

# High-Accuracy M Series Multifunction DAQ 18-Bit, up to 625 kS/s, up to 32 Analog Inputs

## NI M Series – High-Accuracy

- 16 or 32 analog inputs at 18 bits, 625 kS/s (500 kS/s scanning)
- Up to 4 analog outputs at 16 bits, 2.8 MS/s (3  $\mu$ s full-scale settling)
- 7 programmable input ranges ( $\pm 100$  mV to  $\pm 10$  V) per channel
- Programmable, onboard lowpass filtering
- Programmable analog output ranges and offsets per channel
- Up to 48 TTL/CMOS digital I/O lines (up to 32 hardware-timed at 10 MHz)
- Two 32-bit, 80 MHz counter/timers
- Analog and digital triggering
- NI-MCal calibration technology for improved measurement accuracy
- 6 DMA channels for high-speed 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)<sup>1</sup>

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

<sup>1</sup>Mac OS X users must download NI-DAQmx Base driver.



**Lifetime Warranties NEW!**

Family	Bus	Analog Inputs	Analog Input Resolution (bits)	Analog Outputs	Analog Output Resolution (bits)	Max Output Rate (MS/s)	Analog Output Range (V)	Digital I/O	Correlated (clocked) DIO
NI 6280	PCI, PXI	16	18	–	–	–	–	24	8, up to 10 MHz
NI 6281	PCI, PXI	16	18	2	16	2.8	Programmable per channel	24	8, up to 10 MHz
NI 6284	PCI, PXI	32	18	–	–	–	–	48	32, up to 10 MHz
NI 6289	PCI, PXI	32	18	4	16	2.8	Programmable per channel	48	32, up to 10 MHz

Table 1. High-Accuracy M Series Selection Guide

## Overview and Applications

National Instruments M Series high-accuracy multifunction data acquisition (DAQ) devices are optimized for 18-bit analog input accuracy. This resolution is equivalent to 5½ digits for DC measurements. To ensure accuracy, the NI-PGIA 2 amplifier technology is optimized for low noise and fast settling to 18 bits, and the onboard lowpass filter rejects high-frequency noise and prevents aliasing. M Series devices are ideal for applications including test, control, and design. All high-accuracy devices have a minimum of 16 analog inputs, 24 digital I/O lines, seven programmable input ranges, analog and digital triggering, and two counter/timers. All high-accuracy M Series devices are available with lifetime warranties and additional calibration services. High-accuracy M Series devices have an extended 2-year calibration interval.

## M Series for Test

For test, you can use M Series high-accuracy analog inputs and 10 MHz digital lines in conjunction with NI signal conditioning for applications including electronics test, component characterization, and sensor and signal measurements requiring instrument-class accuracy. The 18-bit ADC and available filtering provides a 4X increase in resolution and 5X more measurement sensitivity. With fast sampling rates and a low noise floor, these devices can accurately acquire dynamic signals. For better noise rejection, the onboard lowpass filters significantly improve device accuracy. Advanced analog clamping circuitry protects the hardware from over voltage conditions and ensures accurate measurements on non-saturated channels. High-accuracy 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. By clocking the digital lines as fast as 10 MHz, you can use these lines for pulse-width modulation (PWM) to control valves, motors, fans, lamps, and pumps. With four waveform analog outputs, two 80 MHz counter/timers, and six DMA channels, M Series devices can execute multiple control loops simultaneously. The analog outputs on the high-accuracy M Series devices can generate up to 2.86 MS/s and also provide user-defined programmable offsets and ranges for maximum waveform resolution over any custom range. High-accuracy M Series devices also have direct support for encoder measurements, protected digital lines, and digital debounce filters for control applications. With up to 32 analog inputs, 32 clocked digital lines, 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. With the NI SoftMotion Development Module for LabVIEW, you can create a complete custom motion controller with M Series devices.

### M Series for Design

For design applications, you can use the wide range of I/O – from 32 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 high-speed 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. The 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. NI 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](http://ni.com/sigcon) for resources on available NI signal conditioning. For applications not requiring 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.

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## 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](http://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 <sup>1</sup>	Cable	Cable Adapter	Accessory
68-pin devices	Noise-reducing	SCC portable signal conditioning	0 or 1	SHC68-68-EPM	–	See <a href="http://ni.com/sigcom">ni.com/sigcom</a> or SCC-68
	Noise-reducing	SCXI high-performance signal conditioning	0 only	SHC68-68-EPM	–	See <a href="http://ni.com/sigcom">ni.com/sigcom</a>
	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	

<sup>1</sup>Connector 0 is found on all M Series devices. 0 and 1 require two cables and accessories and are available on NI 6284 and NI 6289 devices.

Table 2. Recommended Accessories

## Ordering Information

### PCI

NI PCI-6280.....	779108-01
NI PCI-6281.....	779109-01
NI PCI-6284.....	779110-01
NI PCI-6289.....	779111-01

### PXI

NI PXI-6280.....	779120-01
NI PXI-6281.....	779121-01
NI PXI-6284.....	779122-01
NI PXI-6289.....	779639-01

Includes data acquisition driver software.

### SCXI Control of PXI/SCXI Combination Chassis

NI PXI-6289.....	779123-01
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### 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](http://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](http://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](http://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](http://ni.com/alliance).



## 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](http://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](http://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](http://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](http://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](http://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](http://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

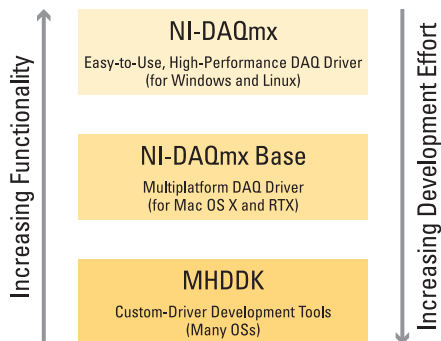
## Measurement Hardware DDK

- 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](http://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<sup>1</sup>

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.

<sup>1</sup>Windows version only.

## Data Acquisition and Signal Conditioning Driver Software Options

### 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
<b>Bus and OS Support</b>			
PCI/PXI	Linux, Windows 2000/NT/XP	Linux, Mac OS X, RTX <sup>4</sup>	Linux, Mac OS X, VxWorks <sup>2</sup> , QNX <sup>2</sup>
USB <sup>1</sup>	Windows 2000/XP	Linux, Mac OS X	–
PCMCIA	Windows 2000/NT/XP	Pocket PC/WinCE	Pocket PC/WinCE
CompactFlash	–	Pocket PC/WinCE	–
<b>Programming Languages</b>			
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
<b>Additional Measurement Services</b>			
Development speed	●	○	○
DAQ Assistant code generation	● <sup>3</sup>	–	–
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
<b>Hardware</b>			
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.

<sup>1</sup>USB DAQPad devices use NI-DAQmx. <sup>2</sup>With third-party software. <sup>3</sup>Windows only. <sup>4</sup>LabVIEW only.

For the latest information on applicable devices and OSs or new features, visit [ni.com/daq/software](http://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](http://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](http://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](http://ni.com/training).



## Professional Services

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## 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](http://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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