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Find the *National Instruments cDAQ-9133* at our website: *Click HERE*

DEVICE SPECIFICATIONS

# NI cDAQ™-9138

## NI CompactDAQ Eight-Slot Controller

These specifications are for the NI cDAQ-9138 controller only. These specifications are typical at 23 °C ±5 °C unless otherwise noted. For the C Series module specifications, refer to the documentation for the C Series module you are using.

The NI cDAQ-9138 was designed and tested in multiple mounting configurations. The varied mounting orientations or configurations can reduce the maximum allowable ambient temperature and can affect the accuracy of C Series modules in the chassis. Visit `ni.com/info` and enter the Info Code `cdaqmounting` for more information about mounting and accuracy.

## Processor

| | |
|---|---|
| CPU | Intel Celeron U3405 |
| Number of cores | 2 |
| CPU frequency | 1.06 GHz |
| On-die L2 cache | 256 KB x2 (256 KB/core) |
| On-die L3 cache | 2 MB shared between cores |
| Hyper-threading | Not supported |

## Operating System

| | |
|---|---|
| Supported operating systems | Windows Embedded Standard 7 (WES7), LabVIEW Real-Time 2012 or later |

## Network/Ethernet Port

| | |
|---|---|
| Number of ports | 2 |
| Network interface | 10Base-T, 100Base-TX, and 1000Base-T Ethernet |
| Compatibility | IEEE 802.3 |

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| | |
|---|---|
| Communication rates | 10 Mbit/s, 100 Mbit/s, 1000 Mbit/s auto-negotiated |
| Maximum cabling distance | 100 m/segment |

## RS-232 Serial Port

| | |
|---|---|
| Maximum baud rate | 115,200 b/s |
| Data bits | 5, 6, 7, 8 |
| Stop bits | 1, 2 |
| Parity | Odd, even, mark, space |
| Flow control | RTS/CTS, XON/XOFF, DTR/DSR |
| RI wake maximum low level | 0.8 V |
| RI wake minimum high level | 2.4 V |
| RI overvoltage tolerance | ±24 V |

## RS-485/422 (DTE) Serial Port

| | |
|---|---|
| Maximum baud rate | 320,400 bit/s |
| Data bits | 5, 6, 7, 8 |
| Stop bits | 1, 1.5, 2 |
| Parity | Odd, Even, Mark, Space |
| Flow control | XON/XOFF |
| Wire mode | 4-wire, 2-wire, 2-wire auto |

## MXI-Express Port

| | |
|---|---|
| Communication rate | 2.5 Gbit/s, PCIe x1 |
| Maximum cabling distance | 7 m |

## USB Ports

| | |
|---|---|
| Number of ports | 4 |
| USB interface | USB 2.0, Hi-Speed |
| Maximum data rate | 480 Mbit/s |
| Maximum current | 500 mA |

# Video (VGA) Port

| | |
|---|---|
| Maximum resolution | 1600 × 1200 at 60 Hz |

# Memory

| | |
|---|---|
| Nonvolatile | 32 GB[1,2] |
| DDR3 system memory | 2 GB |

**Note** For information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory, go to `ni.com/info` and enter Info Code `ssdbp`.

| | |
|---|---|
| Data throughput | |
| System memory to internal storage[1,3] | |
| Read | 85 MB/s |
| Write | 60 MB/s |
| Module slots to system memory[1] | 24 MB/s, application and system dependent |

# Internal Real-Time Clock

| | |
|---|---|
| Accuracy | 140 ppm, maximum, at operating temperature range |

# CMOS Battery

| | |
|---|---|
| Typical battery life with power applied to power connector | 10 years |
| Typical battery life when stored at 55 ºC | 5.7 years |
| Minimum battery life when stored at 85 ºC | 5.3 years |

1 1 MB is equal to 1 million bytes. 1 GB is equal to 1 billion bytes; formatted capacity might be less.
2 Windows and recovery partition installation requires at least 18 GB.
3 Go to `ni.com/info` and enter Info Code `exyerk` for information about best practices for data logging performance with the NI cDAQ-9138.

# Analog Input

| | |
|---|---|
| Input FIFO size | 127 samples per slot |
| Maximum sample rate[4] | Determined by the C Series module or modules |
| Timing accuracy[5] | 50 ppm of sample rate |
| Timing resolution[5] | 12.5 ns |
| Number of channels supported | Determined by the C Series module or modules |

# 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 |
| Timing resolution | 12.5 ns |
| Output FIFO size | |
| Onboard regeneration | 8,191 samples shared among channels used |
| Non-regeneration | 127 samples per slot |
| AO waveform modes | Non-periodic waveform,<br>periodic waveform regeneration mode from onboard memory,<br>periodic waveform regeneration from host buffer including dynamic update |

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

# 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 |
| 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 |

# 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, 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, analog trigger, many internal signals |
| FIFO | Dedicated 127-sample FIFO |

# Frequency Generator

| | |
|---|---|
| Number of channels | 1 |
| Base clocks | 20 MHz, 10 MHz, 100 kHz |
| Divisors | 1 to 16 (integers) |
| Base clock accuracy | 50 ppm |
| Output | Any module PFI terminal |

# Module PFI Characteristics

| | |
|---|---|
| Functionality | Static digital input, static digital output, timing input, and timing output |
| Timing output sources[6] | 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 |

# Digital Triggers

| | |
|---|---|
| Source | Any module PFI terminal |
| Polarity | Software-selectable for most signals |
| Analog input function | Start Trigger, Reference Trigger, Pause Trigger, Sample Clock, Sample Clock Timebase |

[6] Actual available signals are dependent on type of installed C Series module.

| | |
|---|---|
| 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 Data Interface

| | |
|---|---|
| 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[7] |

# Module I/O States

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



**Note** The NI cDAQ-9138 for Windows chassis may revert the input/output of the modules to their power-on state when Windows is put into a low-power state such as hibernate, suspend, or sleep.

# Power Requirements

You must use a UL Listed ITE power supply marked *LPS* with the NI cDAQ-9138.



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



**Note** Sleep mode for C Series modules is not supported in the NI cDAQ-9138.

| | |
|---|---|
| Voltage input range | 9 V to 30 V (measured at the NI cDAQ-9138 power connector) |
| Maximum power consumption[8] | 75 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

[7] 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 controller.

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

all C Series modules, CXM devices, and USB devices consuming the maximum allowed power.

| | |
|---|---|
| Typical standby power consumption | 2 W |
| Recommended power supply | 100 W, 24 V DC |
| Typical leakage current from secondary power input (V2) while system is powered from primary power input (V1) | |
| At 9 V | 0.5 mA |
| At 30 V | 2.7 mA |

**Caution** Do *not* connect V2 to a DC mains supply or to any supply requiring a connecting cable longer than 3 m (10 ft). A DC mains supply is a local DC electricity supply network in the infrastructure of a site or building.

| | |
|---|---|
| EMC ratings for inputs as described in IEC 61000 | |
| V1 | Short lines, long lines, and DC distributed networks |
| V2 | Short lines only |
| Power input connector | 4 positions 5.08 mm pitch pluggable screw terminal with screw locks similar to Phoenix Contact 1955769 |
| Power input mating connector | Phoenix Contact 1704001 or equivalent |

# Physical Characteristics

| | |
|---|---|
| Weight (unloaded) | 2.8 kg (6.16 lb) |
| Dimensions (unloaded) | 403.7 mm × 88.1 mm × 121.3 mm (15.80 in. × 3.47 in. × 4.78 in.) Refer to the following figure. |
| Screw-terminal wiring | |
| Gauge | 3.0 $mm^2$ (12 AWG) copper conductor wire |
| Wire strip length | 7 mm (0.276 in.) of insulation stripped from the end |
| Temperature rating | 85 °C |
| Torque for screw terminals | 0.5 N · m to 0.6 N · m (4.4 lb · in. to 5.3 lb · in.) |
| Wires per screw terminal | One wire per screw terminal |

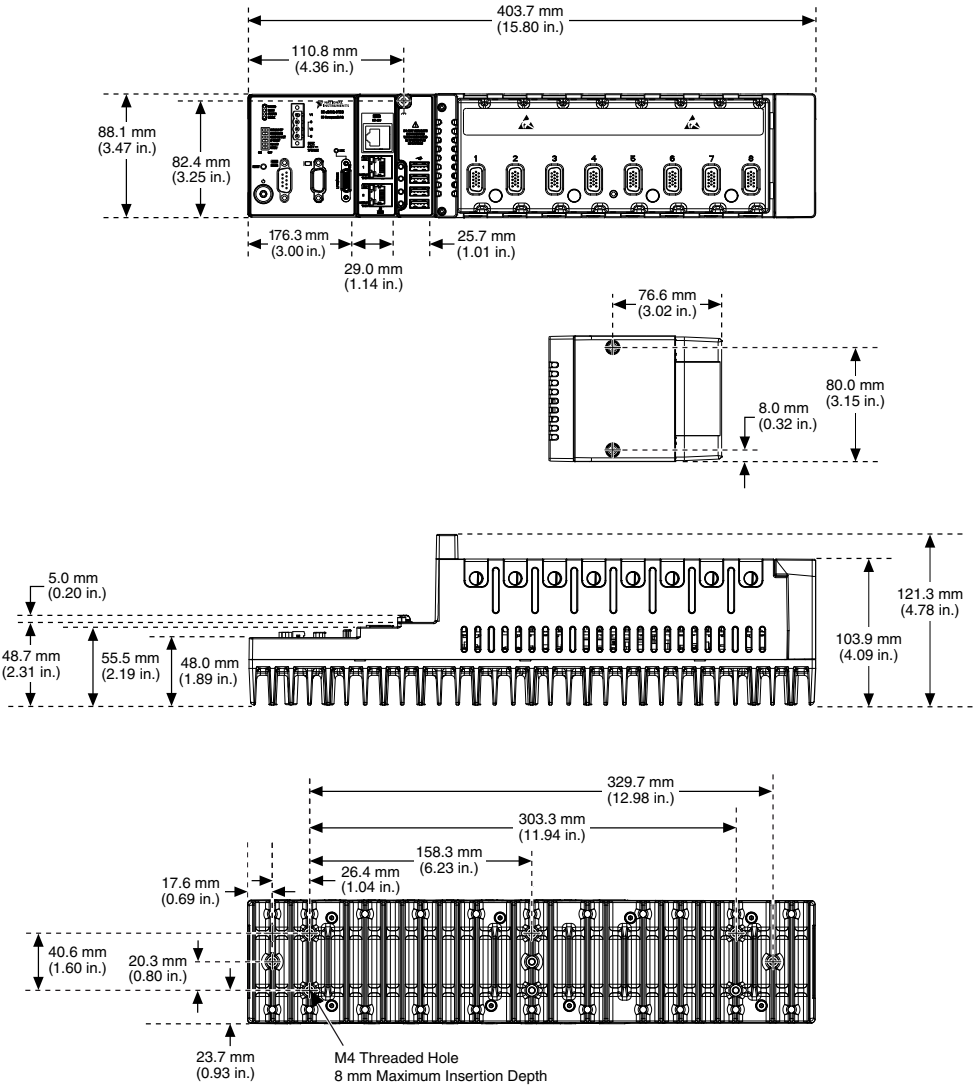
Connector securement

| | |
|---|---|
| Securement type | Screw flanges provided |
| Torque for screw flanges | 0.5 N · m (4.4 lb · in.) |

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

**Caution** The protection provided by the NI cDAQ-9138 controller can be impaired if it is used in a manner not described in this document.

**Figure 1.** NI cDAQ-9138 Dimensions



# Safety Voltages

Connect only voltages that are below these limits.

| | |
|---|---|
| V1 terminal to C terminal | 30 V maximum, Measurement Category I |
| V2 terminal to C terminal | 30 V maximum, Measurement Category I |
| Chassis ground to C terminal | 30 V maximum, Measurement Category I |
| Isolation voltage, RS-485/422 (DTE) serial port to earth ground | |
| Continuous | 60 V DC, Measurement Category I |
| Withstand | 1,000 V RMS, verified by a 5 s dielectric withstand test |

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.

**Caution** Do not connect the cDAQ-9138 to signals or use for measurements within Measurement Categories II, III, or IV.

**Note** Measurement Categories CAT I and CAT O 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

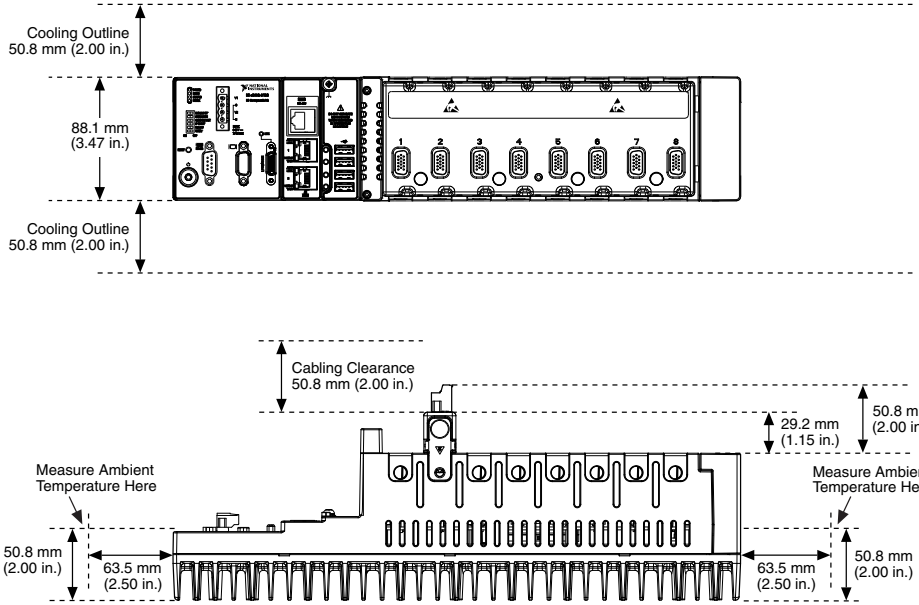
| | |
|---|---|
| Temperature (IEC 60068-2-1 and IEC 60068-2-2) | |
| Operating | 0 ºC to 45 ºC |
| Operating with NI panel mount kit (part number 781919-01) | 0 ºC to 55 ºC |
| Storage | -40 ºC to 85 ºC |

**Caution** Failure to follow the mounting instructions in the *NI cDAQ-9138/9139 User Manual* can cause temperature derating. For more information about mounting configurations and temperature derating, go to `ni.com/info` and enter Info Code `cdaqmounting`.

**Note** The NI cDAQ-9138 was designed and tested in multiple mounting configurations. The varied mounting orientations or configurations can reduce the maximum allowable ambient temperature and can affect the accuracy of C Series

modules in the chassis. Visit `ni.com/info` and enter the Info Code `cdaqmounting` for more information about mounting and accuracy.

**Figure 2.** NI cDAQ-9138 Temperature, Cooling, and Cabling Dimensions




| | |
|---|---|
| Humidity (IEC 60068-2-56) | |
| Operating | 10% to 90% RH, noncondensing |
| Storage | 5% to 95% RH, noncondensing |
| Ingress protection | IP 20 |
| Pollution Degree (IEC 60664) | 2 |
| Maximum altitude | 2,000 m |

Indoor use only.

# Hazardous Locations

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

# Shock and Vibration

To meet these specifications, you must panel mount the NI cDAQ-9138 system, affix ferrules to the ends of the terminal wires, and install a tie wrap on the USB cable for strain relief. You can use the tie wrap to attach the USB cable to the Ethernet cable.

| | |
|---|---|
| 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,<br>50 g, 3 ms half sine,<br>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 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 60079-0:2011, CSA 60079-15:2012

**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

- 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.

## Waste Electrical and Electronic Equipment (WEEE)



**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*.

## Battery Replacement and Disposal



**Battery Directive** This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit *ni.com/environment/batterydirective*.

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