Low-Cost M Series Multifunction DAQ – 16-Bit, 250 kS/s, up to 80 Analog Inputs

NI M Series – Low-Cost

- NI recommends high-speed M Series for 5X faster sampling rates or high-accuracy M Series for 4X higher resolution
- 16, 32, or 80 analog inputs at 16-bit, 250 kS/s
- Up to 4 analog outputs at 16 bits, 833 kS/s (6 µs full-scale settling time)
- Programmable input range (±10, ±5, ±1, ±0.2 V) per channel
- Up to 48 TTL/CMOS digital I/O lines (up to 32 hardware-timed at 1 MHz)
- Two 32-bit, 80 MHz counter/timers
- Digital triggering
- NI-MCal calibration technology for improved measurement accuracy
- 6 DMA channels for fast data throughput
- Available lifetime warranty and calibration services

Operating Systems

- Windows 2000/XP
- Mac OS X
- Linux®

Recommended Software

- LabVIEW
- LabWindows/CVI
- Measurement Studio

Other Compatible Software

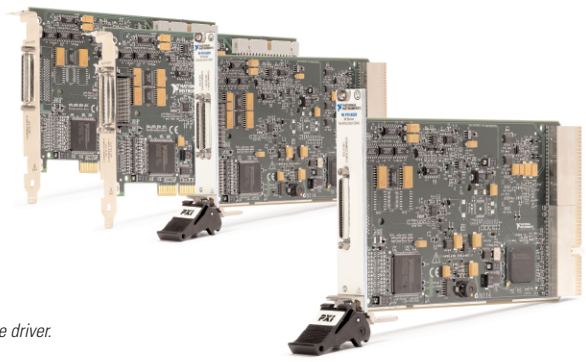
- SignalExpress
- VI Logger
- Visual Studio .NET
- C/C++/C#

Measurement Services Software (included)[1]

- NI-DAQmx driver software
- Measurement & Automation Explorer configuration utility
- VI Logger Lite data-logging software

[1]Mac OS X users must download NI-DAQmx Base driver.

Lifetime Warranties *NEW!*



Family	Bus	Analog Inputs	Analog Input Resolution (bits)	Analog Outputs	Output Resolution (bits)	Max Output Rate (kS/s)	Analog Output Range (V)	Digital I/O	Correlated (clocked) DIO
NI 6220	PCI, PXI	16	16	–	–	–	–	24	8, up to 1 MHz
NI 6221	PCI, PXI	16	16	2	16	833	±10	24	8, up to 1 MHz
NI 6221 (37-Pin)[1]	PCI	16	16	2	16	833	±10	10	2, up to 1 MHz
NI 6224	PCI, PXI	32	16	–	–	–	–	48	32, up to 1 MHz
NI 6225	PCI, PXI	80	16	2	16	833	±10	24	8, up to 1 MHz
NI 6229	PCI, PXI	32	16	4	16	833	±10	48	32, up to 1 MHz

[1] 37-Pin multifunction DAQ devices are not compatible with NI SCC or SCXI platforms.

Table 1. Low-Cost M Series Selection Guide

Overview and Applications

National Instruments M Series low-cost multifunction data acquisition (DAQ) devices provide optimized functionality for cost-sensitive applications. Low-cost M Series devices have up to 80 analog inputs, 48 digital I/O lines, four analog outputs, two counter/timers, and digital triggering. All low-cost M Series devices are available with lifetime warranties and additional calibration services. Low-cost M Series devices have a one-year calibration interval. For better accuracy, faster speeds, and an extended 2-year calibration service, consider the high-speed and high-accuracy M Series devices.

M Series for Test

For test, you can use 16-bit, 250 kS/s analog inputs and 1 MHz digital lines in conjunction with NI signal conditioning for applications including data logging and sensor measurements. Low-cost M Series devices are compatible with National Instruments SCC and SCXI signal conditioning platforms, which provide amplification, filtering, and power for virtually every type of sensor. These platforms also are compliant with IEEE 1451.4 smart transducer electronic data sheet (TEDS) sensors, which provide digital storage for sensor data sheet information.

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M Series for Control

M Series digital lines can drive 24 mA for relay and actuator control. With up to four analog outputs, two 80 MHz counter/timers, and six DMA channels, M Series devices can execute multiple control loops simultaneously. Low-cost M Series devices also have direct support for encoder measurements, protected digital lines, and digital debounce filters for control applications. With up to 80 analog inputs, 32 clocked digital lines at rates of 1 MHz, and four analog outputs, you can execute multiple control loops with a single device. For higher-count control loops, you can use M Series devices in conjunction and tightly synchronized with National Instruments analog output devices for 64 or more loops.

M Series for Design

You can use the wide range of I/O – from 80 analog inputs to 48 digital lines – to measure and verify prototype designs. M Series devices and National Instruments SignalExpress interactive measurement software bring benchtop measurements to the PC.With NI SignalExpress interactive configuration-based steps, you can quickly create design verification tests. The fast acquisition and generation rates of low-cost M Series devices along with SignalExpress provide on-the-fly design analysis. You can convert your tested and verified SignalExpress projects to NI LabVIEW applications for immediate M Series DAQ use and bridge the gap between test, control, and design applications.

Hybrid-Slot-Compatible PXI Modules

PXI M Series modules are hybrid-slot-compatible so that you can use them in both PXI slots and the hybrid slots found in new PXI Express chassis. The PXI Systems Alliance specifies that hybrid-slot-compatible PXI modules use modified slot connectors to mechanically fit in both PXI slots and hybrid slots. This mechanical change:

- Provides compatibility to past, current, and future PXI chassis
- Maintains existing product specifications
- Requires no software changes (application or driver)
- Maintains speed and capability of all PXI communication (PXI Express signaling is not provided)

However, hybrid-slot-compatible PXI modules do not include the pins used to implement PXI local bus communication, which is used for backplane SCXI control from the right most PXI slot in PXI/SCXI combination chassis (PXI-1010, PXI-1011, PXI-1050, and PXI-1052). For these applications, NI provides unmodified PXI M Series modules that maintain the required local bus capabilities. Refer to SCXI Control of PXI/SCXI Combination Chassis section within Ordering Information for part numbers.

Simultaneous and Intelligent Data Acquisition

When you need to obtain performance from a data acquisition device beyond the capabilities of a multifunction DAQ device, National Instruments provides simultaneous sampling with NI S Series and intelligent DAQ with NI R Series. The S Series architecture dedicates an ADC per channel to provide higher aggregate sampling rates compared to multiplexed devices. S Series devices are ideal for applications including IF digitization, transient recording, ultrasound and sonar testing, and high-energy physics.

The multifunction R Series data acquisition devices contain a 1M/3M gate FPGA that is reconfigurable using the NI LabVIEW FPGA Module. Multifunction R Series devices have up to eight independent 16-bit analog inputs with up to 200 kHz simultaneous sampling, up to eight independent 16-bit analog outputs with up to 1 MHz simultaneous update rates, and up to 96 digital I/O lines configurable at rates up to 40 MHz.You can customize these devices to develop capabilities such as complete control over the synchronization and timing of all signals and operations; user-defined onboard decision-making logic; and digital lines individually configurable as input, output, counter/timers, PWM, flexible encoder inputs, or user-defined communication protocols.

Recommended Accessories

Signal conditioning is required for sensor measurements or voltage inputs greater than 10 V. National Instruments SCXI is a versatile, high-performance signal conditioning platform optimized for high-channel-count applications. NI SCC provides portable, flexible signal conditioning options on a per-channel basis. Visit **ni.com/sigcon** for resources on available NI signal conditioning.

The new National Instruments PCI-6221 (37-Pin) is the first M Series device to offer the 37-pin D-Sub connector that lowers connectivity cost by 80 percent. The D-Sub connector makes the NI PCI-6221 (37-Pin) ideal for OEM applications. For applications that do not require signal conditioning, refer to Table 2 for recommended cabling and accessories.

Recommended Training and Services

All M Series devices are available with additional warranty and calibration services. Choose from the one-year extended warranty, lifetime warranty, or lifetime warranty with one basic calibration service. 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 data acquisition applications 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 National Instruments LabVIEW, LabWindows/CVI, and Measurement Studio. To obtain the latest version of NI-DAQmx, visit **ni.com/support/daq/versions**. Mac OS X users can program M Series devices with NI-DAQmx Base driver software. M Series devices are compatible with the following versions (or later) of NI application software – LabVIEW, LabWindows/CVI, or Measurement Studio versions 7.x; SignalExpress 1.x; VI Logger 2.0; or LabVIEW with the LabVIEW Real-Time Module 7.1. M Series devices are not compatible with the Traditional NI-DAQ (Legacy) driver.

M Series	Feature	Connect to…	Connector[1]	Cable[2]	Cable Adapter	Accessory
68-pin devices	Noise-reducing	SCC portable signal conditioning	0 or 1	SHC68-68-EPM	–	See **ni.com/sigcom** or SCC-68
	Noise-reducing	SCXI high-performance signal conditioning	0 only	SHC68-68-EPM	–	See **ni.com/sigcom**
	Noise-reducing	Screw terminals	0 or 1	SHC68-68-EPM	–	SCC-68, SCB-68, or TBX-68
	Noise-reducing	Screw terminals (PXI only)	0 only	–	–	TB-2706
	Noise-reducing	BNC terminal block	0 or 1	SHC68-68-EPM	–	BNC-2110, BNC-2111, BNC-2120, or BNC-2090
	Noise-reducing	50-pin connector	0 or 1	SHC68-68-EPM	68M-50F-MIO	Custom-built or third-party
	Basic shielding	Screw terminals	0 or 1	SHC68-68	–	SCB-68, CB-68LP or CB-68LPR
	Low-cost	Screw terminals	0 or 1	RC68-68	–	CB-68LP or CB-68LPR
	Custom connectivity	Board mounting connectors	0 or 1	SHC68-68-EPM	–	PCB mounting connectors
	Custom connectivity	68-pin female connector	0 or 1	SHC68-68M-EPM	–	Custom-built or third-party
	Custom connectivity	Unterminated	0 or 1	SHC68-NT-S	–	Custom-built or third-party
37-pin devices	Low-cost	Screw terminals	0 only	SH37F-37M-1	–	CB-37FH, CB-37FV
	Low-cost	Screw terminals	0 only	–	–	CB-37F-LP

[1]Connector 0 is found on all M Series devices. 0 and 1 require two cables and accessories and are available on NI 6224, NI 6225, and NI 6229 devices.
[2]For NI 6225, use SHC68-68-EPM on connector 0 and SHC68-68 on connector 1.

Table 2. Recommended Accessories

Ordering Information

PCI

NI PCI-6220 779065-01
NI PCI-6221 779066-01
NI PCI-6221 (37-Pin) 779418-01
NI PCI-6224 779067-01
NI PCI-6225 779295-01
NI PCI-6229 779068-01

PXI

NI PXI-6220 779112-01
NI PXI-6221 779629-01
NI PXI-6224 779114-01
NI PXI-6225 779296-01
NI PXI-6229 779630-01

Includes data acquisition driver software.

SCXI Control of PXI/SCXI Combination Chassis

NI PXI-6221 779113-01
NI PXI-6229 779115-01

Data Acquisition Services

Data Acquisition: 7 Steps to Success 779489-01
1-Year Extended Warranty 960431-01
Lifetime Ltd Warranty 960432-01
Lifetime Ltd Warranty and 1 Basic Calibration 960433-01

BUY NOW!

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

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 Professional Services Team is comprised of NI applications engineers, NI Consulting Services, 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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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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Data Acquisition and Signal Conditioning Driver Software Options

NI-DAQmx

- Compatible with more than 200 DAQ devices
- Full-featured driver software for Windows and Linux®
- High-performance driver engine
- Fast single-point and multithreaded I/O
- Automatic code generation with DAQ Assistant
- Virtual channels for simple measurement configuration
- Multiple-device synchronization
- Optimized integration with LabVIEW VIs and analysis
- API for LabVIEW, ANSI C, Visual Studio .NET, and Visual Basic
- FREE data-logging software included

NI-DAQmx Base

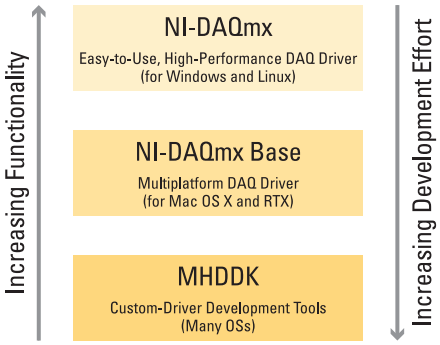
- Compatible with more than 80 DAQ devices
- Multiplatform driver for Linux, Mac OS X, RTX, Pocket PC, and Windows
- Subset of NI-DAQmx functionality
- Similar programming interface to NI-DAQmx
- Basic DAQ driver for LabVIEW and ANSI C

Measurement Hardware DDK

- Custom-driver development tools
- Register-level programming interface
- Designed for OEM customers
- Data acquisition for virtually any OS

Overview

The quality of the driver software is just as important as the quality of the measurement hardware. National Instruments offers three levels of data acquisition software, each with its own unique offering. The result is a complete offering of DAQ software to simplify use of NI data acquisition hardware in any application.



Three Levels of DAQ Driver Software

1. NI-DAQmx is full-featured, high-performance driver software that maximizes productivity and performance through an intuitive programming interface and added software.
2. NI-DAQmx Base is a basic multiplatform DAQ driver with a subset of NI-DAQmx functionality. It is the best option for applications on Mac OS X, RTX, and Pocket PC.
3. Measurement Hardware DDK is a development kit for the creation of custom drivers using register-level programming.

Note: Not all drivers work with all devices. Visit **ni.com/support/daq/versions** to check compatibility.

NI-DAQmx Driver Software

NI-DAQmx is full-featured, high-performance driver software that maximizes productivity and performance through an intuitive programming interface and included measurement services. It supports broad ranges of programming languages, devices, buses, sensors, and even mixed-signal types. NI-DAQmx is the best option almost every time for Windows and Linux development.

Note: National Instruments recommends using the latest version of NI-DAQmx driver software for application development in NI LabVIEW, LabWindows/CVI, and Measurement Studio 7.x or later on Windows and Linux.

Included Measurement Services[1]

NI-DAQmx includes a collection of measurement services designed to save data acquisition system developers time and money. A few of these services include:

Measurement & Automation Explorer (MAX) – Software for configuring, calibrating, testing, and managing your hardware.

DAQ Assistant – Software for creating configuration-based data acquisition tasks and automatic code generation in popular application development environments.

VI Logger Lite – FREE software specifically designed for basic data-logging applications.

NI Device Monitor – Software that provides a true plug-and-play experience for developers using USB DAQ modules.

[1]Windows version only.

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NI-DAQmx Base Driver Software

NI-DAQmx Base offers a subset of NI-DAQmx functionality on Windows, Linux, Mac OS X, RTX, and Pocket PC OSs. This driver software includes ready-to-use LabVIEW VIs and C function examples similar to those included in the full-featured NI-DAQmx software.

National Instruments built NI-DAQmx Base driver software using the NI Measurement Hardware DDK and developed the software almost entirely in the multiplatform LabVIEW graphical development environment. This lightweight, agile architecture makes it possible to quickly develop NI-DAQmx Base for additional OSs and devices in the future.

NI-DAQmx Base is the best choice for applications on Mac OS X, RTX, and Pocket PC.

Developers creating applications for Windows or Linux-based systems should consider using the latest in full-featured NI-DAQmx.

Measurement Hardware DDK

The Measurement Hardware DDK provides development tools and a register-level programming interface for the development of custom driver software. The Measurement Hardware DDK, designed for OEM customers developing applications that require nonstandard OSs, provides access to the full device register map and offers examples for completing common measurement and control functions. The Measurement Hardware DDK works with a selection of multifunction, analog output, digital I/O, and counter/timer I/O devices, including M Series, E Series, and S Series devices. Standard phone and e-mail support are not available for Measurement Hardware DDK users.

Developers considering the Measurement Hardware DDK should also study the advantages of industry-leading NI-DAQmx and NI-DAQmx Base software.

	NI-DAQmx High-Performance Multithreaded Driver	NI-DAQmx Base Multiplatform Register-Level Interface	Measurement Hardware DDK Custom Driver Development Tools
Bus and OS Support			
PCI/PXI	Linux, Windows 2000/NT/XP	Linux, Mac OS X, RTX[4]	Linux, Mac OS X, VxWorks[2], QNX[2]
USB[1]	Windows 2000/XP	Linux, Mac OS X	–
PCMCIA	Windows 2000/NT/XP	Pocket PC/WinCE	Pocket PC/WinCE
CompactFlash	–	Pocket PC/WinCE	–
Programming Languages			
Programming languages	LabVIEW, C/C++, Microsoft Visual Basic .NET and C#	LabVIEW, C/C++	LabVIEW, C/C++
LabVIEW interface	Complete polymorphic VIs and property nodes	Limited NI-DAQmx polymorphic VIs	Register-level VIs
Additional Measurement Services			
Development speed	●	◑	○
DAQ Assistant code generation	●[3]	–	–
Multithreaded I/O performance	●	–	–
Driver footprint	○	◑	●
Test panels	●	○	–
Automatic sensor scaling	●	–	–
Single programming interface for all hardware and I/O types	●	●	–
Measurement examples	>200	≈30	≈30
Hardware			
M Series	•	•	•
S Series	•	•	•
E Series	•	•	•
B Series	•	•	•
USB DAQ	•	•	–
SC Series	•	–	–
SCXI	•	–	–
DSA	•	–	•
Digital I/O	•	•	•
Timing I/O	•	–	–
AO	•	•	•

KEY: ● Best, ◑ Better, ○ Good, • All or many devices supported.
[1]USB DAQPad devices use NI-DAQmx. [2]With third-party software. [3]Windows only. [4]LabVIEW only.

For the latest information on applicable devices and OSs or new features, visit ni.com/daq/software.

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**.

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**.

Training and Certification

NI training is the fastest, most certain route to productivity with our tools. 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**.

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Professional Services

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, 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**.

Software Service Programs

NI offers service programs that provide automatic upgrades to your application development environment and higher levels of technical support. Our service programs ensure that you always have the latest advances in productivity and receive live, on-demand access to NI applications engineers through phone and e-mail to assist in developing your solutions. Service programs are cost-effective and simplify software purchasing as an annual, fixed cost, making it easier to plan and budget than intermittent individual upgrades. You also receive discounts for our training courses and materials. For details, visit **ni.com/ssp**.

Basic Service Level

- Upgrades purchased separately
- Support by NI applications engineers, R&D engineers, partners, and community members through online Developer Exchange
- Access to KnowledgeBase, example code, troubleshooting wizards, solutions, and white papers

Standard Service Level

- Automatic upgrades included
- All the benefits of Basic Service
- Support by NI applications engineers through direct phone or e-mail access
- 10 percent discount on training courses and materials

Premier Service Level

- All the benefits of Standard Service
- Support by NI senior applications engineers through direct phone or e-mail access with extended hours of operation

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