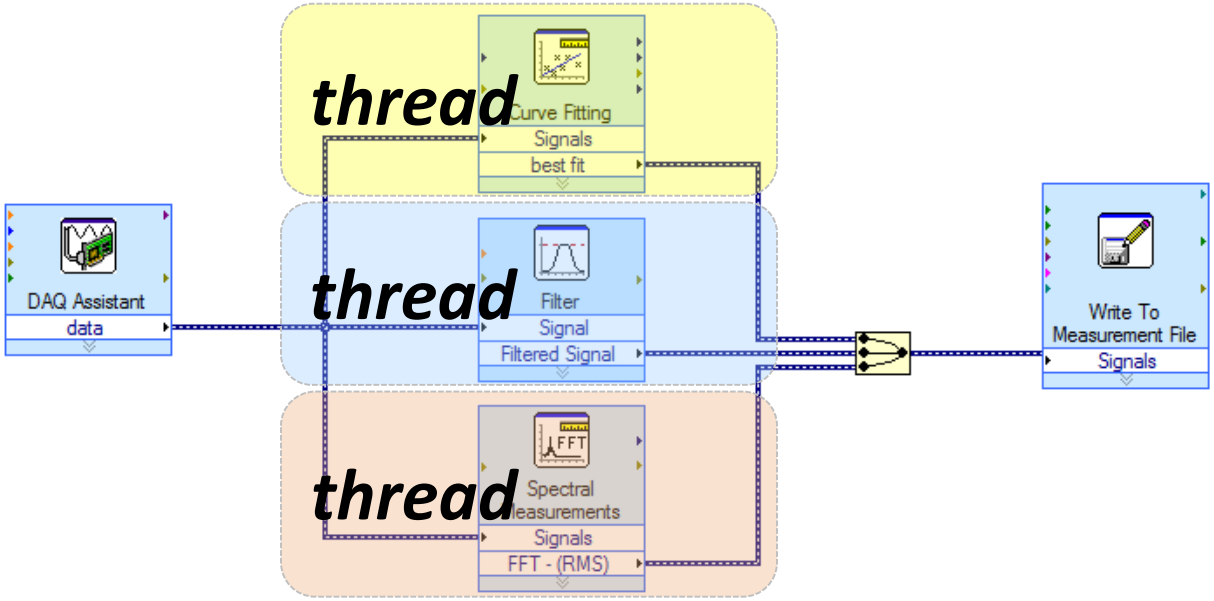
- LabVIEW automatically divides each application into multiple execution threads
- LabVIEW introduced multithreading in 1998



Block Diagram

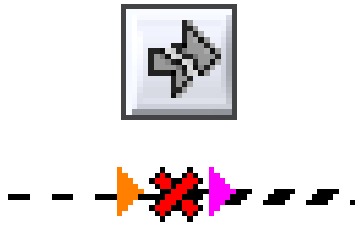
Automatic Multithreading in LabVIEW

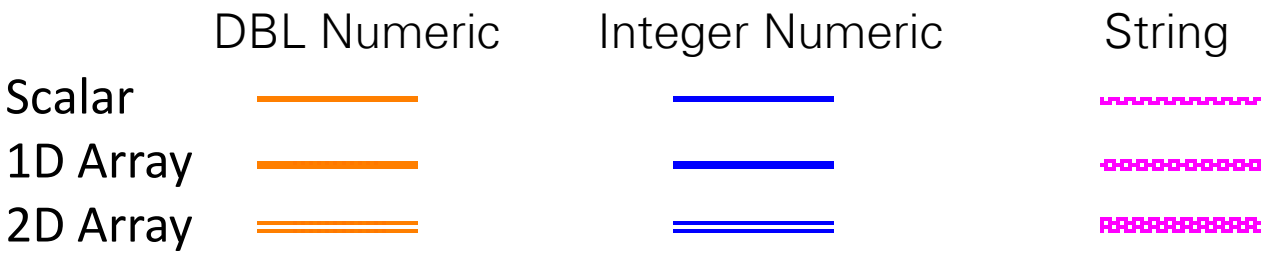
- LabVIEW automatically divides each application into multiple execution threads
- LabVIEW introduced multithreading in 1998



Wires and Data Types

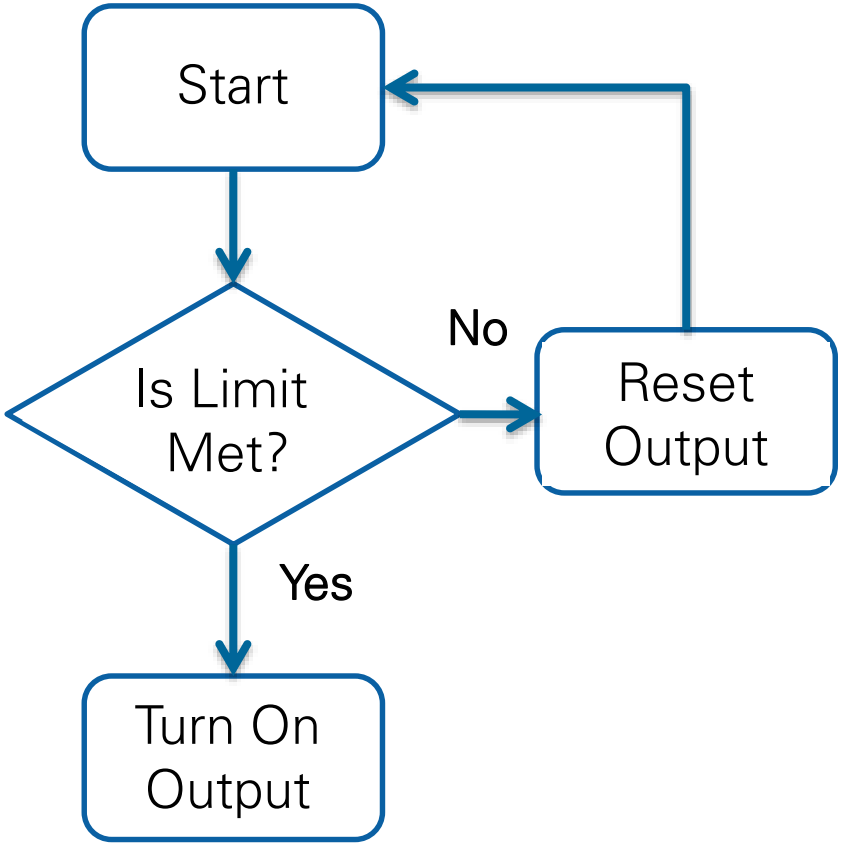
- Transfer data between block diagram objects through wires
- Wires are different colors, styles, and thicknesses, depending on their data types
- A broken wire appears as a dashed black line with a red X in the middle





Controlling Program Execution

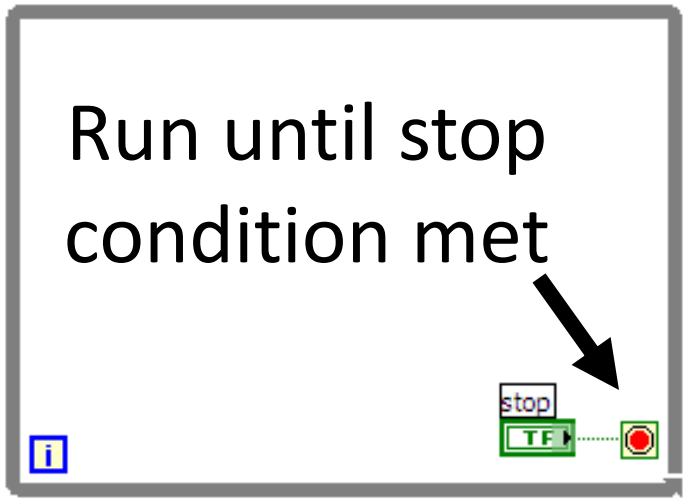
Block Diagram



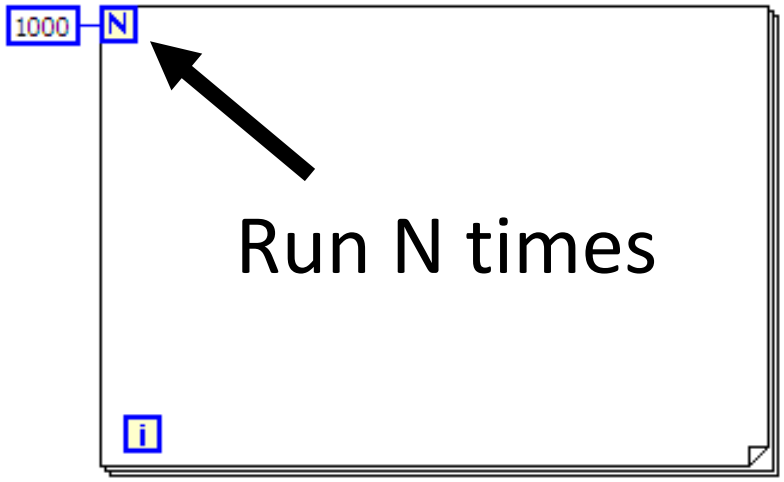
- Looping (For and While)
- Case structure
- Sequence structure
- State machines
- Event structure
- State diagram editor
- Timed loop

Execution Control Structures

While Loop



For Loop

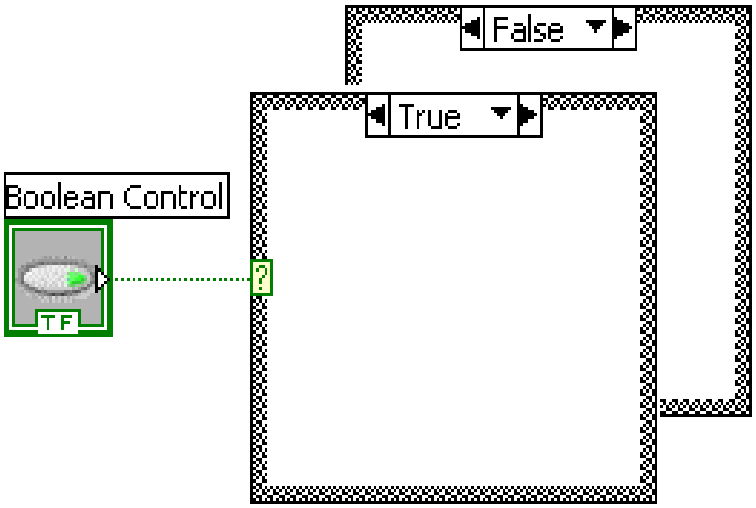


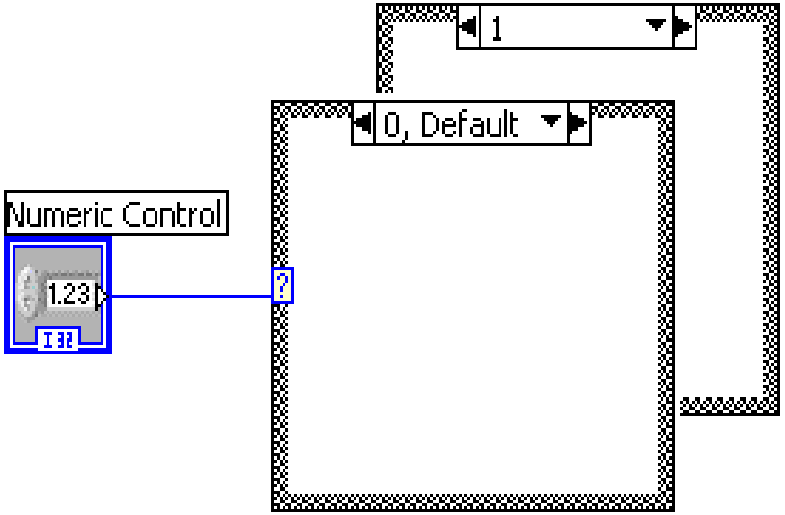
- Allow same piece of code to run multiple times
- Exit conditions different for each

LabVIEW Case Structure

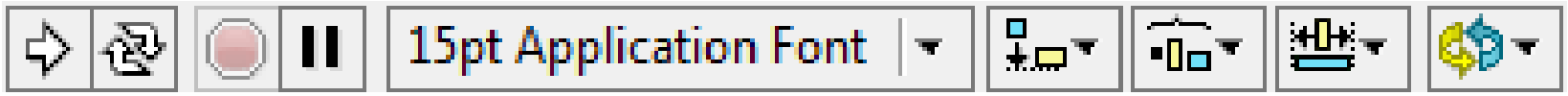
Block Diagram

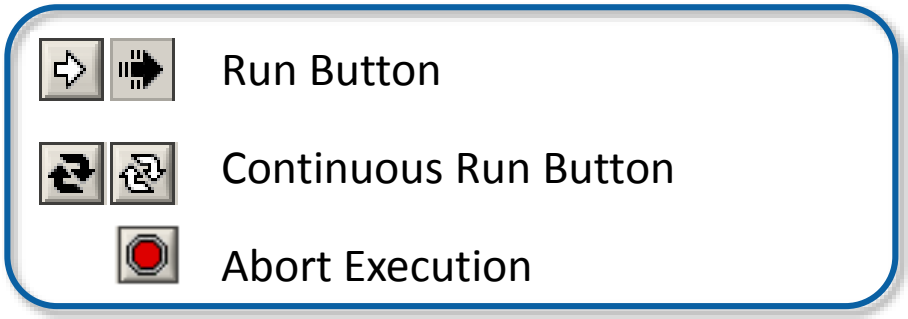
Primary decision making block



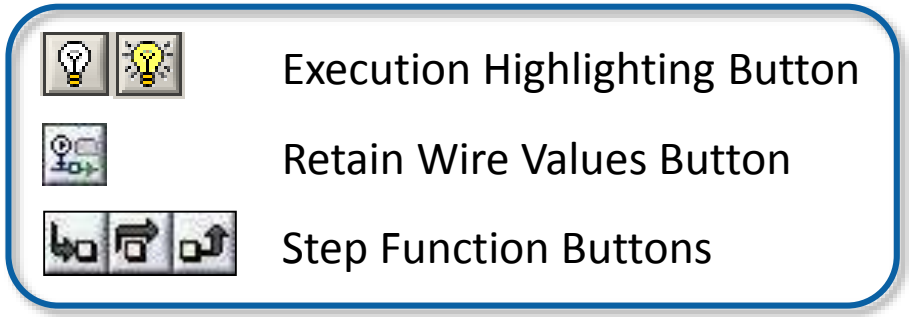


Status Toolbar

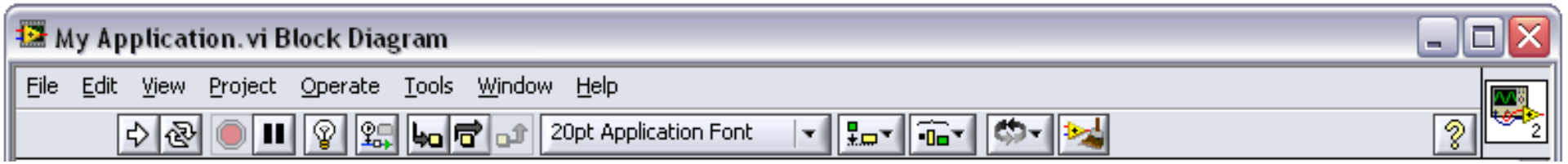




Additional Buttons on the Block Diagram Toolbar



Built-in Programming Assistance



Highlight Execution

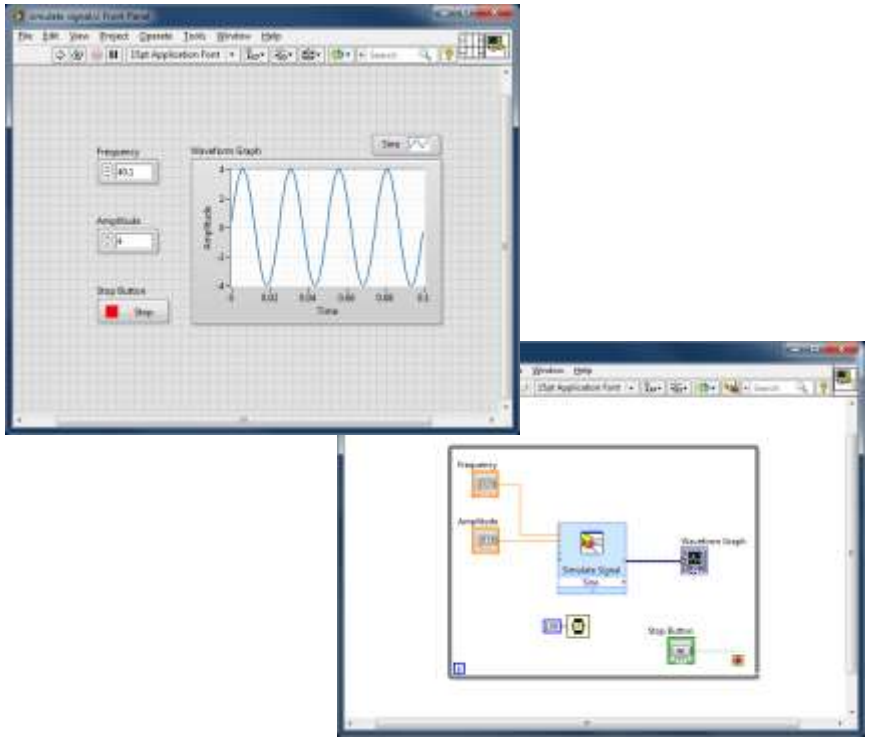
Block Diagram Cleanup

Context Help

Exercise 1 – Simulate Signal to Graph

- Simulate signals
- Write to Graph

Time to complete: 20 minutes



A brief introduction to

Data Acquisition

NATIONAL INSTRUMENTS

DAQ Solution for Your Application

Distributed

Desktop

Rugged and Modular Test

Portable

NI DAQ Platforms

Acquire Analyze Present
with NI LabVIEW

One application, multiple targets

NATIONAL INSTRUMENTS LabVIEW™

USB

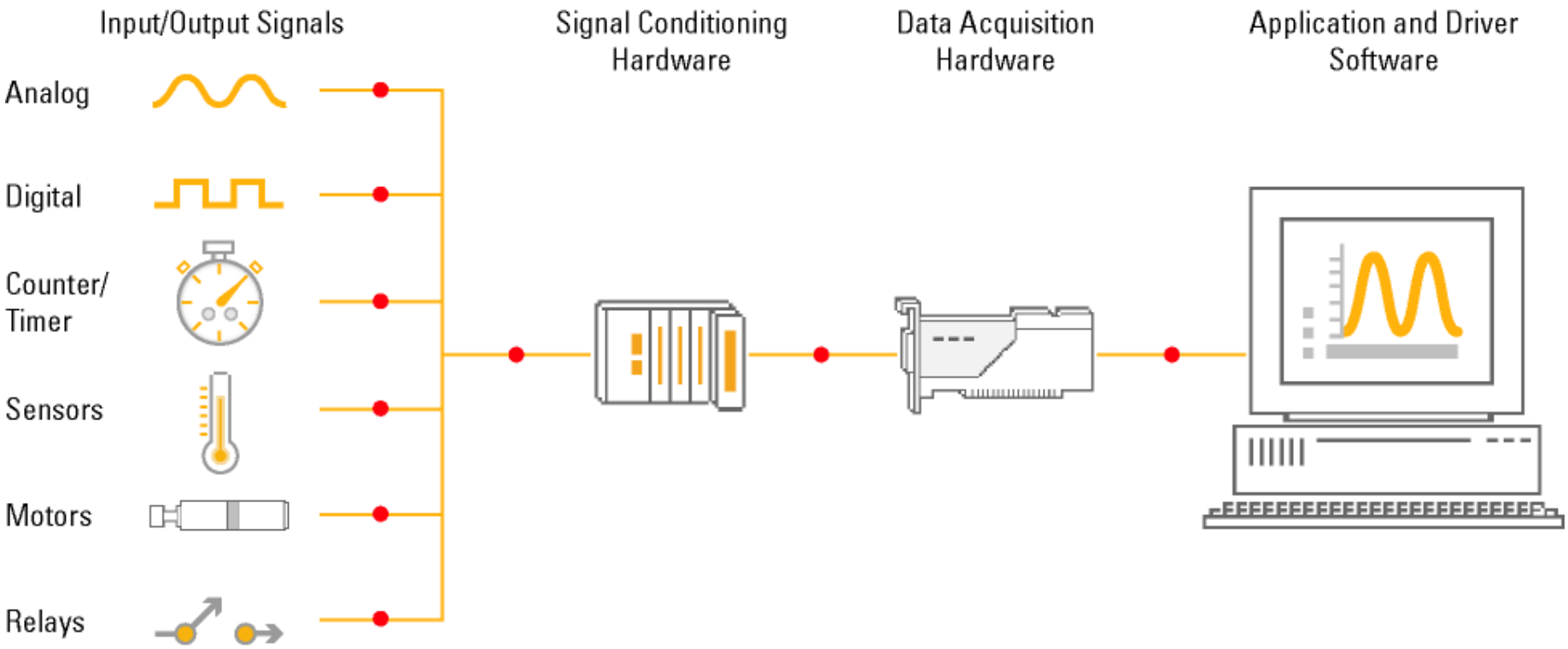
Wireless

PCI

CompactDAQ

PXI

PC-Based Data Acquisition (DAQ)



What is NI CompactDAQ (cDAQ)?

Acquire Analyze Present
with NI LabVIEW

> CompactDAQ provides a flexible, expandable platform to meet the needs of any PC-based electrical or sensor measurement system.

The system is comprised of:

- Chassis
- NI C Series Module(s)
- Windows OS host PC
- Sensors

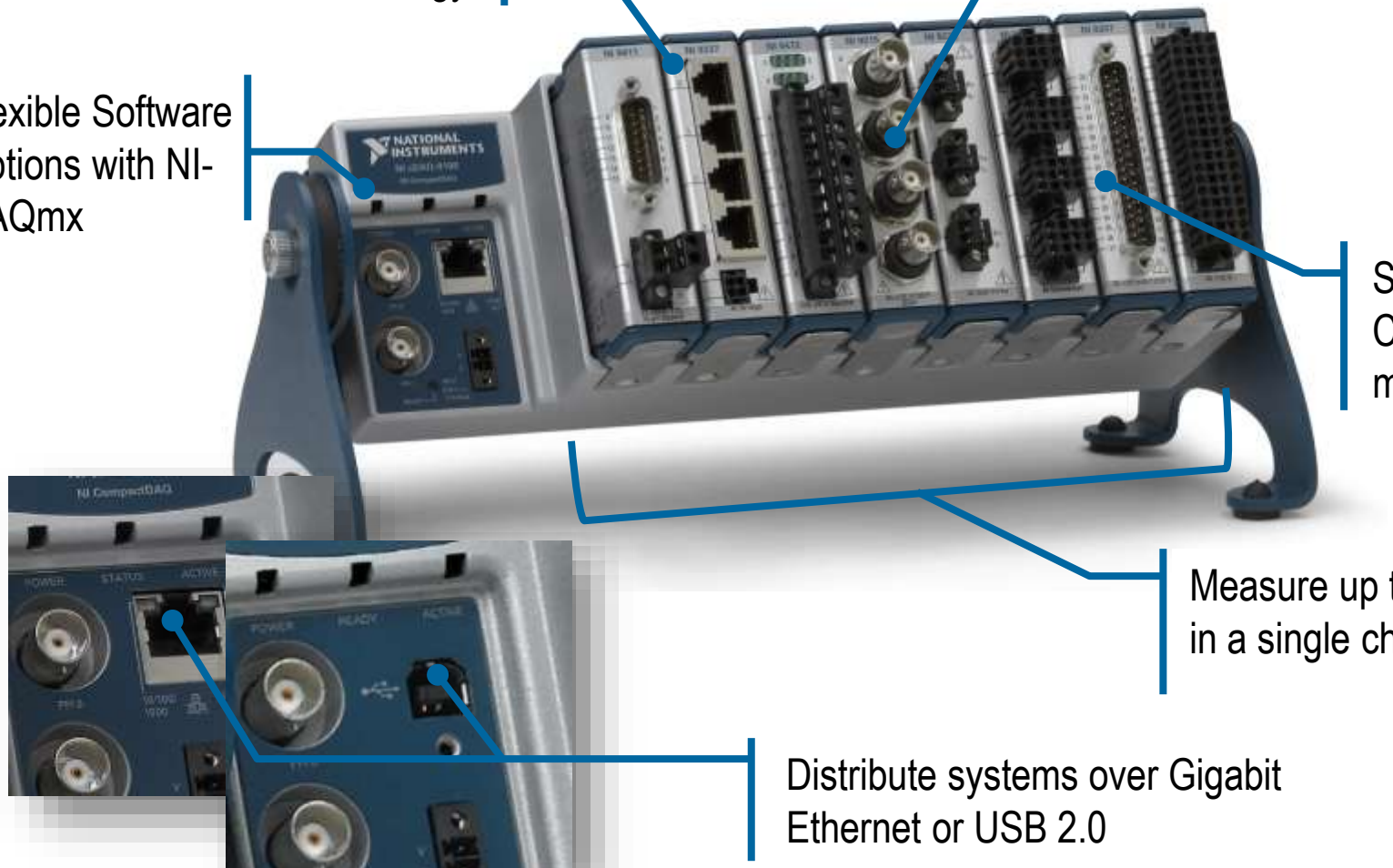
NI CompactDAQ Key Features

Acquire Analyze Present
with NI LabVIEW

Run up to 7 HW-timed I/O tasks at different rates with NI-STC3 technology

Stream continuous waveforms up to 1 MS/s per channel with NI Signal Streaming

Flexible Software Options with NI-DAQmx



Supports 50+ NI C Series I/O modules

Measure up to 256 channels in a single chassis

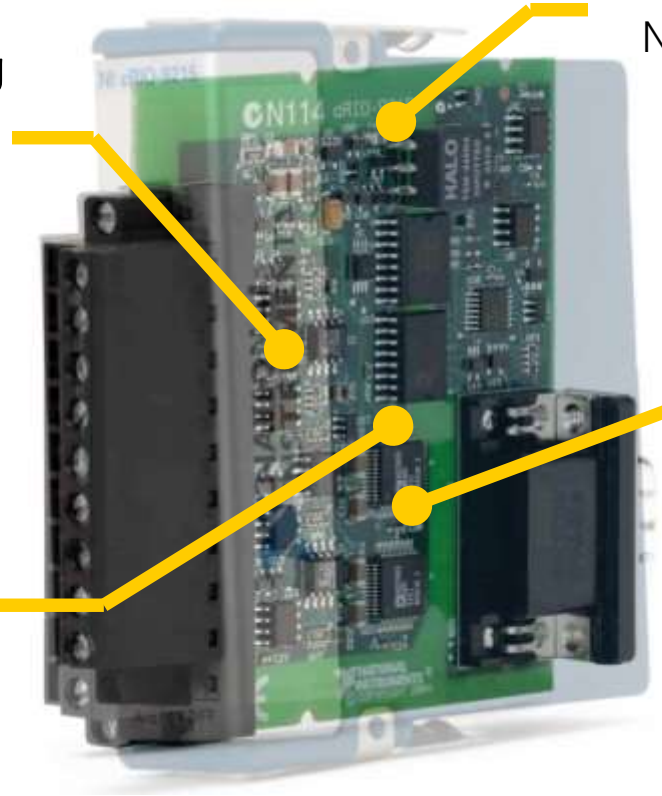
Distribute systems over Gigabit Ethernet or USB 2.0

CompactDAQ – How it works

Acquire Analyze Present
with NI LabVIEW

Guaranteed Accuracy
NIST traceable calibration

Built-in Signal Conditioning
Direct connection to sensors for temperature, pressure, acceleration, strain, load cell, current and so on



Signal to Backplane

Isolation barrier
Safety, noise immunity, common mode rejection

High Quality Measurements
Streaming up to 51.2 kS/s with up to 24-bit resolution

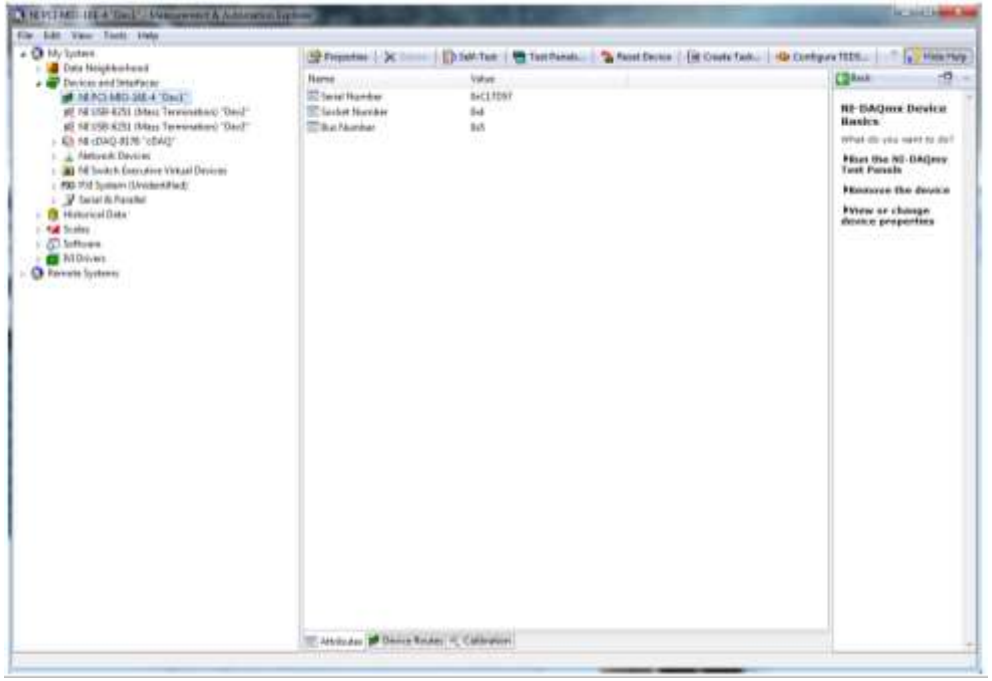
C Series Modules

- Currently, there are more than 50 C Series modules for different measurements including:
  - Thermocouple, voltage, resistance temperature detector (RTD), current, resistance, strain, digital (TTL and other), accelerometers, and microphones.
- Channel counts on the individual modules range from three to 32 channels to accommodate a wide range of system requirements.

What is MAX?

- MAX stands for Measurement & Automation Explorer.
- MAX configures and organises all your National Instruments DAQ, PCI/PXI instruments, GPIB, IMAQ, IVI, Motion, VISA, and VXI devices.
- Used for configuring and testing devices.

Measurement
& Automation



Analysis in LabVIEW

Using Analysis Functions

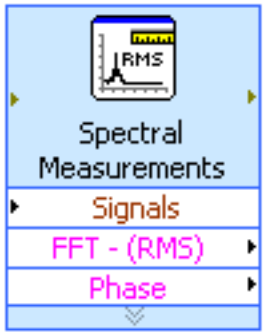
My Application.vi Block Diagram

File Edit View Project Operate Tools Window Help

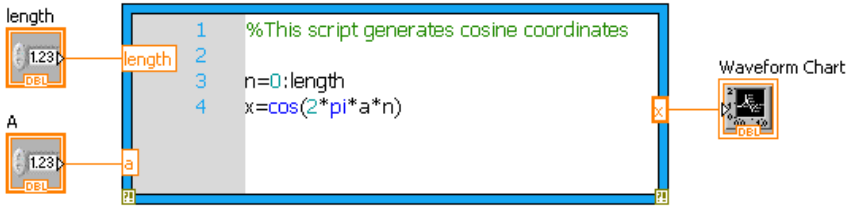
20pt Application Font

Programmatic, Low-Level VIs

Configuration Based Express VIs



Text-based MathScript Node



LabVIEW Signal Processing, Analysis and Math

- **Signal Processing & Analysis**
  - Waveform Generation
  - Waveform Conditioning
  - Waveform Monitoring
  - Waveform Measurements
  - Signal Generation
  - Signal Operations
  - Windows
  - Digital Filters
  - Spectral Analysis
  - Transforms
  - Point-by-Point
- **Mathematics**
  - Numeric
  - Elementary and Special Functions
  - BLAS/LAPAC-based Linear Algebra
  - Curve Fitting
  - Interpolation / Extrapolation
  - Probability and Statistics
  - Optimisation
  - Ordinary Differential Equations
  - Geometry
  - Polynomial
  - Formula Parsing
  - 1D & 2D Evaluation
  - Calculus

Presenting Data in LabVIEW

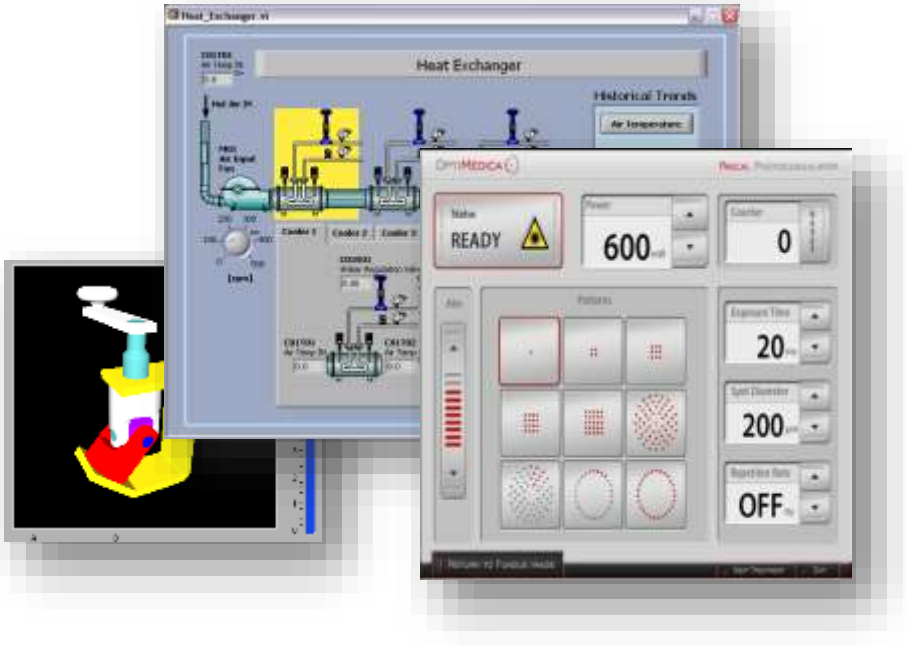
Data Visualisation and Communication

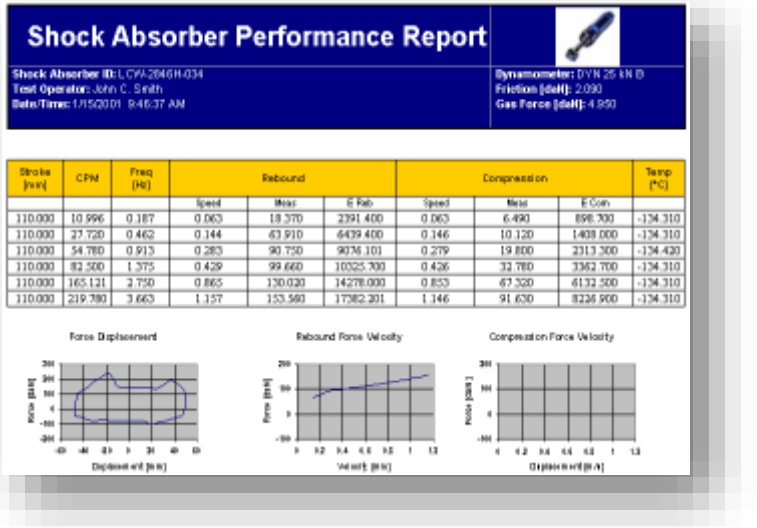
Visualisation

- Built-in user interface objects
- Charting and graphing capabilities
- Remote application control

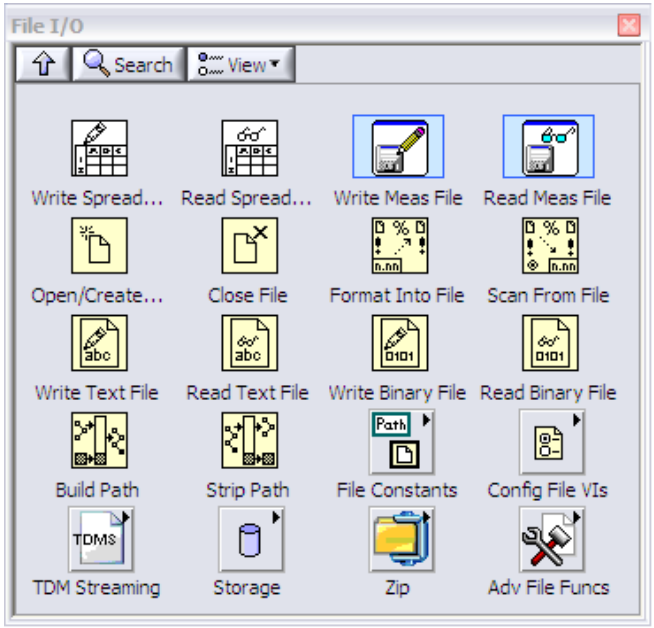
Reporting and Data Storage

- File I/O functionality
- HTML reports for the Web
- Microsoft Word and Excel reports





LabVIEW Supported Storage Types



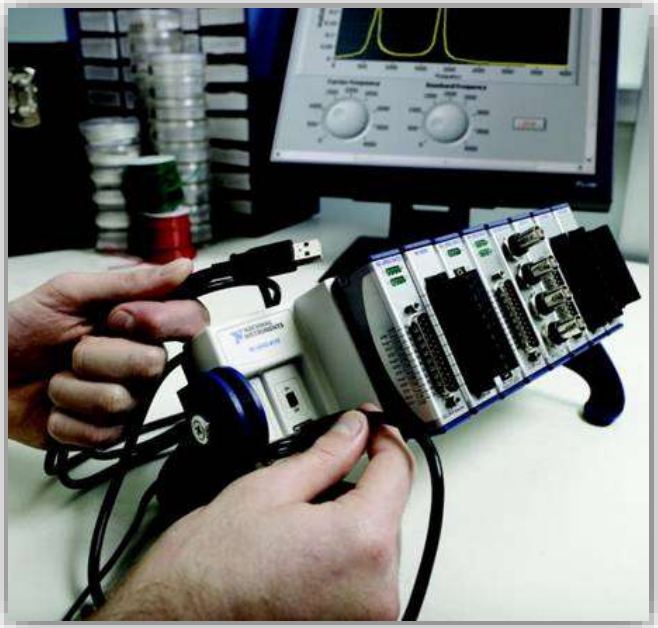
- ASCII
- Binary
- HTML
- XML
- LVM
- TDM(S) *
- Excel
- Word
- Datalog
- Databases

Exercise 1a-1c – Adding Tests from Templates

Taking measurements from scratch using NI CompactDAQ and NI LabVIEW

Time to complete: 20 minutes

- Create an application that
  - Measures from a thermocouple
  - Logs data to a file

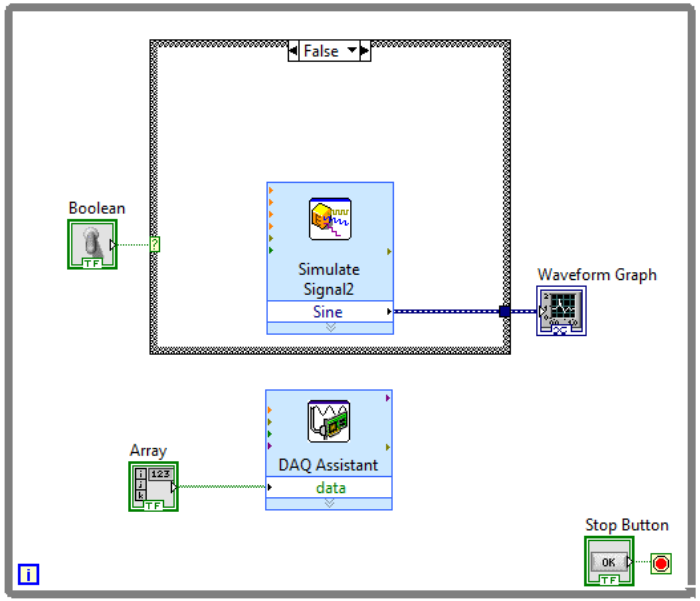


Controlling Program Execution - How to incorporate logic into your LabVIEW application

Create an application that:

- Charts a sine or triangle wave depending on toggle switch position
- Turns on/off digital outputs based on user selections

Time to complete: 15 minutes



Exercise 2 – Controlling Program Execution

Learn More about NI LabVIEW and NI DAQ Systems

Check out additional **LabVIEW** exercises:

ni.com/labview/whatis

View DAQ product specs and demos:

ni.com/daq