Bus-Powered M Series Multifunction DAQ for USB — 16-Bit, up to 400 kS/s, up to 32 Analog Inputs, Isolation

NI USB-6210, NI USB-6211, NI USB-6212, NI USB-6215, NI USB-6216, NI USB-6218

- Up to 32 analog inputs at 16 bits, up to 400 kS/s (250 kS/s scanning)
- Up to 2 analog outputs at 16 bits
- Up to 32 TTL/CMOS digital I/O lines
- Two 32-bit, 80 MHz counter/timers
- Digital triggering
- NI-PGIA 2 and NI-MCal calibration technology for improved measurement accuracy
- NI signal streaming for 4 high-speed data streams on USB
- Bus-powered
- Available with CAT I isolation
- 1-year warranty
- Additional warranty and calibration services available

Operating Systems

- Windows Vista (32- and 64-bit)/XP/2000
- Mac OS X[1]
- Linux®[1]

Recommended Software

- LabVIEW
- LabVIEW SignalExpress
- LabWindows™/CVI
- Measurement Studio

Other Compatible Software

- C#, Visual Basic .NET
- ANSI C/C++

Measurement Services Software (included)

- NI-DAQmx or NI-DAQmx Base driver software
- Measurement & Automation Explorer configuration utility[2]
- LabVIEW SignalExpress LE[2]

[1]Mac OS X and Linux kits are not available for USB-6212 and USB-6216
[2]Windows kits only

Family	Bus	Connector	Analog Inputs	Resolution (bits)	Max Rate (S/s)	Analog Outputs	Analog Input Resolution (bits)	Max Rate (S/s)	Range (V)	Digital I/O	32-Bit Counter	Isolation
USB-6210	USB	Screw	16	16	250 kS/s	0	16	250 k	±10	4 DI/4 DO	2	–
USB-6211	USB	Screw	16	16	250 kS/s	2	16	250 k	±10	4 DI/4 DO	2	–
USB-6212	USB	Screw/68-pin SCSI	16	16	400 kS/s	2	16	250 k	±10	32 DIO[1]	2	–
USB-6215	USB	Screw	16	16	250 kS/s	2	16	250 k	±10	4 DI/4 DO	2	60 V CAT I
USB-6216	USB	Screw/68-pin SCSI	16	16	400 kS/s	2	16	250 k	±10	32 DIO[1]	2	60 V CAT I
USB-6218	USB	Screw	32	16	250 kS/s	2	16	250 k	±10	8 DI/8 DO	2	60 V CAT I

[1] 24 digital I/O for 68-pin SCSI mass terminal versions.

Table 1. NI USB-621x Selection Guide

Overview and Applications

With recent bandwidth improvements and new innovations from National Instruments, USB has evolved into a core bus of choice for measurement and automation applications. NI M Series devices for USB deliver high-performance data acquisition in an easy-to-use and portable form factor through USB ports on laptop computers and other portable computing platforms. NI designed a new and innovative patent-pending NI signal streaming technology that enables sustained bidirectional high-speed data streams on USB. The new technology, combined with advanced external synchronization and isolation, helps engineers and scientists achieve high-performance applications on USB.

NI M Series bus-powered multifunction data acquisition (DAQ) devices for USB are optimized for superior accuracy in a small form factor. They provide an onboard NI-PGIA 2 amplifier designed for fast settling times at high scanning rates, ensuring 16-bit accuracy even when measuring all available channels at maximum speed.

All bus-powered devices have a minimum of 16 analog inputs, digital triggering, and two counter/timers. USB M Series devices are ideal for test, control, and design applications including:

- Portable data logging – log environmental or voltage data quickly and easily
- Field-monitoring applications
- Embedded OEM applications
- In-vehicle data acquisition
- Academic lab use – academic discounts available

NI Signal Streaming

To optimize the use of the Universal Serial Bus (USB) and deliver high-performance data acquisition, National Instruments created several key technologies to push the limits of USB throughput and latency. NI signal streaming combines three innovative hardware- and software-level design elements to enable sustained high-speed and bidirectional data streams over USB. For more information, visit **ni.com/usb**.

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M Series for Test

USB M Series multifunction DAQ devices complement existing test systems that need additional measurement channels. For higher-channel-count signal conditioning on USB, consider the NI CompactDAQ or SCXI platforms.

USB M Series for Design

For design applications, you can use a wide range of I/O – from 16 differential analog inputs to 32 digital lines – to measure and verify prototype designs. USB M Series devices and NI LabVIEW SignalExpress interactive measurement software deliver benchtop measurements to the PC. With LabVIEW SignalExpress, you can quickly create design verification tests. You can convert your tested and verified LabVIEW SignalExpress projects to LabVIEW applications for immediate M Series DAQ use, and bridge the gap between test, control, and design applications.

USB M Series for OEMs

Shorten your time to market by integrating world-class National Instruments OEM measurement products in your design. Board-only versions of USB M Series DAQ devices are available for OEM applications, with competitive quantity pricing and available software customization. The NI OEM Elite Program offers free 30-day trial kits for qualified customers. Visit **ni.com/oem** for more information.

Recommended Training and Services

All M Series devices are available with additional warranty and calibration services. For new data acquisition programmers, NI recommends the "Data Acquisition: 7 Steps to Success" tutorial kit. This tutorial kit helps shorten development time for data acquisition applications by describing the various stages of getting started with DAQ including system definition, setup, test, and application programming.

Recommended Software

National Instruments measurement services software, built around NI-DAQmx driver software, includes intuitive application programming interfaces, configuration tools, I/O assistants, and other tools designed to reduce system setup, configuration, and development time. National Instruments recommends using the latest version of NI-DAQmx driver software for application development in NI LabVIEW, LabVIEW SignalExpress, LabWindows/CVI, and Measurement Studio software. To obtain the latest version of NI-DAQmx, visit **ni.com/support/daq/versions**. NI measurement services software speeds up your development with features including:

- A guide to create fast and accurate measurements with no programming using the DAQ Assistant
- Automatic code generation to create your application in LabVIEW; LabWindows/CVI; LabVIEW SignalExpress; and C#, Visual Studio .NET, ANSI C/C++, or Visual Basic using Measurement Studio
- Multithreaded streaming technology for 1,000 times performance improvements
- Automatic timing, triggering, and synchronization routing to make advanced applications easy
- More than 3,000 free software downloads available at **ni.com/zone** to jump-start your project
- Software configuration of all digital I/O features without hardware switches/jumpers
- Single programming interface for analog input, analog output, digital I/O, and counters on hundreds of multifunction DAQ hardware devices

M Series devices are compatible with the following versions (or later) of NI application software – LabVIEW, LabWindows/CVI, or Measurement Studio versions 7.x; and LabVIEW SignalExpress 2.x.

Recommended Accessories (Mass Terminal Versions)

Signal conditioning is required for sensor measurements or voltage inputs greater than 10 V. NI SCC products, which are designed to increase the performance and reliability of your data acquisition system, are up to 10 times more accurate than using terminal blocks alone. Refer to Table 2 for more information or visit **ni.com/sigcon**.

Sensor/Signals (>10 V)		
System Description	**Cable**	**Carrier**
SCC signal conditioning	SH68-68-EPM	SCC
Sensor/Signals (<10 V)		
System Description	**Cable**	**Terminal Block**
Screw terminal (shielded)[2]	SH68-68-EPM	SCC-68[1]
BNC connectivity	SH68-68-EPM	BNC-2110
Screw terminal (nonshielded)[2]	R68-68	SCC-68[1]

[1] Includes SCC signal conditioning.
[2] Consider the integrated screw terminal version of the USB DAQ device.

Table 2. Recommended Accessories

Ordering Information

NI USB-6210 screw terminal (Windows) 779675-01
NI USB-6210 screw terminal (Mac OS X and Linux®).....780103-01
NI USB-6211 screw terminal (Windows) 779676-01
NI USB-6211 screw terminal (Mac OS X and Linux®).....780104-01
NI USB-6212 screw terminal (Windows) 780107-01
NI USB-6212 mass terminal (Windows)..... 780169-01
NI USB-6215 screw terminal (Windows) 779677-01
NI USB-6215 screw terminal (Mac OS X and Linux®).....780105-01
NI USB-6216 screw terminal (Windows) 780108-01
NI USB-6216 mass terminal (Windows)..... 780170-01
NI USB-6218 screw terminal (Windows) 779678-01
NI USB-6218 screw terminal (Mac OS X and Linux®).....780106-01

Includes NI-DAQmx or NI-DAQmx Base data acquisition driver software and 1 m USB cable.

Board-Only Devices for OEM

NI USB-6211 OEM
1 each 196203-03
10 each 779803-01
NI USB-6212 OEM
1 each 197504-03
10 each 780171-01
NI USB-6216 OEM
1 each 197504-01
10 each 780172-01
NI USB-6218 OEM
1 each 196203-01
10 each 779805-01

Data Acquisition Services

Data Acquisition: 7 Steps to Success..... 779489-01

BUY NOW!

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to **ni.com/daq.**

Specifications

Refer to the *NI USB-621x Specifications* manual at **ni.com/manuals** for more detailed information. Specifications listed below are typical at 25 °C unless otherwise noted.

Analog Input

Number of channels	
USB-6210/6211/6212/6215/6216	8 differential or 16 single ended
USB-6218	16 differential or 32 single ended
ADC resolution	16 bits
Sampling rate	
USB-6210/6211/6215/6218	250 kS/s single channel, 250 kS/s multichannel (aggregate)
USB-6212/6216	400 kS/s single channel, 400 kS/s multichannel (aggregate)
Input coupling	DC
Input range	
USB-6210/6211/6212/6215/6216/6218	±10, ±5, ±1, ±0.2 V
Maximum working voltage for analog inputs (signal + common mode)	±10.4 V of AI GND
Input impedance	
Device on	
AI+ to AI GND	>10 GΩ in parallel with 100 pF
AI- to AI GND	>10 GΩ in parallel with 100 pF
Device off	
AI+ to AI GND	1200 Ω
AI- to AI GND	1200 Ω
Input bias current	±100 pA
Crosstalk (at 100 kHz)	
Adjacent channels	-75 dB
Nonadjacent channels	-90 dB
Input FIFO size	4,095 samples
Scan list memory	4,095 entries
Data transfers	NI signal streaming on USB, programmed I/O

Analog Output

Number of channels	
USB-6210	0
USB-6211/6212/6215/6216/6218	2
DAC resolution	16 bits
Maximum update rate	
1 channel	250 kS/s
2 channels	250 kS/s per channel
Timing accuracy	50 ppm of sample rate
Timing resolution	50 ns
Output range	±10 V
Output coupling	DC
Output impedance	0.2 Ω
Output current drive	±2 mA
Output FIFO size	8,191 samples shared among channels used
Data transfers	NI signal streaming on USB, programmed I/O

Calibration (AI and AO)

Recommended warm-up time	15 minutes
Calibration interval	1 year

Digital I/O/PFI

Static Characteristics

Number of channels	
Digital input	
USB-6210/6211/6215	4
USB-6218	8
Digital output	
USB-6210/6211/6215	4
USB-6218	8
Digital input/output	
USB-6212/6216 screw terminal	32
USB-6212/6216 mass terminal	24
Ground reference	D GND
Direction control	Each terminal individually programmable as input or output
Pull-down resistor	
USB-6210/6211/6215/6218	47 kΩ ±1%
USB-6212/6216	50 kΩ typical, 20 kΩ minimum

PFI Functionality

USB-6210/6211/6215/6218

Functionality	Static digital input, static digital output, timing input, timing output
Timing output sources	Many AI, AO, counter, DI, DO timing signals
Debounce filter settings	125 ns, 6.425 µs, 2.56 ms, disable; high and low transitions; selectable per input

USB-6212/6216

Functionality	Static digital input, static digital output, timing input, timing output
Timing output sources	Many AI, AO, counter timing signals
Debounce filter settings	125 ns, 6.425 ms, 2.56 ms, disable; high and low transitions; selectable per input timing signals

General-Purpose Counter/Timers

Number of counter/timers	2
Counter measurements	Edge counting, pulse, semiperiod, period, two-edge separation

Position measurements	X1, X2, X4 quadrature encoding with Channel Z reloading; two-pulse encoding
Output applications	Pulse, pulse train with dynamic updates, frequency division, equivalent time sampling
Internal base clocks	80 MHz 20 MHz 0.1 MHz
Base clock accuracy	50 ppm
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down
Data transfers	NI signal streaming on USB, programmed I/O

Frequency Generator

Number of channels	1
Base clocks	10 MHz, 100 kHz
Divisors	1 to 16
Base clock accuracy	50 ppm

Output can be available on any output PFI line.

External Digital Triggers

Source	Any input PFI
Polarity	Software-selectable for most signals
Analog input function	Start Trigger Reference Trigger Pause Trigger Sample Clock Convert Clock Sample Clock Timebase
Analog output function	Start Trigger Pause Trigger Sample Clock Sample Clock Timebase
Counter/timer functions	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down

Bus Interface

USB	Hi-Speed USB or full-speed USB
NI signal streaming	4 high-speed data streams; can be used for analog input, analog output, counter/timer 0, counter/timer 1

Power Requirements

USB

Input voltage on USB-621x	
USB port	4.5 to 5.25 V in configured state

Caution: Do not exceed 16 mA per DIO pin.

Maximum Working Voltage

USB-6210/6211/6212

Channel-to-earth ground	11 V, Measurement Category I

Caution: Do not use for measurements within categories II, III, and IV.

USB-6215/6216/6218

Channel-to-earth ground

Continuous	30 V_{rms}/60 VDC Measurement Category I
Withstand	840 V_{rms}/1200 VDC Verified by a 5 s dielectric withstand test

Channel-to-bus

Continuous	30 V_{rms}/60 VDC Measurement Category I
Withstand	1400 V_{rms}/1950 VDC Verified by a 5 s dielectric withstand test

Caution: This device is rated for Measurement Category I and the voltage across the isolation barrier is limited to no greater than 30 V_{rms}/60 VDC/42.4 V_{pk} continuous. Do not use for measurements within categories II, III, or IV.

Physical Requirements

Enclosure dimensions (includes connectors)

Screw terminal	16.9 by 9.4 by 3.1 cm (6.65 by 3.70 by 1.20 in.)
Mass terminal	9.3 by 9.4 by 3.1 cm (7.61 by 3.68 by 1.20 in.)

I/O connector

USB-6210/6211/6215	
Screw terminal	Two 16-position COMBICON
USB-6212/6216/6218	
Screw terminal	Four 16-position COMBICON
USB-6212/6216	
Mass terminal	One 68-pin SCSI
USB connector	Series B receptacle
Screw terminal wiring	16 to 28 AWG

Environmental

Operating temperature	0 to 45 °C
Storage temperature	-20 to 70 °C
Humidity	10 to 90% RH, noncondensing
Maximum altitude	2,000 m
Pollution degree (indoor use only)	2

Safety and Compliance

Safety

This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1

Note: For UL and other safety certifications, refer to the product label or visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Electromagnetic Compatibility

This product is designed to meet the requirements of the following standards of EMC for electrical equipment for measurement, control, and laboratory use:

- EN 61326 EMC requirements; Minimum Immunity
- EN 55011 Emissions; Group 1, Class A
- CE, C-Tick, ICES, and FCC Part 15 Emissions; Class A

Note: For EMC compliance, operate this device according to product documentation.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

Note: Refer to the Declaration of Conformity (DoC) for this product for any additional regulatory compliance information. To obtain the DoC for this product, visit **ni.com/certification**, search by model number or product line, and click the appropriate link in the Certification column.

Environmental Management

NI is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the NI and the Environment Web page at **ni.com/environment**. This page contains the environmental regulations and directives with which NI complies, as well as any other environmental information not included in this document.

Waste Electrical and Electronic Equipment (WEEE)

EU Customers: At the end of their life cycle, all products must be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit **ni.com/environment/weee.htm**.

Management Methods for Controlling Pollution Caused by Electronic Information Products Regulation (China RoHS)

电子信息产品污染控制管理办法（中国 RoHS）

中国客户 National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 ni.com/environment/rohs_china。(For information about China RoHS compliance, go to ni.com/environment/rohs_china.)

NI Services and Support

NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit **ni.com/services**.

Training and Certification

NI training is the fastest, most certain route to productivity with our products. NI training can shorten your learning curve, save development time, and reduce maintenance costs over the application life cycle. We schedule instructor-led courses in cities worldwide, or we can hold a course at your facility. We also offer a professional certification program that identifies individuals who have high levels of skill and knowledge on using NI products. Visit **ni.com/training**.

Professional Services

Our NI Professional Services team is composed of NI applications and systems engineers and a worldwide National Instruments Alliance Partner program of more than 600 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit **ni.com/alliance**.

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Certified Alliance Partner

OEM Support

We offer design-in consulting and product integration assistance if you want to use our products for OEM applications. For information about special pricing and services for OEM customers, visit **ni.com/oem**.

Local Sales and Technical Support

In offices worldwide, our staff is local to the country, giving you access to engineers who speak your language. NI delivers industry-leading technical support through online knowledge bases, our applications engineers, and access to 14,000 measurement and automation professionals within NI Developer Exchange forums. Find immediate answers to your questions at **ni.com/support**.

We also offer service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Visit **ni.com/ssp**.

Hardware Services

NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with **ni.com/pxiadvisor**.

Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit **ni.com/calibration**.

Repair and Extended Warranty

NI provides complete repair services for our products. Express repair and advance replacement services are also available. We offer extended warranties to help you meet project life-cycle requirements. Visit **ni.com/services**.

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