cDAQ™-9189 Specifications

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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 performance met by a majority of models.
- ***Nominal*** specifications describe an attribute that is based on design, conformance testing, or supplemental testing.

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

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.

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

Analog Output

Table 1. Number of channels supported

Task	Regeneration	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

Table 2. Waveform generation (DO) FIFO

Modules	**Slots**	**Samples per slot**
Parallel Modules	Slots 1 to 4	2,047 samples per slot
	Slots 5 to 8	1,023 samples per slot
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

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

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.

Cable length	3 m (10 ft)
Cable impedance	50 Ω
PFI 0 connector	SMB
Power-on state	High impedance

Table 3. 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 4. 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

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

Table 5. 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
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

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-	7

performance data streams	
Data stream types available	Analog input, analog output, digital input, digital output, counter/timer input, counter/timer output, NI-XNET[6]
Default MTU size	1,500 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	10/100/1,000 Mb/s, 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.

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

Note IEEE 1588 protocol is supported in NI-DAQmx 18.1 and later. When configured to use IEEE 1588, performance of synchronization may vary from these specifications.

Safety Voltages

Connect only voltages that are within these limits.

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

Measurement Category

Caution Do not connect the product to signals or use for measurements

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

within Measurement Categories II, III, or IV.



Attention Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour effectuer des mesures dans ces catégories.



Warning Do not connect the product to signals or use for measurements within Measurement Categories II, III, or IV, or for measurements on MAINs circuits or on circuits derived from Overvoltage Category II, III, or IV which may have transient overvoltages above what the product can withstand. The product must not be connected to circuits that have a maximum voltage above the continuous working voltage, relative to earth or to other channels, or this could damage and defeat the insulation. The product can only withstand transients up to the transient overvoltage rating without breakdown or damage to the insulation. An analysis of the working voltages, loop impedances, temporary overvoltages, and transient overvoltages in the system must be conducted prior to making measurements.



Mise en garde Ne pas connecter le produit à des signaux dans les catégories de mesure II, III ou IV et ne pas l'utiliser pour des mesures dans ces catégories, ou des mesures sur secteur ou sur des circuits dérivés de surtensions de catégorie II, III ou IV pouvant présenter des surtensions transitoires supérieures à ce que le produit peut supporter. Le produit ne doit pas être raccordé à des circuits ayant une tension maximale supérieure à la tension de fonctionnement continu, par rapport à la terre ou à d'autres voies, sous peine d'endommager et de compromettre l'isolation. Le produit peut tomber en panne et son isolation risque d'être endommagée si les tensions transitoires dépassent la surtension transitoire nominale. Une analyse des tensions de fonctionnement, des impédances de boucle, des surtensions temporaires et des surtensions transitoires dans le système doit être effectuée avant de procéder à des mesures.

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

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

Environmental Characteristics

Temperature and Humidity

Operating temperature	-40 °C to 70 °C[11]
Storage temperature	-40 °C to 85 °C
Ingress protection	IP40
Operating humidity	10% to 90% RH, noncondensing
Storage humidity	5% to 95% RH, noncondensing
Pollution Degree	2
Maximum altitude	5,000 m

11. 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.

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	5 g RMS, 10 Hz to 500 Hz
Sinusoidal	5 g, 10 Hz to 500 Hz
Operating shock	30 g, 11 ms half sine, 50 g, 3 ms half sine, 18 shocks at 6 orientations

Power Requirements

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[12]	16 W

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.

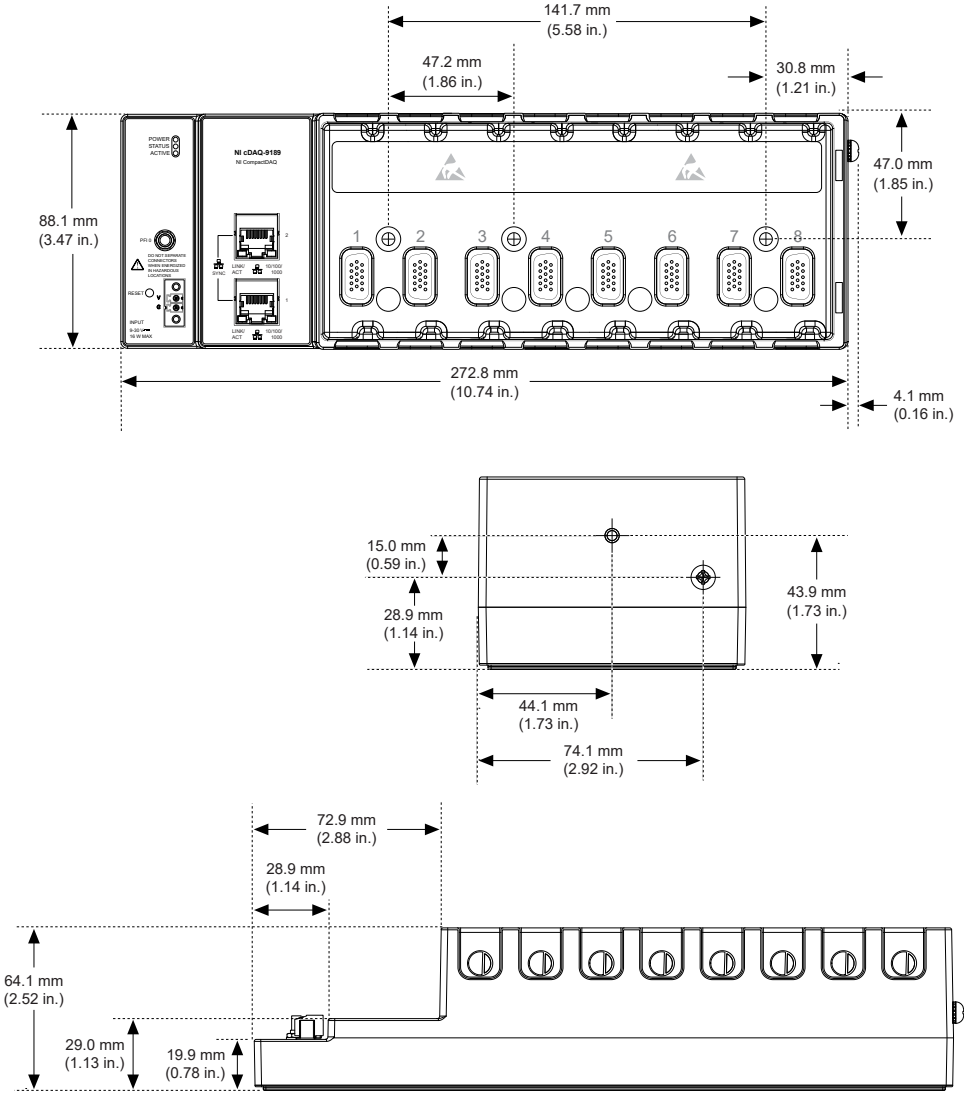
Power input connector	2 positions 3.5 mm pitch mini-combicon screw terminal with screw flanges, Sauro CTMH020F8-0N002
Power input mating connector	Sauro CTF020V8, Phoenix Contact 1714977, or equivalent

Physical Characteristics

Weight (unloaded)	1,065.9 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.

12. Includes maximum 1 W module load per slot across rated temperature and product variations.

Figure 1. cDAQ-9189 Dimensions



Power Connector

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.)

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