

Data Acquisition and Signal Conditioning Course

Overview

Using LabVIEW, plug-in DAQ boards, and SCXI signal conditioning hardware, the Data Acquisition and Signal Conditioning course teaches you the fundamentals of PC-based data acquisition and signal conditioning. During the course, you get hands-on experience with installing and configuring data acquisition hardware and learn to use data acquisition software functions to build your application. Although LabVIEW is the application software used during the class, non-LabVIEW users using the NI-DAQmx API will also benefit by learning about analog input, triggering, signal conditioning, signal processing, analog output, digital I/O, and counters.

Duration – Three Days

Audience

- Developers and users using, LabVIEW, NI Developer Suite, DAQ and/or signal conditioning to create data acquisition and control applications
- Developers using NI-DAQmx API (with C or Visual Basic) to create DAQ applications
- Users new to PC-based data acquisition and signal conditioning

Prerequisites

- LabVIEW Basics I and II courses, or equivalent experience

NI Products Used During the Course

- LabVIEW Professional Development System Version 7
- NI-DAQmx, E-Series multifunction DAQ board
- SCXI-1000, SCXI-1520, SCXI-1125, SCXI-1141
- DAQ Signal Accessory

REGISTRATION

Register online at ni.com/china/events or call (800) 820-3622 • Fax: 021-65556244
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Worldwide Contact Info: ni.com/global

NI can also hold this class onsite at your facility.

Ordering Information 910010-xx

-01 NI Corporate or Branch, -11 Regional, -21 Onsite

After attending this course you will be able to:

- Develop integrated, high performance data acquisition systems that produce accurate measurements
- Properly connect transducers such as thermocouples and strain gauges to your measurement hardware
- Have an advanced understanding of LabVIEW DAQ VIs and the NI-DAQmx API
- Eliminate measurement errors due to under sampling and signal grounding techniques
- Start your measurements using hardware and software triggering
- Use signal processing to improve quality of acquired signals
- Make pulse, frequency, and position measurements using counters
- Generate single and continuous waveforms

Suggested Next Courses

- LabVIEW Advanced: Performance and Communication
- LabVIEW Advanced Application Development
- LabVIEW Real-Time Systems Using PXI

Data Acquisition and Signal Conditioning Course Outline

Day 1

Overview of Transducers, Signals, and Signal Conditioning

This lesson introduces the basics of data acquisition (DAQ). You will learn how to identify the correct sensor for your measurements that can transform the physical phenomenon into a stable, appropriate electrical signal. Topics include:

- Components of a typical data acquisition system
- Typical transducers used in data acquisition
- Types of signals produced by transducers
- How to measure the digital state, digital rate, level, shape, and frequency of a signal
- Overview of signal conditioning

Data Acquisition Hardware and Software

In this lesson, you will learn how to choose the appropriate sampling rate, grounding mode, and LabVIEW VIs to implement an efficient, safe, and powerful data acquisition system. Topics include:

- How to determine the best sampling rate, resolution, and gain for a measurement system
- Issues with grounding a measurement system to a transducer
- Differential, referenced single-ended, and non-referenced single ended grounding modes
- Advantages and disadvantages to all grounding modes, and when to use the modes
- How the National Instruments NI-DAQmx driver integrates with hardware
- Overview of NI-DAQmx VIs and Property Nodes
- NI-DAQmx task state model

Triggering Overview

In this lesson, you will develop a data acquisition application that can use a signal to start, stop or pause the data acquisition system. Topics include:

- Starting an acquisition using triggering
- Starting an acquisition with a digital signal
- Triggering off of an analog signal
- Testing and configuring trigger with the DAQ Assistant

Analog Input

In this lesson, you will develop a LabVIEW application that performs analog input. You will learn how to determine the most appropriate sampling rate to prevent both aliasing and buffer overflow, and whether or not an application should be written to perform single point or continuous analog input data acquisition.

Topics include:

- Acquiring voltage signals using analog input
- Observe the affects of aliasing on your signal
- How anti-aliasing filters can improve your measurements
- Single point analog input
- Advantages of multi-sample buffered analog input
- Continuous acquisition analog input to continuously sample a voltage

Day 2

Signal Conditioning

In this lesson, you will learn how to select the appropriate signal conditioning method such as amplification, attenuation, and or filtering, so that can precisely measure a low voltage signal which contains noise, or unwanted frequencies. Topics include:

- Overview of signal conditioning
- Configuring an actual signal conditioning system
- Capabilities of signal conditioning
- Hardware filtering
- Benefits of isolation
- Transducer conditioning with thermocouples
- Configuring a strain gauge and measuring strain

Signal Processing

In this lesson, you will learn how to use signal processing on acquired signals to determine the frequencies present in the signal, filter unwanted frequencies, and isolate wanted frequencies to improve signal quality. Topics include:

- Signal processing (windows and digital filters) to improve the quality of acquired signals
- How to use the Fast Fourier Transform (FFT) and Power Spectrum Analysis tools to detect frequency components in a measured signal
- Different types of digital filters and how to easily configure them
- Advantages of digital filters over analog filters

Analog Output

In this lesson, you will learn how to perform single-point voltage output or multiple point waveform generation for circuit testing, automotive component testing, audio signal generation, or stimulus for vibration testing applications. Topics include:

- How a data acquisition system can generate output voltages
- Generating voltages that can be used in applications where excitation is needed for a unit under test
- Buffered analog output to generate waveforms

Day 3

Digital I/O

In this lesson, you learn to use digital I/O in an application such as on/off sensing of contacts, discrete machine control, signal switching, interfacing computers to external equipment, or testing digital communication devices. Topics include:

- Digital input and output to acquire a digital state
- LabVIEW advanced features for performing digital I/O

Counters

In this lesson, you learn the most appropriate counter/timer operation to create a wide variety of measurement solutions including measuring a number of time-related quantities, counting events or totalizing, and monitoring position with quadrature encoders. Topics include:

- Architecture of National Instruments counters
- On-board counters to perform digital pulse generation
- Pulse measurement using counters to accurately determine digital timing
- Measuring the frequency of digital signals using counters
- Using a quadrature encoder to determine position with a counter

Synchronization

In this lesson, you learn how to synchronize a measurement task given a complex data acquisition application where a number of operations need to be started at the same time, on multiple DAQ devices need to be synchronized. Topics include:

- NI-DAQmx task state model
- Using explicit state transitions to gain finer control of the driver
- Single device synchronization to simultaneously start and synchronize multiple functions on the DAQ device
- Synchronizing multiple functions on multiple DAQ devices