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Find the *National Instruments cDAQ-9189* at our website: *Click HERE*

SPECIFICATIONS

cDAQ™-9189

8-Slot, Extended Temperature, Ethernet CompactDAQ Chassis

Definitions

Warranted specifications describe the performance of a model under stated operating conditions and are covered by the model warranty.

Characteristics describe values that are relevant to the use of the model under stated operating conditions but are not covered by the model warranty.

- *Typical* specifications describe the expected performance met by a majority of the models.
- *Nominal* specifications describe parameters and attributes that may be useful in operation.

Specifications are *Typical* unless otherwise noted.

Conditions

Specifications are valid at 25 °C unless otherwise noted.

Analog Input

Input FIFO size	127 samples per slot
Maximum sample rate[1]	Determined by the C Series module or modules
Timing accuracy[2]	50 ppm of sample rate
Internal base clocks	80 MHz, 20 MHz, 13.1072 MHz, 12.8 MHz, 10 MHz, 100 kHz
Number of channels supported	Determined by the C Series module or modules

[1] Performance dependent on type of installed C Series module and number of channels in the task.
[2] Does not include group delay. For more information, refer to the documentation for each C Series module.

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Analog Output

Number of channels supported	
Hardware-timed task	
Onboard regeneration	16
Non-regeneration	Determined by the C Series module or modules
Non-hardware-timed task	Determined by the C Series module or modules
Maximum update rate	
Onboard regeneration	1.6 MS/s (multi-channel, aggregate)
Non-regeneration	Determined by the C Series module or modules
Timing accuracy	50 ppm of sample rate
Internal base clocks	80 MHz, 20 MHz, 13.1072 MHz, 12.8 MHz, 10 MHz, 100 kHz
Output FIFO size	
Onboard 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	
Parallel modules	511 samples per slot
Serial modules	63 samples per slot
Waveform generation (DO) FIFO	
Parallel modules	
Slots 1 to 4	2,047 samples per slot
Slots 5 to 8	1,023 samples per slot

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Serial modules	63 samples per slot

Note When parallel modules in a digital task are in slots 1 through 4, FIFO is 2,047 samples per slot for all slots. When any parallel module in a digital task is 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 MHz to 10 MHz
Digital output sample clock frequency	
Streaming from application memory	System-dependent
Regeneration from FIFO	0 MHz to 10 MHz
Finite	0 MHz to 10 MHz
Timing accuracy	50 ppm
Internal base clocks	80 MHz, 20 MHz, 13.1072 MHz, 12.8 MHz, 10 MHz, 100 kHz

General-Purpose Counters/Timers

Number of counters/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, 13.1072 MHz, 12.8 MHz, 10 MHz, 100 kHz
External base clock frequency	0 MHz to 20 MHz
Base clock accuracy	50 ppm
Output frequency	0 MHz to 20 MHz
Inputs	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down
Routing options for inputs	Any module PFI, chassis PFI, analog trigger, many internal signals
FIFO	Dedicated 127-sample FIFO

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Frequency Generator

Number of channels	1
Base clocks[3]	20 MHz, 10 MHz, 100 kHz
Divisors	1 to 16 (integers)
Base clock accuracy	50 ppm
Output	Any chassis PFI or module PFI terminal

Module PFI Characteristics

Functionality	Static digital input, static digital output, timing input, and timing output
Timing output sources[4]	Many analog input, analog output, counter, digital input, and digital output timing signals
Timing input frequency	0 MHz to 20 MHz
Timing output frequency	0 MHz to 20 MHz

Chassis PFI Characteristics

Maximum input or output frequency	1 MHz
Cable length	3 m (10 ft)
Cable impedance	50 Ω
PFI 0 connector	SMB
Power-on state	High impedance

[3] Base clocks can be synchronized with other chassis using the network synchronization feature.
[4] Actual available signals are dependent on type of installed C Series module.

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Table 1. Input/Output Voltage Protection

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

Maximum operating conditions[5]

I_{OL} output low current	8 mA maximum
I_{OH} output high current	-8 mA maximum

Table 2. DC Input Characteristics

Voltage	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

Table 3. DC Output Characteristics

Voltage	Conditions	Minimum	Maximum
High	—	—	5.25 V
	Sourcing 100 µA	4.65 V	—
	Sourcing 2 mA	3.60 V	—
	Sourcing 3.5 mA	3.44 V	—
Low	Sinking 100 µA	—	0.10 V
	Sinking 2 mA	—	0.64 V
	Sinking 3.5 mA	—	0.80 V

Digital Triggers

Source	Any chassis PFI or module PFI terminal
Polarity	Software-selectable for most signals

[5] Stresses beyond those listed under *Maximum operating conditions* may cause permanent damage to the chassis.

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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 function	Gate, Source, HW_Arm, Aux, A, B, Z, Up_Down

Module I/O States

At power-on	Module-dependent. Refer to the documentation for each C Series module.

Time-Based Triggers and Timestamps

Number of time-based triggers	5
Number of timestamps	4
Analog input	
Time-based triggers	Start Trigger, Sync Pulse
Timestamps	Start Trigger, Reference Trigger, First Sample
Analog output	
Time-based triggers	Start Trigger, Sync Pulse
Timestamps	Start Trigger, First Sample
Digital input	
Time-based triggers	Start Trigger
Timestamps	Start Trigger, Reference Trigger, First Sample
Digital output	
Time-based triggers	Start Trigger
Timestamps	Start Trigger, First Sample
Counter/timer input	
Time-based triggers	Arm Start Trigger
Timestamps	Arm Start Trigger
Counter/timer output	
Time-based triggers	Start Trigger, Arm Start Trigger
Timestamps	Start Trigger, Arm Start Trigger

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Network Interface

Network protocols	TCP/IP, UDP
Network ports used	HTTP:80 (configuration only), TCP:3580; UDP:5353 (configuration only), TCP:5353 (configuration only); TCP:31415; UDP:7865 (configuration only), UDP:8473 (configuration only)
Network IP configuration	DHCP + Link-Local, DHCP, Static, Link-Local
High-performance data streams	7
Data stream types available	Analog input, analog output, digital input, digital output, counter/timer input, counter/timer output, NI-XNET[6]
Default MTU size	1500 bytes

Ethernet

Number of ports	2 ports, internally switched[7]
Network interface	1000 Base-TX, full-duplex; 1000 Base-TX, half-duplex; 100 Base-TX, full-duplex; 100 Base-TX, half-duplex; 10 Base-T, full-duplex; 10 Base-T, half-duplex
Communication rates	10/100/1000 Mbps, auto-negotiated
Maximum cabling distance	100 m/segment
Maximum hops per line[8]	15

[6] When a session is active, CAN or LIN (NI-XNET) C Series modules use a total of two data streams regardless of the number of NI-XNET modules in the chassis.

[7] This allows for line topologies or network redundancy.

[8] With default software configuration. For information about creating reliable Ethernet-based systems, visit `ni.com/info` and enter Info Code `cdaqenet`.

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Timing and Synchronization

Protocol	IEEE 802.1AS for network synchronization over 1000 Base-TX, full-duplex
Network synchronization accuracy[9]	<1 µs
Network synchronization accuracy with optimized configuration[10]	<100 ns

Power Requirements

Caution The protection provided by the cDAQ-9189 chassis can be impaired if it is used in a manner not described in the *cDAQ-9185/9189 User Manual*.

Note Some C Series modules have additional power requirements. For more information about C Series module power requirements, refer to the documentation for each C Series module.

Note Sleep mode for C Series modules is not supported in the cDAQ-9189.

Note When operating the cDAQ-9189 in hazardous locations, you must use the power connector with an external power supply rated for hazardous locations. The power supply included in the cDAQ-9189 kit is intended only for desktop use. For all other applications use the included 2-position power connector plug and a power supply rated for your application power requirements. Visit `ni.com` to find hazardous locations-certified power supplies.

Voltage input range	9 V to 30 V (measured at the cDAQ-9189 power connector)
Maximum power consumption[11]	16 W

[9] I/O synchronization is system-dependent. Assumes the chassis are connected in a line topology with a typical selection of C Series modules containing a variety of timing architectures. For information about network synchronization accuracy, visit `ni.com/info` and enter Info Code `syncacc`.

[10] I/O synchronization is system-dependent. Assumes a system containing one hop with optimized C Series module selection. For information about achieving high accuracy synchronization, visit `ni.com/info` and enter Info Code `cdaqsync`.

[11] Includes maximum 1 W module load per slot across rated temperature and product variations.

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Note The maximum power consumption specification is based on a fully populated system running a high-stress application at elevated ambient temperature and with all C Series modules consuming the maximum allowed power.

Power input connector	2 positions 3.5 mm pitch mini-combicon screw terminal with screw flanges, Sauro CTMH020F8-0N002
Power input mating connector	Sauro CTF020V8, Phoenix Contact 1714977, or equivalent

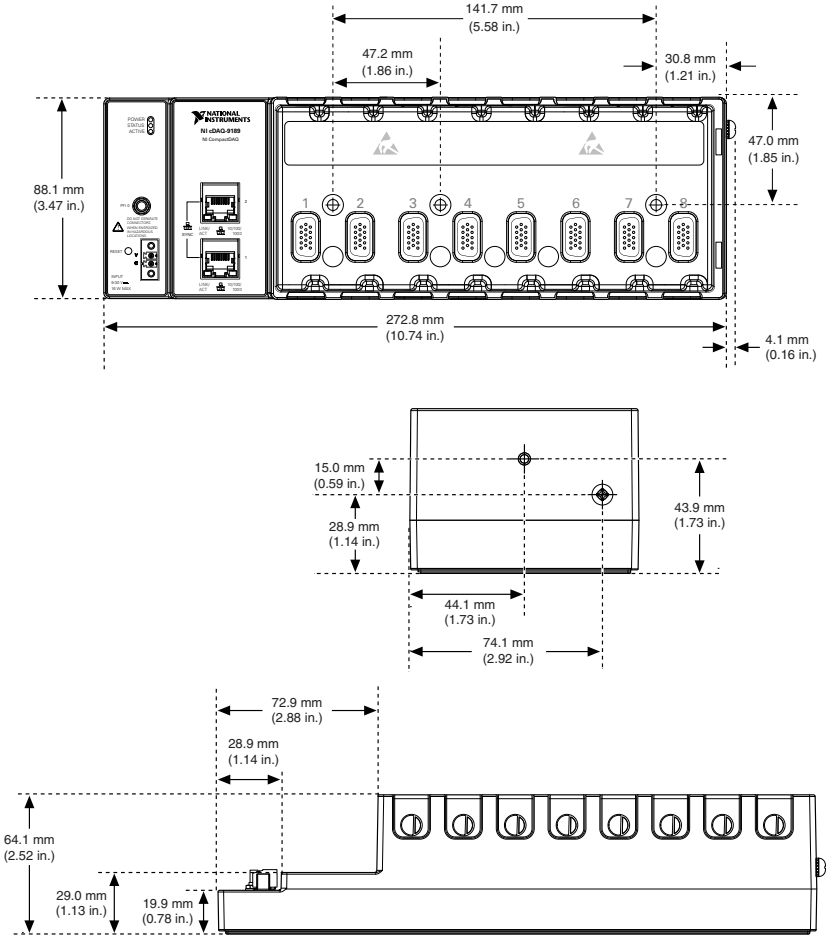
Physical Characteristics

Weight (unloaded)	1065.9 g (37.6 oz)
Dimensions (unloaded)	272.8 mm × 88.1 mm × 62.3 mm (10.74 in. × 3.47 in. × 2.45 in.) Refer to the following figure.
Screw-terminal wiring	
Gauge	0.2 mm^2 to 2.1 mm^2 (24 AWG to 14 AWG) copper conductor wire
Wire strip length	6 mm (0.24 in.) of insulation stripped from the end
Temperature rating	85 °C
Torque for screw terminals	0.20 N · m to 0.25 N · m (1.8 lb · in. to 2.2 lb · in.)
Wires per screw terminal	One wire per screw terminal
Connector securement	
Securement type	Screw flanges provided
Torque for screw flanges	0.3 N · m to 0.4 N · m (2.7 lb · in. to 3.5 lb · in.)

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

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Figure 1. cDAQ-9189 Dimensions



Safety Voltages

Connect only voltages that are within these limits.

V terminal to C terminal	30 V maximum, Measurement Category I

Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels,

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special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Caution Do not connect the system to signals or use for measurements within Measurement Categories II, III, or IV.

Note Measurement Categories CAT I and CAT O (Other) are equivalent. These test and measurement circuits are not intended for direct connection to the MAINs building installations of Measurement Categories CAT II, CAT III, or CAT IV.

Environmental

Operating temperature (IEC 60068-2-1 and IEC 60068-2-2)	-40 °C to 70 °C[12]

Note Failure to follow the mounting instructions in the *cDAQ-9185/9189 User Manual* can cause temperature derating.

Storage temperature (IEC 60068-2-1 and IEC 60068-2-2)	-40 °C to 85 °C
Ingress protection	IP 40
Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	5% to 95% RH, noncondensing
Pollution Degree (IEC 60664)	2
Maximum altitude	5,000 m

Indoor use only.[13]

Hazardous Locations

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4 Gc
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Ex nA IIC T4 Gc
Europe (ATEX) and International (IECEx)	Ex nA IIC T4 Gc

[12] When operating the cDAQ-9189 in temperatures below 0 °C, you must use the PS-15 power supply or another power supply rated for below 0 °C.

[13] Use NI 9917 and NI 9918 industrial enclosures to protect the device in harsh, dirty, or wet environments.

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Shock and Vibration

To meet these specifications, you must direct mount the cDAQ-9189 system and affix ferrules to the ends of the terminal lines.

Operating vibration	
Random (IEC 60068-2-64)	5 g RMS, 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500 Hz
Operating shock (IEC 60068-2-27)	30 g, 11 ms half sine, 50 g, 3 ms half sine, 18 shocks at 6 orientations

Safety and Hazardous Locations Standards

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

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA C22.2 No. 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4
- UL 60079-0; Ed 6, UL 60079-15; Ed 4
- CSA C22.2 No. 60079-0, CSA C22.2 No. 60079-15

Note For UL and other safety certifications, refer to the product label or the *Online Product Certification* section.

Electromagnetic Compatibility

This product meets the requirements of the following EMC standards for electrical equipment for measurement, control, and laboratory use:

- EN 61326-1 (IEC 61326-1): Class A emissions; Industrial immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- EN 55022 (CISPR 22): Class A emissions
- EN 55024 (CISPR 24): Immunity
- AS/NZS CISPR 11: Group 1, Class A emissions
- AS/NZS CISPR 22: Class A emissions

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- 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 generate 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 CE

This product meets the essential requirements of applicable European Directives, as follows:

- 2014/35/EU; Low-Voltage Directive (safety)
- 2014/30/EU; Electromagnetic Compatibility Directive (EMC)
- 2014/34/EU; Potentially Explosive Atmospheres (ATEX)

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*, 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 to the environment and to NI customers.

For additional environmental information, refer to the *Minimize Our Environmental Impact* web page at *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.

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EU Customers At the end of the product life cycle, all NI products must be disposed of according to local laws and regulations. For more information about how to recycle NI products in your region, visit *ni.com/environment/weee*.

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