

Any Bus. Any Signal.

Data Acquisition

Benchtop

Industrial

Portable

Embedded

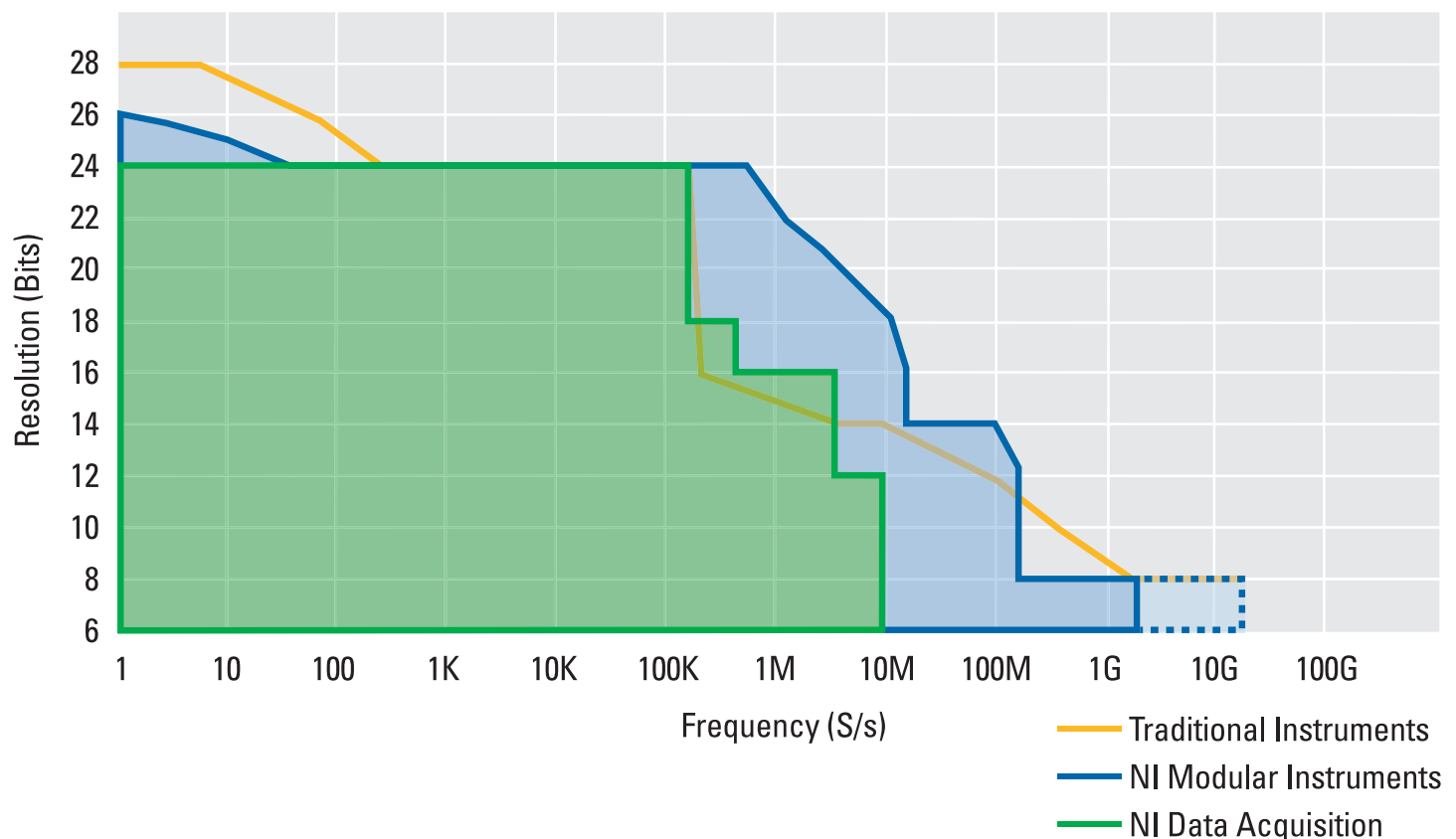


What is Data Acquisition?

The purpose of data acquisition is to measure an electrical or physical phenomenon such as voltage, current, temperature, pressure, or sound. PC-based data acquisition uses a combination of hardware, software, and a computer to automate measurements and make data available for analysis.

Frequency versus Resolution

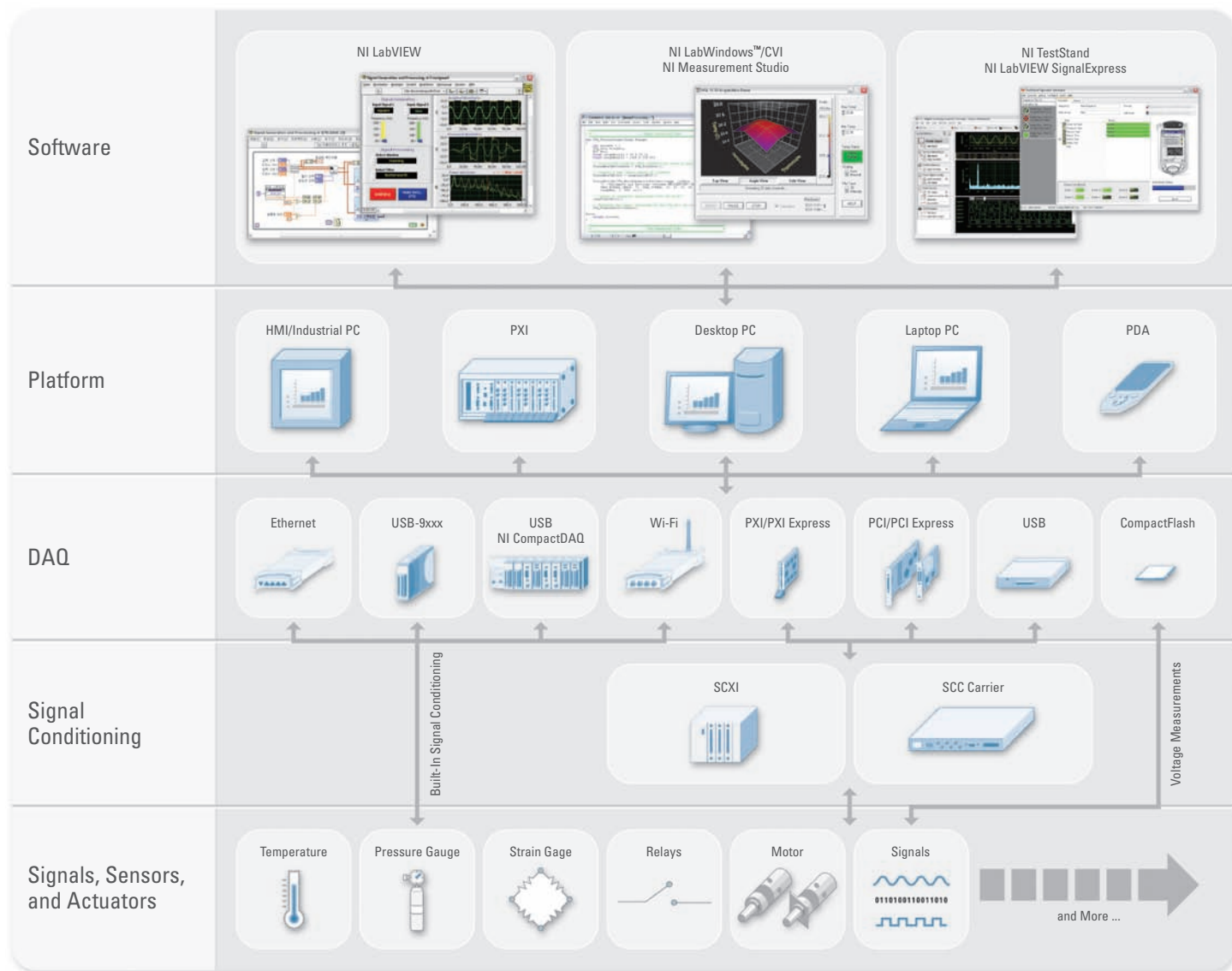
It is important to select the best measurement device based on your application need. NI offers measurement products with a wide range of resolution and sampling rates – from 26 bits of resolution at slow sampling rates to 8 bits at 2 GHz. Data acquisition (DAQ) devices typically provide 12 to 18 bits of resolution with sampling rates ranging from a few hertz to tens of megahertz. For higher resolution or sampling rates, NI modular instrumentation products can help meet your application requirements.



Obtain additional information on modular instruments at ni.com/modularinstruments

Data Acquisition System Architecture

While each data acquisition system is uniquely defined by its application requirements, every system shares a common goal of acquiring, analyzing, and presenting information. Data acquisition systems incorporate signals, sensors, or actuators; signal conditioning; data acquisition devices; and software.



Any Language. Any OS.

NI offers easy-to-use application software for multiple programming languages and operating systems. Whether you are creating custom drivers or building applications on multiple operating systems, NI data acquisition software delivers powerful, customizable solutions.

NI LabVIEW

NI LabVIEW SignalExpress

NI LabWindows™/CVI

NI Measurement Studio

C/C++/C#

Visual Studio .NET

Visual Basic

Windows Vista (32- and 64-bit)/XP/2000

Linux® OS

Mac OS X

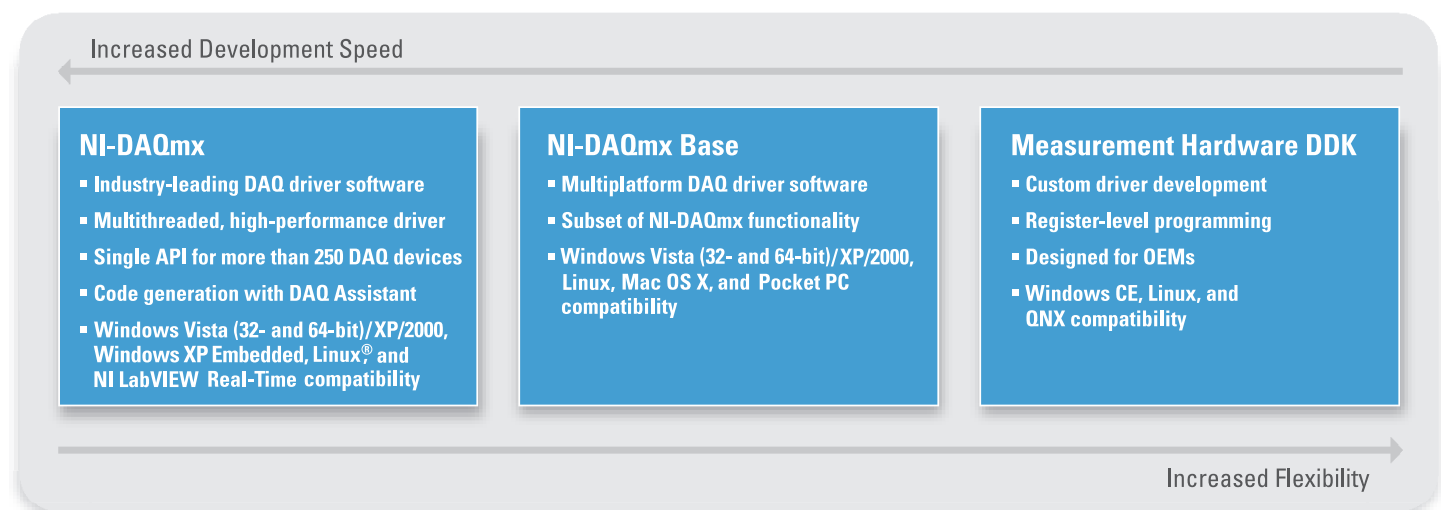
Pocket PC/Windows CE

QNX

Windows XP Embedded

Three Levels of Data Acquisition Driver Software

The capability of driver software is just as important as the quality of measurement hardware. National Instruments provides three levels of data acquisition software, each with something unique to offer. The result is a complete range of data acquisition software to simplify the use of National Instruments DAQ hardware in any application.



The mark LabWindows is used under a license from Microsoft Corporation. Windows is a registered trademark of Microsoft Corporation in the United States and other countries.

Increase Productivity with NI-DAQmx and Measurement Services

NI-DAQmx, a high-performance, multithreaded driver for Windows and Linux, is at the heart of NI measurement services software. NI-DAQmx driver software goes far beyond a basic DAQ driver to deliver increased productivity and performance. Every DAQ device supported by NI-DAQmx is shipped with NI Measurement & Automation Explorer (MAX), DAQ Assistant, LabVIEW SignalExpress LE, and more.



Download DAQ Drivers Online

To make selecting the right driver software easy, NI provides detailed driver comparisons based on device support, operating system support, and software features. When combined with NI data acquisition hardware, this software provides the best option for quickly developing virtual instruments for measurement and control applications.

ni.com/dataacquisition/software

LabVIEW SignalExpress Data-Logging Software

NI data acquisition devices are shipped with NI-DAQmx and LabVIEW SignalExpress LE, free data-logging software. LabVIEW SignalExpress helps you get measurements in minutes without any programming involved. It scales seamlessly to the full LabVIEW graphical development environment with automatic code generation.

ni.com/signalexpress

Any Bus. Any Signal.

Use the following tables to help select the right hardware for your measurement application.

| Common Sensors | 1 to 32 Channels | 33 to 256 Channels | 257 to 3,072 Channels | Also See ... |
|---------------------------------------|---|-----------------------|-----------------------|----------------------------------|
| Thermocouples | NI CompactDAQ SCC Series | NI CompactDAQ SCXI | SCXI | CompactRIO Compact FieldPoint |
| RTDs, thermistors | NI CompactDAQ SCC Series | NI CompactDAQ SCXI | SCXI | CompactRIO Compact FieldPoint |
| Strain gages | NI CompactDAQ SCC Series | NI CompactDAQ SCXI | SCXI | SC Series |
| Dynamic sensors – sound and vibration | NI CompactDAQ Dynamic signal acquisition | NI CompactDAQ SCXI | SCXI | CompactRIO |
| DC LVDTs | Multifunction DAQ | SCXI | SCXI | – |
| AC LVDTs | SCXI | | | |

| Analog Signals | 1 to 32 Channels | 33 to 256 Channels | 257 to 3,072 Channels | Also See ... |
|--------------------------------------|---|--|---------------------------|----------------------------------|
| ±10 VDC | Multifunction DAQ | PXI multifunction DAQ | PXI multifunction DAQ | High-speed digitizers |
| 0 to 20 mA input | NI CompactDAQ SCC Series Multifunction DAQ | NI CompactDAQ SCC Series SCXI | SCXI | CompactRIO Compact FieldPoint |
| 0 to 20 mA output | NI CompactDAQ Analog output | NI CompactDAQ PXI analog output SCXI | PXI analog output SCXI | CompactRIO |
| Millivolts <10 kHz | Multifunction DAQ NI CompactDAQ | NI CompactDAQ SCXI | SCXI | CompactRIO |
| Millivolts >10 kHz | Multifunction DAQ NI CompactDAQ | PXI multifunction DAQ NI CompactDAQ | PXI multifunction DAQ | CompactRIO |
| Voltage outputs, DC | NI CompactDAQ Analog output | NI CompactDAQ PXI analog output SCXI | SCXI | CompactRIO Compact FieldPoint |
| Voltage outputs, waveform | NI CompactDAQ Analog output | NI CompactDAQ PXI analog output | PXI analog output | CompactRIO |
| Frequency inputs | SCC Series | SCC Series SCXI | SCXI | – |
| High bandwidth, 1 MHz to 2.7 GHz | Multifunction DAQ, high-speed digitizers, or RF signal analyzer | | | – |
| High-voltage inputs, 10 to 1,000 VDC | NI CompactDAQ SCC Series SCXI | SCXI | SCXI | Compact FieldPoint |
| High-voltage inputs, 10 to 300 VAC | SC Series SCXI | SCXI | SCXI | Compact FieldPoint |
| Isolated voltage inputs | Multifunction DAQ NI CompactDAQ | NI CompactDAQ SCXI | SCXI | CompactRIO Compact FieldPoint |
| Isolated current inputs | Multifunction DAQ NI CompactDAQ | NI CompactDAQ SCXI | SCXI | CompactRIO Compact FieldPoint |

| Digital and Timing Signals | 1 to 96 Channels | 16 to 3,072 Channels | Also See ... |
|---|---|--|----------------------------------|
| Static signals: relays, switches, LEDs, and so on | Digital I/O NI CompactDAQ | PXI digital I/O SCXI digital I/O | CompactRIO Compact FieldPoint |
| Isolated input/output | Industrial digital I/O NI CompactDAQ | PXI industrial digital I/O SCXI digital I/O | CompactRIO Compact FieldPoint |
| Pattern or handshaking I/O to 200 MHz | High-speed digital I/O | | |
| Timing I/O: pulse I/O, frequency I/O, and so on | Counter/timer I/O Multifunction DAQ | R Series | CompactRIO |

The NI Measurement Difference

National Instruments data acquisition designs are optimized for absolute accuracy, high-speed performance, ease of use, and safety. Through a combination of innovative analog and digital designs, NI devices can easily meet all of your measurement needs.

NI-PGIA 2 Amplifier Technology

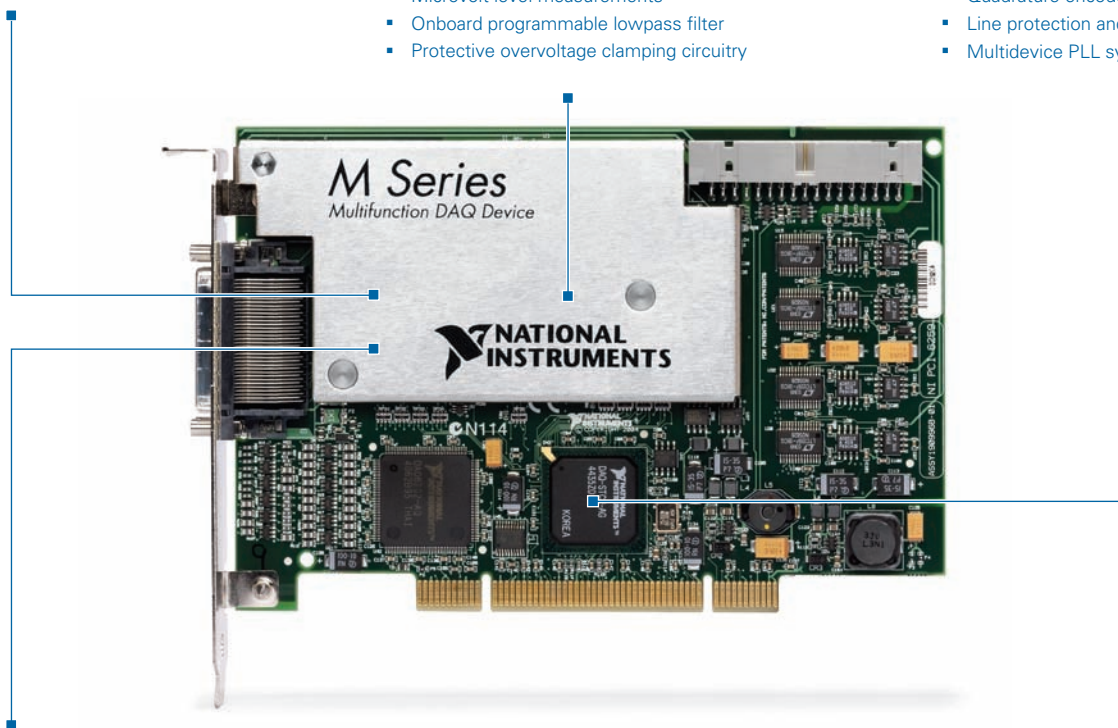
- Custom instrumentation class amplifier
- True 16-bit resolution at 1 MS/s scan rate
- Low settling times to ± 1 LSB at 1 μ s

Advanced Analog Design Path

- Fully balanced design from NI-PGIA 2 to ADC
- Up to 18 bits of resolution
- Equivalent 5.5 digits of resolution
- Microvolt-level measurements
- Onboard programmable lowpass filter
- Protective overvoltage clamping circuitry

NI-STC 2 System Timing Controller

- 6 DMA channels for data throughput
- 10 MHz clocked/correlated digital I/O
- 32-bit, 80 MHz counter/timers
- Quadrature encoder inputs
- Line protection and debounce filters
- Multidevice PLL synchronization



NI-MCal Calibration Methodology

- 4X more accurate self-calibration
- Third-order correction for nonlinearity, offset, and gain
- Calibration for each input range in a scan list
- Ultrastable, low-drift precision voltage reference

Versatile Device Selection

- Low-cost, high-speed, high-accuracy, and industrial M Series families
- Hi-Speed USB with NI signal streaming
- USB, PCI, PCI Express, PXI, PXI Express
- 68-pin VHDCI connectors or 37-pin D-Sub
- OEM-ready designs

Industrial M Series Features

- 1,400 V_{rms}/1,950 VDC transient isolation
- 60 VDC continuous bank isolation
- Voltage and ± 20 mA current I/O
- 5 V TTL and 24 V digital I/O
- Digital programmable power-up states
- Digital debounce circuitry on PFI lines

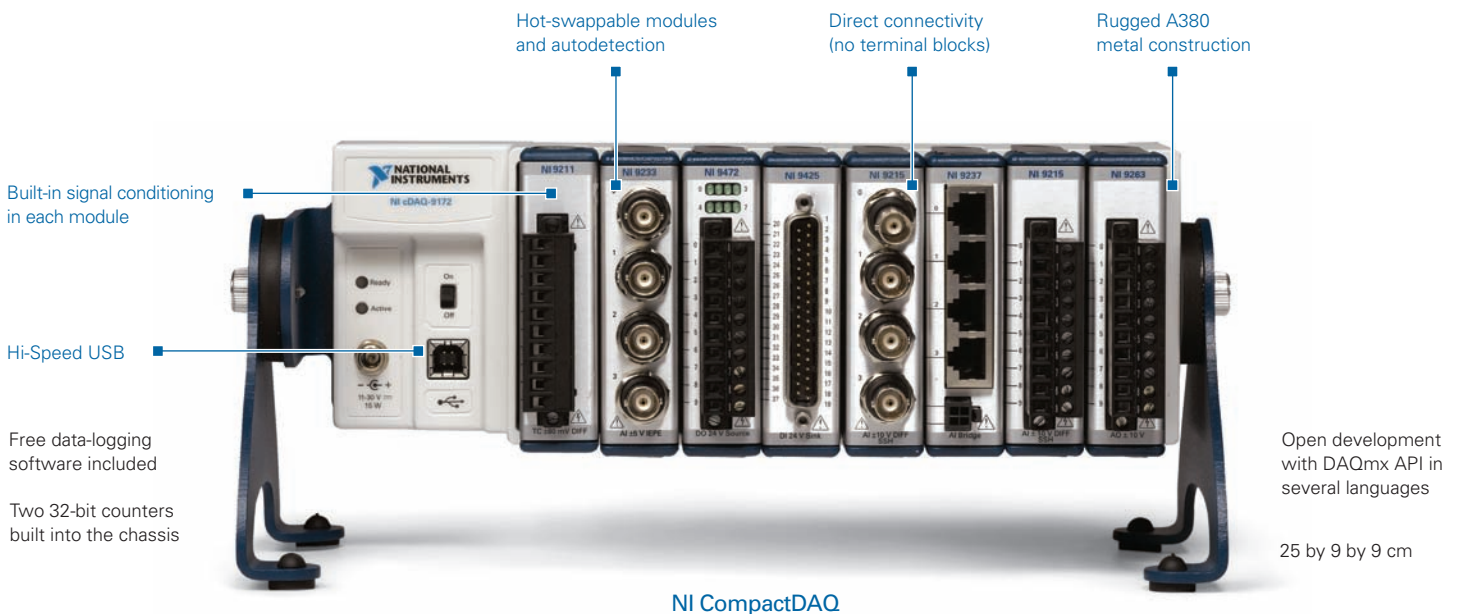
Find the Right Data Acquisition Device Online

Search more than 250 data acquisition devices by specification online. NI data acquisition devices are organized in an easy-to-use hierarchy so you can search by any combination of bus, operating system, product family, measurement type, input or output channel, and more. Prices, product comparisons, and instant quote generation are available online.

ni.com/dataacquisition

A DAQ Device for Every Need

NI C Series hardware consists of more than 40 modules for sensor and signal measurements and four chassis options for PC connectivity via USB, Wi-Fi, or Ethernet, depending on your needs. For easier system configuration and setup, each module contains all the A/D conversion circuitry, signal conditioning, and connectivity needed for the required measurement. Whether you are taking sensor measurements for portable, benchtop, or remote applications, C Series hardware can satisfy your data acquisition requirements.



NI Signal Streaming Technology for USB

NI signal streaming is a patent-pending technology for USB devices that you can use for simultaneous high-speed streaming by a USB device. This technology means an NI USB device can both acquire and generate waveform data continuously and simultaneously over the USB bus. For example, NI CompactDAQ can acquire waveform data from 28 channels at up to 100 kS/s/ch. Generating four channels of 100 kS/s/ch data in the same system at the same time does not degrade the input performance. All NI M Series USB devices and NI CompactDAQ hardware feature this technology.

Sensor Measurements with USB, Wi-Fi, and Ethernet

True USB Plug and Play – With true plug and play, you can view data within a few clicks of power-on. NI has gone beyond device autodetection and further shortened the time needed to take a measurement with USB data acquisition devices.

Remote Measurements Simplified – NI Ethernet and Wi-Fi DAQ devices make it easy for you to take measurements across extended distances. With the same NI-DAQmx driver as NI USB DAQ, Ethernet and Wi-Fi devices simplify remote measurements.

Secure Wireless Monitoring – Using the highest commercially available wireless security standard, IEEE 802.11i, NI Wi-Fi DAQ devices can stream data up to 100 kS/s/ch in real time over an IEEE 802.11g wireless network back to a host PC.

More Channels, Less Space – NI CompactDAQ packs up to 256 channels of analog and digital I/O in a 25 by 9 by 9 cm chassis, making it ideal for applications that require portability. The chassis fits easily in a laptop bag, and you can power it with DC sources for in-vehicle and other applications where AC wall power is not available.



NI USB DAQ

NI Wi-Fi DAQ

NI Ethernet DAQ

NI CompactDAQ Online Configuration Advisor

With the NI CompactDAQ Advisor, C Series data acquisition systems are as easy to configure as they are to use. The advisor takes you step-by-step through your module, chassis, and optional accessory selection and calculates final performance based on your configuration. Prices and instant quote generation are available online.

ni.com/compactdaq

C Series Modules

National Instruments C Series modules combine A/D converters, signal conditioning, and signal connectivity in one package. Select from the NI C Series modules listed below and install in an NI CompactDAQ chassis or a Wi-Fi, Ethernet, or USB carrier for a customized, complete data acquisition system.



| | Signal | Model | Channels | Special Features | Connectivity |
|---------------|-------------------------------------|---------|----------|---|-------------------------------|
| Analog Input | Voltage, ± 200 mV to ± 10 V | NI 9205 | 32 | 16-bit, 250 kS/s multiplexed | Spring terminal, 37-pin D-Sub |
| | Voltage, ± 60 V | NI 9221 | 8 | 12-bit, 800 kS/s high voltage | Screw terminal, 25-pin D-Sub |
| | Universal (11 modes) | NI 9219 | 4 | 24-bit, 100 S/s/ch universal, 250 V ch-ch ISO | Spring terminal |
| | Thermocouple | NI 9211 | 4 | 24-bit, 14 S/s, CJC, 8 TC types supported | Screw terminal |
| | Simultaneous voltage, ± 60 V | NI 9229 | 4 | 24-bit, 50 kS/s/ch, 250 V ch-ch ISO, antialias filter | Screw terminal |
| | Simultaneous voltage, ± 10 V | NI 9215 | 4 | 16-bit, 100 kS/s/ch | BNC, screw terminal |
| | Voltage, 300 V _{rms} | NI 9225 | 3 | 24-bit, 50 kS/s/ch, 600 V ch-ch ISO antialias filter | Screw terminal |
| | Simultaneous voltage, ± 10 V | NI 9239 | 4 | 24-bit, 50 kS/s/ch, 250 V ch-ch ISO, antialias filter | Screw terminal |
| | RTD | NI 9217 | 4 | 100 Ω , 16-bit, 400 S/s RTD | Screw terminal |
| | Low-cost voltage, ± 10 V | NI 9201 | 8 | 12-bit, 500 kS/s | Screw terminal |
| | Isolated voltage, ± 10 V | NI 9206 | 16 | 16-bit, 250 kS/s, 500 V (ISO) | Spring terminal |
| | IEPE sensors (accel, microphone) | NI 9233 | 4 | 24-bit, 50 kS/s/ch, IEPE excitation | BNC |
| | IEPE sensors (accel, microphone) | NI 9234 | 4 | 24-bit, 51.2 kS/s/ch, software-selectable IEPE excitation | BNC |
| | Current | NI 9203 | 8 | ± 20 mA, 16-bit, 200 kS/s | Screw terminal |
| | 120 Ω Quarter Bridge | NI 9235 | 8 | 24-bit, 10 kS/s/ch, voltage excitation, 120 Ω | Screw terminal |
| | 350 Ω Quarter Bridge | NI 9236 | 8 | 24-bit, 10 kS/s/ch, voltage excitation, 350 Ω | Screw terminal |
| Analog Output | Bridge (1/4, 1/2, full) | NI 9237 | 4 | ± 25 mV/V, 24-bit, 50 kS/s/ch, voltage excitation | RJ45 |
| | Voltage | NI 9263 | 4 | ± 10 V, 16-bit, 100 kS/s/ch | Screw terminal |
| Digital | Current | NI 9265 | 4 | 0 to 20 mA, 16-bit, 100 kS/s/ch | Screw terminal |
| | 5 V TTL | NI 9401 | 8 | DIO, 10 MHz | 25-pin D-Sub |
| | 5 V TTL | NI 9403 | 32 | DIO, 140 kHz | 37-pin D-Sub |
| | 5 to 24 V | NI 9411 | 6 | DI, 2 MHz | 15-pin D-Sub |
| | 24 V | NI 9421 | 8 | DI (sink), 10 kHz | Screw terminal, 25-pin D-Sub |
| | 24 to 60 V | NI 9422 | 8 | DI (sink/source), 4 kHz | Screw terminal |
| | 24 to 30 V | NI 9423 | 8 | DI (sink), 1 MHz | Screw terminal |
| | 12 to 24 V | NI 9425 | 32 | DI (sink), 140 kHz | 37-pin D-Sub |
| | 12 to 24 V | NI 9426 | 32 | DI (source), 140 kHz | 37-pin D-Sub |
| | 5 to 250 V | NI 9435 | 4 | Universal, 333 Hz | Screw terminal |
| | 24 V | NI 9472 | 8 | DO (source), 10 kHz | Screw terminal, 25-pin D-Sub |
| | 5 to 30 V | NI 9474 | 8 | DO (source), 1 MHz | Screw terminal |
| | 5 to 60 V | NI 9475 | 8 | DI (source), 1 MHz | 25-pin D-Sub |
| | 6 to 36 V | NI 9476 | 32 | DO (source), 2 kHz | 37-pin D-Sub |
| | 5 to 60 V | NI 9477 | 32 | DO (sink), 125 kHz | 37-pin D-Sub |
| | 0 to 50 V | NI 9478 | 16 | DO (sink), 125 kHz | 37-pin D-Sub |
| Relay | 250 VAC | NI 9481 | 4 | SSR, 50 Hz | Screw terminal |
| | ± 60 V | NI 9485 | 8 | SSR, 50 Hz | Screw terminal |

M Series – Multifunction DAQ

National Instruments M Series DAQ devices set a new standard for performance, value, I/O capability, and safety. NI M Series multifunction DAQ combines analog input, analog output, counter/timers, and digital I/O on a single device. These devices feature the NI-STC 2 system timing controller, NI-PGIA 2 amplifier technology, NI-MCal calibration methodology, and high-speed digital isolators. M Series devices are available for USB, PCI, PXI, PCI Express, and PXI Express buses.



| | Model | Bus | Analog Inputs ¹ | Input Resolution (bits) | Max Sampling Rate (S/s) ² | Analog Triggering | Integrated Signal Conditioning | Analog Outputs ¹ | Max Output Rate (S/s) | Output Range (V) | DIO | DIO Features ³ |
|-----------------|------------------|--|----------------------------|-------------------------|--------------------------------------|-------------------|--------------------------------|-----------------------------|-----------------------|--------------------------|-----|---------------------------|
| High-Accuracy | NI 6289 | USB, PCI, PXI | 32 | 18 | 625 k | ✓ | Lowpass filters | 4 | 2.8 M | Programmable per channel | 48 | 5 V TTL, 10 MHz |
| | NI 6284 | PCI, PXI | 32 | 18 | 625 k | ✓ | Lowpass filters | 0 | – | – | 48 | 5 V TTL, 10 MHz |
| | NI 6281 | USB, PCI, PXI | 16 | 18 | 625 k | ✓ | Lowpass filters | 2 | 2.8 M | Programmable per channel | 24 | 5 V TTL, 10 MHz |
| | NI 6280 | PCI, PXI | 16 | 18 | 625 k | ✓ | Lowpass filters | 0 | – | – | 24 | 5 V TTL, 10 MHz |
| High-Speed | NI 6259 | USB, PCI, PCIe ⁴ , PXI, PXIe ⁵ | 32 | 16 | 1.25 M | ✓ | – | 4 | 2.8 M | ±10, ±5, ±ext ref | 48 | 5 V TTL, 10 MHz |
| | NI 6255 | PCI, PXI, USB | 80 | 16 | 1.25 M | ✓ | – | 2 | 2.8 M | ±10, ±5, ±ext ref | 24 | 5 V TTL, 10 MHz |
| | NI 6254 | PCI, PXI | 32 | 16 | 1.25 M | ✓ | – | 0 | – | – | 48 | 5 V TTL, 10 MHz |
| | NI 6251 | USB, PCI, PCIe ⁴ , PXI, PXIe ⁵ | 16 | 16 | 1.25 M | ✓ | – | 2 | 2.8 M | ±10, ±5, ±ext ref | 24 | 5 V TTL, 10 MHz |
| | NI 6250 | PCI, PXI | 16 | 16 | 1.25 M | ✓ | – | 0 | – | – | 24 | 5 V TTL, 10 MHz |
| Industrial | NI 6239 | PCI, PXI | 81 | 16 | 250 k | – | Bank isolation | 21 | 500 k | 0 to 20 mA | 10 | 24 V, sinking |
| | NI 6238 | PCI, PXI | 81 | 16 | 250 k | – | Bank isolation | 21 | 500 k | 0 to 20 mA | 10 | 24 V, sourcing |
| | NI 6236 | PCI, PXI | 41 | 16 | 250 k | – | Bank isolation | 4 | 500 k | ±10 | 10 | 5 V TTL, static |
| | NI 6233 | PCI, PXI | 16 | 16 | 250 k | – | Bank isolation | 2 | 500 k | ±10 | 10 | 24 V, sinking |
| | NI 6232 | PCI, PXI | 16 | 16 | 250 k | – | Bank isolation | 2 | 500 k | ±10 | 10 | 24 V, sourcing |
| | NI 6230 | PCI, PXI | 8 | 16 | 250 k | – | Bank isolation | 4 | 500 k | ±10 | 10 | 5 V TTL, static |
| Low-Cost | NI 6229 | USB, PCI, PXI | 32 | 16 | 250 k | – | – | 4 | 833 k | ±10 | 48 | 5 V TTL, 1 MHz |
| | NI 6225 | PCI, PXI, USB | 80 | 16 | 250 k | – | – | 2 | 833 k | ±10 | 24 | 5 V TTL, 1 MHz |
| | NI 6224 | PCI, PXI | 32 | 16 | 250 k | – | – | 0 | – | – | 48 | 5 V TTL, 1 MHz |
| | NI 6221 | USB, PCI, PXI | 16 | 16 | 250 k | – | – | 2 | 833 k | ±10 | 24 | 5 V TTL, 1 MHz |
| | NI 6221 (37-pin) | PCI | 16 | 16 | 250 k | – | – | 2 | 833 k | ±10 | 10 | 5 V TTL, 1 MHz |
| | NI 6220 | PCI, PXI | 16 | 16 | 250 k | – | – | 0 | – | – | 24 | 5 V TTL, 1 MHz |
| USB Bus-Powered | NI 6218 | USB | 32 | 16 | 250 k | – | Bank isolation | 2 | 250 k | ±10 | 16 | 5 V TTL, static |
| | NI 6216 | USB | 16 | 16 | 400 k | – | Bank isolation | 2 | 250 k | ±10 | 326 | 5 V TTL, static |
| | NI 6215 | USB | 16 | 16 | 250 k | – | Bank isolation | 2 | 250 k | ±10 | 8 | 5 V TTL, static |
| | NI 6212 | USB | 16 | 16 | 400 k | – | – | 2 | 250 k | ±10 | 326 | 5 V TTL, static |
| | NI 6211 | USB | 16 | 16 | 250 k | – | – | 2 | 250 k | ±10 | 8 | 5 V TTL, static |
| | NI 6210 | USB | 16 | 16 | 250 k | – | – | 0 | – | – | 8 | 5 V TTL, static |

¹Indicates ±20 mA inputs or 0 to 20 mA outputs; all other devices have voltage I/O; ²All channels share one A/D converter; ³USB-625x modules can clock DIO up to 1 MHz across the bus and up to 10 MHz using onboard regeneration; ⁴PCI Express; ⁵PXI Express; ⁶24 DIO for mass termination

Other Portable DAQ

| Family | Bus | Analog Inputs ¹ | Sampling Rate | Input Resolution (bits) | Max Input Range (V) | Number of Input Ranges | Triggering | Analog Outputs | Output Resolution (bits) | DIO |
|----------|--------------|----------------------------|---------------|-------------------------|---------------------|------------------------|------------|----------------|--------------------------|-----|
| USB-6009 | USB | 8 SE/4 DI | 48 kS/s | 14 | ±1 to ±20 | 8 | Digital | 2 | 12 | 12 |
| USB-6008 | USB | 8 SE/4 DI | 10 kS/s | 12 | ±1 to ±20 | 8 | Digital | 2 | 12 | 12 |
| CF-6004 | CompactFlash | 4 SE | 200 kS/s | 14 | ±5 | 1 | Digital | 0 | – | 4 |

¹SE = single ended, DI = differential

DAQ for OEM and Embedded Systems

Through OEM data acquisition products, NI delivers instrumentation-grade I/O to embedded systems with flexibility in connectivity, measurement performance, bus, driver software, and OS compatibility – all with the ease of use of off-the-shelf products at OEM prices. For mid- to high-volume OEM customers, NI also offers product customization such as firmware modifications, custom connectivity, and hardware modifications, as well as support from and direct communication with the NI R&D team.



S Series – Simultaneous Sampling Multifunction DAQ

Use for transient signal recording or other applications requiring simultaneous sampling or high-throughput PCI and PXI devices.

- Take advantage of a dedicated A/D converter per channel
- Measure dynamic signals up to 5 MHz
- Eliminate crosstalk and increase accuracy
- Use for high-bandwidth applications such as acoustics, ballistics, ultrasonics, or radar



| Family | Bus | Analog Inputs ¹ | Sampling Rate | Input Resolution (bits) | Integrated Signal Conditioning | Input Ranges (V) | Analog Triggering | Analog Outputs | Output Resolution (bits) | DIO |
|---------|----------|----------------------------|---------------|-------------------------|--------------------------------|---------------------------------------|-------------------|----------------|--------------------------|-----|
| NI 6110 | PCI | 4 SS | 5 MS/s/ch | 12 | — | ±42, ±20, ±10, ±5, ±2, ±1, ±0.5, ±0.2 | ✓ | 2 | 16 | 8 |
| NI 6111 | PCI | 2 SS | 5 MS/s/ch | 12 | — | ±42, ±20, ±10, ±5, ±2, ±1, ±0.5, ±0.2 | ✓ | 2 | 16 | 8 |
| NI 6115 | PCI, PXI | 4 SS | 10 MS/s/ch | 12 | Antialiasing filters | ±42, ±20, ±10, ±5, ±2, ±1, ±0.5, ±0.2 | ✓ | 2 | 12 | 8 |
| NI 6120 | PCI, PXI | 4 SS | 1 MS/s/ch | 16 | Antialiasing filters | ±42, ±20, ±10, ±5, ±2, ±1, ±0.5, ±0.2 | ✓ | 2 | 16 | 8 |
| NI 6123 | PCI, PXI | 8 SS | 500 kS/s/ch | 16 | — | ±10, ±5, ±2.5, ±1.25 | ✓ | — | — | 8 |
| NI 6122 | PCI, PXI | 4 SS | 500 kS/s/ch | 16 | — | ±10, ±5, ±2.5, ±1.25 | ✓ | — | — | 8 |
| NI 6133 | PCI, PXI | 8 SS | 3 MS/s/ch | 14 | — | ±10, ±5, ±2.5, ±1.25 | ✓ | — | — | 8 |
| NI 6132 | PCI, PXI | 4 SS | 3 MS/s/ch | 14 | — | ±10, ±5, ±2.5, ±1.25 | ✓ | — | — | 8 |
| NI 6143 | PCI, PXI | 8 SS | 250 kS/s/ch | 16 | — | ±5 | — | — | — | 8 |
| NI 6154 | PCI | 4 SS | 250 kS/s/ch | 16 | Ch-ch isolation | ±10, ±5, ±2, ±1 | — | 4 | 16 | 8 |

¹SS = simultaneous sampling

R Series – Intelligent DAQ

Have you ever wanted more flexible triggering options, multirate sampling, or other tasks outside the capabilities of typical data acquisition devices? NI R Series intelligent DAQ devices feature the following:

- Complete control over I/O timing and synchronization
- User-defined, embedded logic that is developed with LabVIEW and available on the onboard FPGA chip
- Up to 160 digital lines individually configured as input, output, counter/timer, pulse-width modulation, and more



| Family | Bus | FPGA | Analog Inputs ¹ | Sampling Rate | Input Resolution (bits) | Max Input Range (V) | Analog Triggering | Analog Outputs | Output Resolution (bits) | DIO |
|----------------------|----------|---------------------|----------------------------|---------------|-------------------------|---------------------|-------------------|----------------|--------------------------|-----|
| Multifunction | | | | | | | | | | |
| NI 7851R | PXI | Virtex-5 LX30 | 8 SS | 750 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7852R | PXI | Virtex-5 LX50 | 8 SS | 750 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7853R | PXI | Virtex-5 LX85 | 8 SS | 750 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7854R | PXI | Virtex-5 LX110 | 8 SS | 750 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7841R | PXI | Virtex-5 LX30 | 8 SS | 200 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7842R | PXI | Virtex-5 LX50 | 8 SS | 200 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7830R | PCI, PXI | Virtex-II 1 M gates | 4 SS | 200 kS/s/ch | 16 | ±10 | ✓ | 4 | 16 | 56 |
| NI 7831R | PCI, PXI | Virtex-II 1 M gates | 8 SS | 200 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| NI 7833R | PCI, PXI | Virtex-II 3 M gates | 8 SS | 200 kS/s/ch | 16 | ±10 | ✓ | 8 | 16 | 96 |
| Digital | | | | | | | | | | |
| NI 7811R | PCI, PXI | Virtex-II 1 M gates | — | — | — | — | — | — | — | 160 |
| NI 7813R | PCI, PXI | Virtex-II 3 M gates | — | — | — | — | — | — | — | 160 |

¹SS = simultaneous sampling

Analog Output

- Software-timed and high-speed waveform generation devices
- Deterministic control loop execution with LabVIEW Real-Time
- Densely packed devices with up to 32 outputs with additional digital I/O counters



| Model ¹ | Bus | Analog Outputs | Resolution (bits) | Update Rate ² | Output Range | Digital I/O | Counter/Timers | Triggers |
|--------------------|----------|----------------|-------------------|--------------------------|-------------------|-------------|----------------|----------|
| NI 6070 | PCI | 16 | 16 | Static | ±10 V | 8 | — | — |
| NI 6704 | PCI, PXI | 32 | 16 | Static | ±10 V, 0 to 20 mA | 8 | — | — |
| NI 6711 (3) | PCI, PXI | 4 (8) | 12 | 1 MS/s | ±10 V | 8 | 2, 24-bit | ✓ |
| NI 6715 | PCMCIA | 8 | 12 | 1 MS/s | ±10 V | 8 | 2, 24-bit | ✓ |
| NI 6722 (3) | PCI, PXI | 8 (32) | 13 | 800 kS/s | ±10 V | 8 | 2, 24-bit | ✓ |
| NI 6731 (3) | PCI | 4 (8) | 16 | 1 MS/s | ±10 V | 8 | 2, 24-bit | ✓ |

¹Number in parentheses refers to NI 67x3 model; ²Single-channel rate

Digital Input/Output

National Instruments offers isolated digital I/O (DIO) devices suitable for a wide range of industrial automation applications including controlling switches, relays, actuators, fans, lights, and motors. NI DIO devices provide an industrial feature set including:

- Programmable power-up states
- Watchdog timers
- Change detection
- Isolation
- Programmable input filters



| Family | Bus | Digital I/O Lines | Voltage Range | Max Output Current | Isolation | Industrial Feature Set |
|---------|---------------|--------------------------|--------------------|--------------------|-----------|------------------------|
| NI 6501 | USB | 24 DIO, 32-bit counter | 5 V/TTL/CMOS | 8.5 mA | — | — |
| NI 6503 | PCI, PCMCIA | 24 DIO | 5 V/TTL/CMOS | 4 mA | — | — |
| NI 6509 | USB, PCI, PXI | 96 DIO | 5 V/TTL/CMOS | 24 mA | — | ✓ |
| NI 6510 | PCI | 32 DI | ±30 V | — | Bank | ✓ |
| NI 6511 | PCI, PXI | 64 DI | ±30 V | — | Bank | ✓ |
| NI 6512 | PCI, PXI | 64 DO (source) | ±30 V | 350 mA | Bank | ✓ |
| NI 6513 | PCI, PXI | 64 DO (sink) | ±30 V | 500 mA | Bank | ✓ |
| NI 6514 | PCI, PXI | 32 DI and 32 DO (source) | ±30 V | 350 mA | Bank | ✓ |
| NI 6515 | PCI, PXI | 32 DI and 32 DO (sink) | ±30 V | 500 mA | Bank | ✓ |
| NI 6516 | PCI | 32 DO (source) | ±30 V | 350 mA | Bank | ✓ |
| NI 6517 | PCI | 32 DO (sink) | ±30 V | 500 mA | Bank | ✓ |
| NI 6518 | PCI | 16 DI and 16 DO (source) | ±30 V | 350 mA | Bank | ✓ |
| NI 6519 | PCI | 16 DI and 16 DO (sink) | ±30 V | 500 mA | Bank | ✓ |
| NI 6520 | PCI | 8 DI, 8 mech. relay DO | ±60 V | 2 A ¹ | Ch-ch | ✓ |
| NI 6521 | PCI, PXI | 8 DI, 8 mech. relay DO | ±30 V DI, 150 V DO | 2 A ¹ | Ch-ch | ✓ |
| NI 6525 | USB | 8 DI, 8 SSR DO | ±60 V | 500 mA | Ch-ch | ✓ |
| NI 6528 | PCI, PXI | 24 DI, 24 SSR DO | ±60 V | 150 mA | Ch-ch | ✓ |

¹NI 6520 and NI 6521 devices have a maximum switching power of 60 W/ch

Counter/Timers

Precision timing is a critical component of any measurement solution. You can use National Instruments counter/timers for:

- Frequency measurement/generation
- Edge counting
- Pulse-width measurement/modulation
- Period measurement
- Event timestamps
- Frequency division
- Simple pulse generation
- Pulse-train generation



| Family | Bus | Counter/Timers | Resolution (bits) | Max Source Frequency | Compatibility | Voltage Range | Isolation | Digital I/O | Pulse Generation | Buffered Operations | Digital Filtering | Quadrature Encoder |
|---------|----------|----------------|-------------------|----------------------|---------------|---------------|-----------|-------------|------------------|---------------------|-------------------|--------------------|
| NI 6601 | PCI | 4 | 32 | 20 MHz ¹ | 5 V/TTL | 5 V | — | Up to 32 | ✓ | ✓ | ✓ | ✓ |
| NI 6602 | PCI, PXI | 8 | 32 | 80 MHz ¹ | 5 V/TTL | 5 V | — | Up to 32 | ✓ | ✓ | ✓ | ✓ |
| NI 6608 | PXI | 8 | 32 | 80 MHz ¹ | 5 V/TTL | 5 V | — | Up to 32 | ✓ | ✓ | ✓ | ✓ |
| NI 6624 | PCI, PXI | 8 | 32 | 20 MHz | 5 V | 48 V | Ch-ch | — | ✓ | ✓ | ✓ | ✓ |

¹Max source frequency with prescalers is 80 MHz for an NI 6601 and 125 MHz for an NI 6602 and NI 6608

SC – Integrated DAQ and Signal Conditioning

SC Series devices combine the data acquisition device and signal conditioning into one unit with all the hardware you need for many specialty measurement applications.



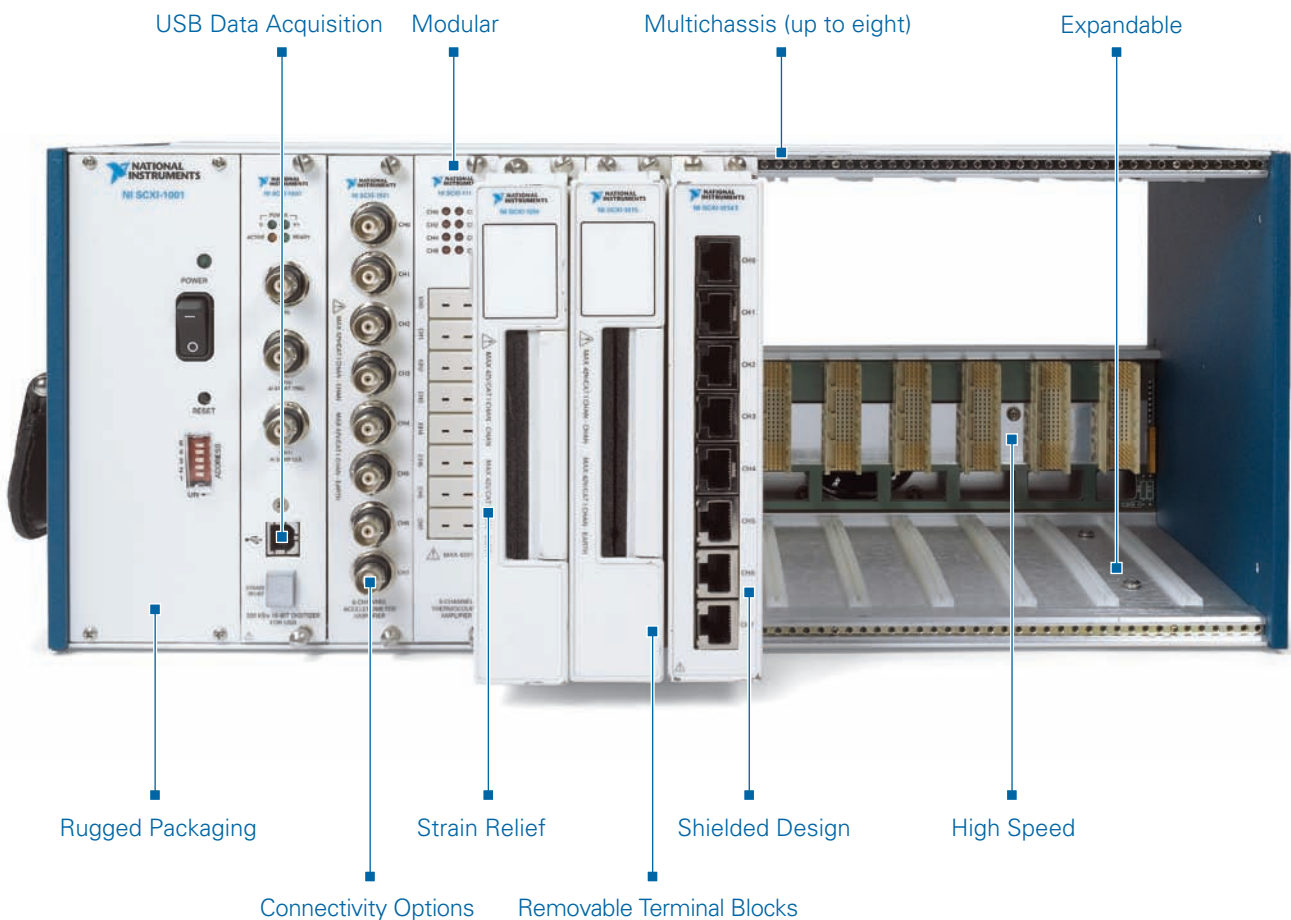
| Model | Bus | Analog Inputs | Resolution (bits) | Sampling Rate | Input Range | Simultaneous Sampling | Triggers | Features |
|---------|----------|------------------------------|-------------------|-----------------------|------------------|-----------------------|-----------|---|
| NI 4204 | PXI | 8 DI | 16 | 200 kS/s | ±0.05 to ±100 V | ✓ | 2 digital | 2-pole Butterworth (6 Hz or 10 kHz/ch) filtering |
| NI 4220 | PXI | 2 (1/4, 1/2, or full bridge) | 16 | 333 kS/s ¹ | ±0.01 to ±10 V | ✓ | 2 digital | 4-pole Butterworth (10 Hz or 100 Hz, 1 kHz, 10 kHz bypass) filter |
| NI 4224 | PXI | 8 DI | 16 | 333 kS/s ² | 60 VDC | — | 2 digital | Per-channel selectable gain |
| NI 4351 | PCI, PXI | 16 signal or 14 thermocouple | 24 | 60 readings/s | ±625 mV to ±15 V | — | — | 10, 50, and 60 Hz notch filter and open thermocouple detection |

¹333 kS/s single-channel, 100 kS/s simultaneous sampling; ²Single-channel rate

SCXI Signal Conditioning – High-Channel-Count DAQ Systems

An effective data acquisition system should incorporate the critical signal conditioning technologies you need without sacrificing the measurement accuracy, power, or flexibility of your custom solution. You can configure an NI SCXI DAQ system to accept a wide variety of sensor and signal types and easily reconfigure or expand the system for your future application demands.

- Customize your system with a variety of modules
- Easily connect to your PC via USB, PCI, or PXI
- Take advantage of NIST-traceable calibration
- Protect your system with isolation up to 1,000 V
- Link chassis to expand to up to 3,000 channels
- Save costs by choosing a 4- or 12-slot chassis



Use the following table to help select the right hardware for your measurement application.

| | Module | Channels ¹ | Signal Types | | | | | | | | | | | Description | Gain | Ranges/ Signal Types | Filtering | Isolation | Excitation Values | Parallel Mode |
|---------------|--|-----------------------|---|-----------------------|---|----------------------|--------------------|----------------------|---------------|------------------|--------------|-------------------------------|-------------------------|--|-------------------------------------|---|--|----------------------------------|--|------------------|
| | | | Millivolts/Volts | Medium Voltage (60 V) | High Voltage (300 V/1,000 V) ⁹ | Current (4 to 20 mA) | High Current (5 A) | Frequency-to-Voltage | Thermocouples | RTDs/Thermistors | Strain Gages | Force, Load, Torque, Pressure | LVDIs, RVDIs, Resolvers | Accelerometers | TTL/CMOS | | | | | |
| USB | SCXI-1600 | 1 DI | Any signal type can be measured when combined with other SCXI modules | | | | | | | | | | | USB digitizer ² | 1 to 200 | ±0.05 to ±10 V | — | — | — | — |
| | SCXI-1100 | 32 DI | ✓ | — | — | ✓ | — | — | ✓ | — | — | — | — | Multiplexer amplifier | 1 to 2000 ³ (program) | ±2.5 mV to ±10 V; 4 to 20 mA | 4 Hz, 10 kHz, bypass ⁴ | — | — | — |
| Analog Input | SCXI-1102 | 32 DI | ✓ | — | — | ✓ | — | — | ✓ | ✓ ⁵ | — | — | — | Thermocouple amplifier | 1 or 100 (per channel) | ±100 mV to ±10 V; 4 to 20 mA; TC ⁵ | 2 Hz | — | — | — |
| | SCXI-1102B, SCXI-1102C | 32 DI | ✓ | — | — | ✓ | — | — | — | — | — | — | — | Multiplexer amplifier | 1 or 100 (per channel) | ±100 mV to ±10 V; 4 to 20 mA | 1102B – 200 Hz 1102C – 10 kHz | — | — | — |
| | SCXI-1104, SCXI-1104C | 32 DI | ✓ | ✓ | — | — | — | — | — | — | — | — | — | Multiplexer | 0.1 | ±60 VDC, ±42 VAC | 1104 – 2 Hz 1104C – 10 kHz | — | — | — |
| | SCXI-1112 ⁶ | 8 DI | — | — | — | — | — | — | ✓ | — | — | — | — | Thermocouple input | 100 | TC ⁵ | 2 Hz | — | — | — |
| | SCXI-1120 | 8 ISO | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | — | — | — | — | Isolation amplifier | 1 to 2000 (per channel) | ±2.5 mV to ±1000 V ^{7,12} 4 to 20 mA | 4 Hz, 10 kHz (per channel) | 250 V _{rms} (CAT II) | — | ✓ |
| | SCXI-1120D | 8 ISO | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | Wide band isolation amplifier | 1 to 1000 | ±50 mV to ±1000 V ^{7,12} (per channel) | 4.5 kHz, 22.5 kHz (per channel) | 250 V _{rms} (CAT II) | — | ✓ |
| | SCXI-1121 | 4 ISO | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | ✓ | ✓ | ✓ | — | Isolation amplifier with excitation and filter | 1 to 2000 (per channel) | ±2.5 mV to ±250 V ⁷ 4 to 20 mA; TC ⁵ | 4 Hz, 10 kHz (per channel) | 250 V _{rms} (CAT II) | 3.33 V, 10 V 0.15 mA, 0.45 mA | ✓ |
| | SCXI-1122 | 16 ISO | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | ✓ | ✓ | ✓ | — | Isolated multiplexer amplifier | 1 to 2000 ³ (program) | ±2.5 mV to ±250 V ⁷ 4 to 20 mA | 4 Hz, 4 kHz ⁴ | 480 V _{rms} (CAT II) | 3.33 V, 1 mA | — |
| | SCXI-1125 | 8 ISO | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | — | — | — | — | Isolation amplifier | 1 to 2000 (per channel) | ±2.5 mV to ±1000 V ^{7,12} 4 to 20 mA; TC ⁵ | 4 Hz, 10 kHz (per channel) | 300 V _{rms} (CAT II) | — | ✓ |
| | SCXI-1126 | 8 ISO | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | Programmable isolated F-to-V | — | ±50 mV to ±1000 V ^{7,12} 15 Hz to 128 kHz | — | 250 V _{rms} (CAT II) | — | ✓ |
| | SCXI-1140 | 8 DI | ✓ | — | — | — | — | — | — | — | — | — | — | SSH ⁸ amplifier | 1 to 500 (per channel) | ±10 mV to ±10 V | — | — | — | ✓ |
| | SCXI-1141, SCXI-1142, SCXI-1143 | 8 DI | ✓ | — | — | — | — | — | — | — | — | — | — | Programmable lowpass filter | 1 to 100 (per channel) | ±50 mV to ±5 V | 10 Hz to 25 kHz | — | — | ✓ |
| | SCXI-1503 | 16 DI | — | — | — | — | — | — | ✓ | — | — | — | — | Programmable RTD/thermister input | 1 or 100 (per channel) | ±100 mV, ±10 V | 5 kHz | — | current excitation 100 µA | — |
| | SCXI-1520 | 8 DI | ✓ | — | — | — | — | — | — | ✓ | ✓ | — | — | Programmable strain input module w/SSH ⁸ | 1 to 1000 (per channel) | ±10 mV to ±10 V strain gage | 10 Hz to 10 kHz (program per channel) | — | 0 to 10 V (17 settings) | ✓ |
| | SCXI-1521, SCXI-1521B | 24 DI | — | — | — | — | — | — | — | ✓ | — | — | — | Programmable strain input | 42 | 0 to 250 mV strain gage | 10 Hz | — | 0, 1.25, 2.5, 5 V programmable | — |
| Analog Output | SCXI-1530 ⁹ , SCXI-1531 ⁹ | 4/8 SE or DI | ✓ | — | — | — | — | — | — | — | — | — | ✓ | Programmable accelerometer input w/SSH ⁸ | 1 to 100 (per channel) | ±50 mV to ±5 V AC coupled accelerometer | 2.5 to 20 kHz (program per channel) | — | 4 mA (program per channel) | ✓ |
| | SCXI-1540 | 8 DI | — | — | — | — | — | — | — | — | — | ✓ | — | Programmable LVDT input | 0.8 to 25 | ±0.5 to ±6 V _{rms} (per channel) | 250 Hz (per channel) | — | 1 to 3 V _{rms} 2.5 to 10 kHz | — |
| DIO | SCXI-1124 | 6 ISO output | ✓ | — | — | ✓ | — | — | — | — | — | — | — | Isolated output | Voltage/current (per channel) | ±1 to ±10 V, 1 to 10 V, 0 to 20 mA | — | 250 V (CAT II) | — | — |
| | SCXI-1581 | 32 | — | — | — | — | — | — | — | ✓ ⁵ | — | — | — | Current excitation | — | — | — | — | 100 µA | — |
| Switching | SCXI-1162, SCXI-1162HV | 32 | — | — | ✓ ¹⁰ | — | — | — | — | — | — | — | ✓ ¹¹ | Isolated digital input | — | TTL/CMOS ±240 VAC/VDC | — | 300 V _{rms} | — | ✓ |
| | SCXI-1163 | 32 | — | — | — | — | — | — | — | — | — | — | ✓ | Isolated digital output | — | TTL/CMOS | — | 300 V _{rms} | — | ✓ |
| | SCXI-1127, SCXI-1128 | 64 SE, 32 DI, 8x4 | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | ✓ | — | — | — | Multiplexer/matrix switch | — | ±5 mV to ±250 V 20 mA, TC ⁵ | — | 250 V _{rms} | — | — |
| | SCXI-1129 | 256 crosspoint | ✓ | ✓ | ✓ | ✓ | — | — | ✓ | ✓ | — | — | — | Matrix switch (mechanical) | — | ±5 mV to ±150 V 20 mA, TC ⁵ | — | 150 V _{rms} | — | — |
| | SCXI-1160 | 16 | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | — | SPDT relay (latching) | — | 2 A at 250 VAC 2 A at 30 VDC | — | 250 V _{rms} | — | — |
| | SCXI-1161 ⁵ | 8 | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | SPDT relay (nonlatching) | — | 8 A at 125 VAC, 6 A at 250 VAC, 5 A at 30 VDC | — | 250 V _{rms} | — | — |
| | SCXI-1163R | 8 4x1 | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | Solid-state relay | — | 200 mA at 240 VAC/VDC | — | 250 V _{rms} | — | ✓ |
| | SCXI-1166 | 32 | ✓ | ✓ | ✓ | ✓ | ✓ | — | — | — | — | — | — | SPDT relay | — | 5 A at 30 VDC | — | 125 V _{rms} | — | — |
| | SCXI-1190/ ¹⁵ | Quad/4x1 | ✓ | — | — | ✓ | — | — | — | — | — | — | — | RF switch | — | Up to 4 GHz | — | 300 V _{rms} | — | — |
| | SCXI-1192 | 8 | — | ✓ | — | — | — | — | — | — | — | — | — | RF SPDT | — | 18 GHz | — | — | — | — |
| Switching | SCXI-1193 | 32 | ✓ | ✓ | ✓ | — | — | — | — | — | — | — | — | RF multiplexer/matrix | — | 150 V, 500 MHz | — | 150 V (CAT I) | — | — |

¹ Recommended module for that type of measurement; ² DI – differential, SE – single-ended, ISO – isolated input; ³ For use with other SCXI modules; ⁴ One programmable gain amplifier per module; ⁵ One filter for entire module, low-bandwidth settings will reduce usable scanning rate; ⁶ TC – works with these thermocouple types: K, E, R, S, N, B, or custom; ⁷ Module does not require a terminal block; ⁸ Input signals greater than ±5 V require SCXI-1313 or SCXI-1327, TBX-1316 terminal blocks; ⁹ SSH – simultaneous sample-and-hold amplifiers; ¹⁰ Add the SCXI-1581 current excitation module to SCXI-1102 for high-channel-count RTD measurements; ¹¹ SCXI-1162 HV only; ¹² Input signals greater than ±300 V require the TBX-1316 terminal block

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