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## NI CompactDAQ

### USB Data Acquisition Systems



- Mix sensor measurements with analog and digital I/O in the same instrument
- Acquire from analog input modules at different rates with multiple timing engines
- Run up to seven I/O tasks simultaneously
- Windows 7/XP support
- Hi-Speed USB communication with NI Signal Streaming technology
- LabVIEW SignalExpress LE data-logging software included
- Four 32-bit general-purpose counters built into chassis (access through digital module or BNC triggers)
- BNC trigger connections on the cDAQ-9178 for up to 1 MHz clocks and triggers

### Overview

The NI cDAQ-9178 is an eight-slot NI CompactDAQ chassis designed for small, portable, mixed-measurement test systems. Combine the cDAQ-9178 with up to eight NI C Series I/O modules for a custom analog input, analog output, digital I/O, and counter/timer measurement system.

Modules are available for a variety of sensor measurements including thermocouples, RTDs, strain gages, load and pressure transducers, torque cells, accelerometers, flow meters, and microphones. NI CompactDAQ systems combine sensor measurements with voltage, current, and digital signals to create custom, mixed-measurement systems with a single, simple USB cable back to the PC, laptop, or netbook.

The cDAQ-9178 has four 32-bit general-purpose counter/timers built in. You can access these counters through an installed, hardware-timed digital module such as the NI 9401 or NI 9402 for applications that involve quadrature encoders, PWM, event counting, pulse train generation, and period or frequency measurement.

Use the two built-in BNC connections to share clocks or triggers up to 1 MHz.

The cDAQ-9178 chassis is shipped with the following:

- AC/DC converter that plugs directly into the chassis
- USB cable with a thumbscrew lock for strain relief

Power cord sold separately.

The NI-DAQmx driver shipped with every chassis includes the following:

- LabVIEW SignalExpress LE for simple data-logging applications
- API for NI LabVIEW, ANSI C/C++, C#, Visual Basic .NET
- DAQ Assistant code generation for NI LabVIEW, LabWindows™/CVI, and Measurement Studio
- Example programs for all supported languages
- NI Measurement & Automation Explorer (MAX) for system configuration and test

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### Comparison Tables

Model	Slots	Counters	Number of Simultaneous Tasks	Number of AI Timing Engines
cDAQ-9178	8	4	7	3
cDAQ-9174	4	4	7	3

## Application and Technology

### Mix Analog, Digital, and Sensor Measurements in the Same System

Many devices can measure temperature, voltage, or bridge-based sensors, but NI CompactDAQ can integrate all of these measurements and more into a single device that outputs all of the data via the same bus interface, such as USB. An NI CompactDAQ system can mix multiplexed voltage input signals, simultaneously sampled accelerometers, low-speed thermocouples, and TTL digital I/O all in the same 4- or 8-slot chassis using the same driver, NI-DAQmx. NI CompactDAQ makes programming easier because the same driver is used for all measurements. This solution saves space and simplifies service and support. With NI CompactDAQ, there is only one box on your lab bench, and, if there are problems with any of the measurements or equipment, award-winning National Instruments support is your contact for all your instrumentation needs.



Figure 1. NI cDAQ-9174 with Three Analog and One Digital Module Connected to a Laptop

### C Series Modules

You have more than 50 C Series modules, most of which work with NI CompactDAQ, to choose from for different measurements including thermocouple, voltage, resistance temperature detector (RTD), current, resistance, strain, digital (TTL and other), accelerometers, and microphones. Channel counts on the individual modules range from three to 32 channels to accommodate a wide range of system requirements. C Series modules combine signal conditioning, connectivity, and data acquisition into a small module for each specific measurement type. You can insert these modules into any of the C Series chassis to create a variety of systems. You can create a mix of channel counts and measurement types within one system by selecting the desired modules and installing them into one of several C Series systems. For this reason, systems built on the C Series platform are highly customizable. See [ni.com/crio/cseries](http://ni.com/crio/cseries) for the C Series compatibility table.



Figure 2. Three High-Speed Analog Input Modules

### Rugged Design

NI CompactDAQ and all C Series modules are constructed from A380 cast aluminum for a rugged system that can withstand operating temperatures from -20 to 55 °C, and up to 30 g of shock. NI CompactDAQ was built to be used in the lab but not to necessarily stay there. With a rugged, flexible system such as NI CompactDAQ, you can reconfigure and move a single test system from place to place without having to purchase different equipment for every lab or test stand. C Series modules are equally rugged and designed with spring loaded latches to lock into place when installed in the chassis. The shock and vibration specifications are all tested on an NI CompactDAQ system with modules installed, so modules do not fall out or come undocked under the specified conditions. For cable strain relief, a locking USB cable with thumbscrew is included to prevent accidental disconnection during use. The rugged features of NI CompactDAQ help you quickly begin testing because you need less time to prepare the instrumentation for the rigors of field testing. For added system portability, or to help track multiple systems around the lab, purchase the CASE-0750 rugged carrying case that has room for chassis, modules, power supplies, and signal wire.



Figure 3. The carrying case has removable foam blocks for further customization.

### Multiple Timing Engines to Acquire from Different Modules at Different Rates

With the cDAQ-9174/78 chassis, you can install a thermocouple module next to an accelerometer measurement module and acquire from both simultaneously at different rates. The cDAQ-9174/78 chassis have multiple analog input timing engines, which means you can group all of your analog input modules in up to three sets of modules. These sets, known as tasks, can all run at different rates because each one has its own timing engine in the chassis backplane. This alleviates the need to decimate or parse lower-speed data from the higher-speed data as you need to do in the original cDAQ-9172 chassis.

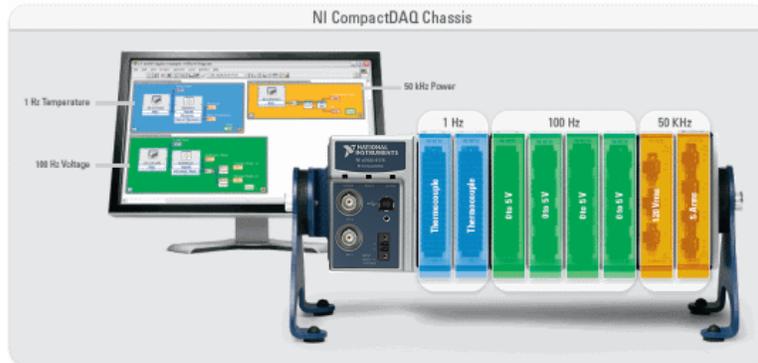


Figure 4. Run analog input modules at different rates with multiple AI timing engines.

### Four 32-Bit General-Purpose Counters Built In

The cDAQ-9174/78 chassis both have four 32-bit counters built in. These counters are accessed through an installed hardware-timed digital I/O module (sold separately) such as the NI 9401 or NI 9402. Once you have installed the digital module, you can create a counter task in software for operations such as quadrature encoder, period and frequency measurement, or finite pulse train and PWM generation. For some operations, you can access the counters in the cDAQ-9178 chassis through the built-in BNC connectors on the chassis.

### Flexible Power Options

The upgraded chassis features a new physical connection for power supplies. Each chassis is shipped with an AC/DC converter that plugs directly into the chassis. (Note that the power cord to go from the AC/DC converter to the wall is sold separately.) For other power options, such as a power supply with leads for V/C, an automotive electrical system, or an off-the-shelf battery pack, purchase the screw-terminal accessory for the chassis to enable easy connection of a V and C lead to the chassis. NI CompactDAQ requires a 9 to 30 VDC power supply and uses a maximum load 15 W of power.

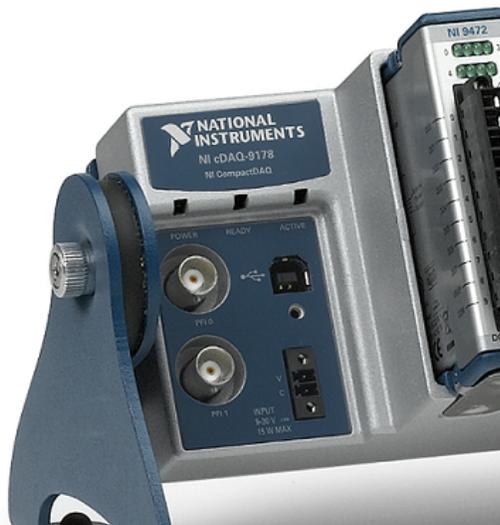


Figure 5. NI cDAQ-9178 Connections Showing BNC Triggers, Flexible Power Connector, and USB Port with Threaded Hole for Cable Strain Relief

### Included Data-Logging Software

NI ships NI CompactDAQ, and every other NI data acquisition (DAQ) device, with a driver kit that includes the following:

Measurement & Automation Explorer (MAX) – This configuration utility is for quick measurement debugging or system diagnostic test via the device self-test.

NI-DAQmx – Driver and API for all NI data acquisition devices. This installer includes interfaces to LabVIEW, ANSI C/C++, C#, Visual Basic .NET, and hundreds of example programs for LabVIEW and text-based languages.

LabVIEW SignalExpress LE – With configuration-based data logging, you can get up and running out of the box without programming. Using LabVIEW SignalExpress LE, you can acquire data from the hardware, build a custom user interface, and log data to Technical Data Management Streaming (TDMS) files or to Microsoft Excel for graphing and postprocessing. LabVIEW SignalExpress is available for purchase and includes analysis and processing blocks for use within the data-logging environment.

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## Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
<b>NI CompactDAQ Chassis</b>			
cDAQ-9178 8 slot chassis	781156-01	No accessories required.	
cDAQ-9174 4 slot chassis	781157-01	No accessories required.	
<b>Accessories</b>			
Filler Module for Empty Slots	196917-01	No accessories required.	
Rugged Carrying Case (CASE-0750)	780315-01	No accessories required.	
Screw Terminals for Alternate Power Supply	780702-01	No accessories required.	
Desktop Mounting Kit (as seen in images)	779473-01	No accessories required.	
Replacement/Spare Power Supply	780703-01	No accessories required.	
<b>Power Cords</b>			
US 120VAC	763000-01	No accessories required.	
North America, 240 VAC	763068-01	No accessories required.	
UK, 240 VAC	763064-01	No accessories required.	
Australia, 240 VAC	763066-01	No accessories required.	
Switzerland, 220 VAC	763065-01	No accessories required.	
Japan, 100VAC	763634-01	No accessories required.	
Europe, 240 VAC	763067-01	No accessories required.	

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## Support and Services

### System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

### Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

### Technical Support

Get answers to your technical questions using the following National Instruments resources.

**Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.

**Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.

**Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

### Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

### Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

**Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.

**On-site training at your facility** - an excellent option to train multiple employees at the same time.

**Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.

**Course kits** - lowest-cost, self-paced training that you can use as reference guides.

**Training memberships** and training credits - to buy now and schedule training later.

Visit [ni.com/training](http://ni.com/training) for more information.

## Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit [ni.com/warranty](http://ni.com/warranty).

## OEM

NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit [ni.com/oem](http://ni.com/oem).

## Alliance

Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit [ni.com/alliance](http://ni.com/alliance).

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## Detailed Specifications

These specifications are for the NI cDAQ-9171/9174/9178 chassis only.

These specifications are typical at 25 °C unless otherwise noted. For the C Series I/O module specifications, refer to the documentation for the C Series I/O module you are using.

### Analog Input

Input FIFO size	127 samples per slot
Maximum sample rate <sup>1</sup>	Determined by the C Series I/O module(s)
Timing accuracy <sup>2</sup>	50 ppm of sample rate
Timing resolution <sup>2</sup>	12.5 ns
Number of channels supported	Determined by the C Series I/O module(s)

### Analog Output

Numbers of channels supported	
Hardware-timed task	
Onboard regeneration	16
Non-regeneration	Determined by the C Series I/O module(s)
Non-hardware-timed task	Determined by the C Series I/O module(s)
Maximum update rate	
Onboard regeneration	1.6 MS/s (multi-channel, aggregate)
Non-regeneration	Determined by the C Series I/O module(s)
Timing accuracy	50 ppm of sample rate
Timing resolution	12.5 ns
Output FIFO size	
Regeneration	8,191 samples shared among channels used
Non-regeneration	127 samples per slot
AO waveform modes	Non-periodic waveform, periodic waveform regeneration mode from onboard memory, periodic waveform regeneration from host buffer including dynamic update

### Digital Waveform Characteristics

Waveform acquisition (DI) FIFO	127 samples per slot
Waveform generation (DO) FIFO	
NI cDAQ-9171	2,047 samples
NI cDAQ-9174	

Slots 1-4	2,047 samples
NI cDAQ-9178	
Slots 1-4	2,047 samples
Slots 5-8	1,023 samples



**Note (NI cDAQ-9178)** When modules are installed in slots 1 through 4, FIFO is 2,047 samples per slot for all slots. When any module is installed in slots 5 through 8, FIFO is 1,023 samples per slot for all eight slots.

Digital input sample clock frequency	
Streaming to application memory	System-dependent
Finite	0 to 10 MHz
Digital output sample clock frequency	
Streaming from application memory	System-dependent
Regenerate from FIFO	0 to 10 MHz
Finite	0 to 10 MHz
Digital output or digital input sample clock source	Any PFI, analog sample or convert clock, analog output sample clock, Ctr <i>n</i> Internal Output, and many other sources

### General-Purpose Counter/Timers

Number of counter/timers	4
Resolution	32 bits
Counter measurements	Edge counting, pulse, semi-period, period, two-edge separation, pulse width
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, 100 kHz
External base clock frequency	0 to 20 MHz
Base clock accuracy	50 ppm
Output frequency	0 to 20 MHz
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down
Routing options for inputs	Any module PFI, chassis PFI BNC, analog trigger, many internal signals
FIFO	Dedicated 127-samples FIFO

### Frequency Generator

Number of channels	1
Base clocks	10 MHz, 20 MHz, 100 kHz
Divisors	1 to 16 (integers)
Base clock accuracy	50 ppm
Output	
NI cDAQ-9171/9174	Available on module PFI terminals
NI cDAQ-9178	Available on any chassis PFI BNC terminal or module PFI terminals

### Module PFI Characteristics

Functionality	Static digital input, static digital output, timing input, and timing output
Timing output sources	Many analog input, analog output, counter, digital input, and digital output timing signals
Debounce filter settings	Selectable per input: 125 ns, 6.425 $\mu$ s, 2.56 ms, disable, high and low transitions
Timing input frequency	0 - 20 MHz
Timing output frequency	0 - 20 MHz

### Chassis PFI Characteristics (NI cDAQ-9178 Only)

Max input or output frequency	1 MHz
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Cable length	3 m (10 ft)
Cable impedance	50 $\Omega$
TRIG 0 (PFI 0), TRIG 1 (PFI 1) connectors	BNC
Power-on state	High impedance

#### Input/output voltage protection

Voltage	Minimum	Maximum
Input	-20 V	25 V
Output	-15 V	20 V

#### Maximum operating conditions

Level	Minimum	Maximum
$I_{OL}$ output low current	--	8 mA
$I_{OH}$ output high current	--	-8 mA

#### DC input characteristics

Level	Minimum	Maximum
Positive going threshold	1.43 V	2.28 V
Negative going threshold	0.86 V	1.53 V
Hysteresis	0.48 V	0.87 V

#### DC output characteristics - Level High

Conditions	Minimum	Maximum
--	--	5.25 V
Sourcing 100 $\mu$ A	4.65 V	--
Sourcing 2 mA	3.60 V	--
Sourcing 3.5 mA	3.44 V	--

#### DC output characteristics - Level Low

Conditions	Minimum	Maximum
Sinking 100 $\mu$ A	--	0.10 V
Sinking 2 mA	--	0.64 V
Sinking 3.5 mA	--	0.8 V

### Digital Triggers

#### Source

NI cDAQ-9171/9174	Any module PFI terminal
NI cDAQ-9178	Any chassis PFI BNC terminal or module PFI terminal

Polarity	Software-selectable for most signals
Analog input function	Start Trigger, Reference Trigger, Pause Trigger, Sample 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

### Module I/O States

At power-on	Module-dependent. Refer to the documentation included with the C Series I/O module(s).
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 **Note** The chassis may revert the input/output of the modules to its power-on state when the USB cable is removed.

### Power Requirements

 **Caution** You must use a National Electric Code (NEC) Class 2 power source with the NI cDAQ-9178/9174 chassis.

 **Note** Some I/O modules have additional power requirements. For more information about C Series I/O module(s) power requirements, refer to documentation included with the C Series I/O module(s).

 **Note** Sleep mode for C Series I/O modules is not supported in the NI cDAQ-917x.

NI cDAQ-9171	
Power consumption from USB, 4.75 to 5.25 V	500 mA maximum
Suspend mode	2.5 mA maximum
NI cDAQ-9174/9178	
Input voltage range	9–30 V
Maximum required input power	15 W

Power input connector	2 positions 3.5 mm pitch pluggable screw terminal with screw locks similar to Sauro CTMH020F8-0N001
Power input mating connector	Sauro CTF020V8, Phoenix Contact 1714977, or equivalent
Power consumption from USB, 4.10 to 5.25 V	500 $\mu$ A maximum

## Bus Interface

USB specification	USB 2.0 Hi-Speed
High-performance data streams	
NI cDAQ-9171	6
NI cDAQ-9174/9178	7
Data stream types available	Analog input, analog output, digital input, digital output, counter/timer input, counter/timer output

 **Note** If you are connecting the NI cDAQ-917x to a USB hub, the hub must be externally powered.

## Physical Characteristics

NI cDAQ-9171 chassis	
Weight (unloaded)	Approx. 353 g (12.5 oz)
Dimensions (unloaded)	131.4 mm $\times$ 88.6 mm $\times$ 33.3 mm (5.17 in. $\times$ 3.49 in. $\times$ 1.31 in.)
NI cDAQ-9174 chassis	
Weight (unloaded)	Approx. 574 g (20.2 oz)
Dimensions (unloaded)	15.9 cm $\times$ 8.81 cm $\times$ 5.89 cm (6.28 in. $\times$ 3.5 in. $\times$ 2.3 in.)
NI cDAQ-9178 chassis	
Weight (unloaded)	Approx. 878 g (31.0 oz)
Dimensions (unloaded)	25.4 cm $\times$ 8.81 cm $\times$ 5.89 cm (10.0 in. $\times$ 3.5 in. $\times$ 2.3 in.)

If you need to clean the chassis, wipe it with a dry towel.

## Safety

### Safety Standards

If you need to clean the chassis, wipe it with a dry towel.

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](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## Environmental

Temperature	
Operating	-20 $^{\circ}$ C to 55 $^{\circ}$ C (IEC-60068-2-1 and IEC-60068-2-2)
Storage	-40 $^{\circ}$ C to 85 $^{\circ}$ C (IEC-60068-2-1 and IEC-60068-2-2)
NI cDAQ-9174/9178 ingress protection	IP 30
Humidity	
Operating	10 to 90% RH, noncondensing (IEC-60068-2-56)
Storage	5 to 95% RH, noncondensing (IEC-60068-2-56)
Maximum altitude	2,000 m
Pollution Degree (IEC 60664)	2

Indoor use only.

## Shock and Vibration

To meet these specifications, you must panel mount the NI cDAQ-917x system, use an NI locking USB cable, and affix ferrules to the ends of the terminal lines.

Operating shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.)
Random vibration	
Operating	5 to 500 Hz, 0.3 grms

Non-operating

5 to 500 Hz, 2.4 grms (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

## Safety

This product meets 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 the Online Product Certification section.

## 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  
AS/NZS CISPR 11: Group 1, Class A emissions  
FCC 47 CFR Part 15B: Class A emissions  
ICES-001: Class A emissions



**Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



**Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generates radio frequency energy for the treatment of material or inspection/analysis purposes.



**Note** For EMC declarations and certifications, and additional information, refer to the Online Product Certification section..

## 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)

## Online Product Certification

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

## Environmental Management

National Instruments 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](http://ni.com/environment). This page contains the environmental regulations and directives with which NI complies, as well as 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](http://ni.com/environment/weee.htm).

## 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](http://ni.com/environment/rohs_china)。  
(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

<sup>1</sup> Performance dependent on type of installed C Series I/O modules and number of channels in the task.

<sup>2</sup> Does not include group delay. Refer to C Series I/O module documentation for more information

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