cRIO-9043 Specifications

Contents

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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 for -40 °C to 70 °C unless otherwise noted.

Processor

CPU	Intel Atom E3930
Number of cores	2
CPU frequency	1.3 GHz (base), 1.8 GHz (burst)
On-die L2 cache	2 MB

Software

> **Note** For minimum software support information, visit ni.com/info and enter the Info Code swsupport.

Supported operating system	NI Linux Real-Time (64-bit)
Supported C Series module programming modes	Real-Time (NI-DAQmx) Real-Time Scan (I/O Variables) LabVIEW FPGA
Application software LabVIEW[1]	LabVIEW 2017 or later, LabVIEW Real-Time Module 2017 or later, LabVIEW FPGA Module 2017 or later,
C/C++ Development Tools for NI Linux Real-Time[2]	Eclipse Edition 2014 or later
Driver software	NI CompactRIO Device Drivers December 2017 or later

Network/Ethernet Port

Number of ports	2
Network interface	10Base-T, 100Base-TX, and 1000Base-T Ethernet
Compatibility	IEEE 802.3
Communication rates	10 Mb/s, 100 Mb/s, 1000 Mb/sauto-negotiated

Maximum cabling distance	100 m/segment

Network Timing and Synchronization

Protocol	IEEE 802.1AS-2011 IEEE 1588-2008 (default end-to-end profile)
Supported ethernet ports	Port 0, port 1
Network synchronization accuracy[3]	<1 µs

> ✏ **Note** The cRIO-9043 employs time-aware transmission support. For more information about time-aware transmission support, visit ni.com/info and enter Info Code timeaware.

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 Serial Port

Maximum baud rate	230,400 b/s
Data bits	5, 6, 7, 8
Stop bits	1, 2
Parity	Odd, even, mark, space
Flow control	XON/XOFF
Wire mode	4-wire, 2-wire, 2-wire auto
Isolation voltage	60 V DC continuous, port to earth ground

Note The RS-485 serial port ground and shield are functionally isolated from chassis ground to prevent ground loops, but do not meet IEC 61010-1 for safety isolation.

Cable requirement	Unshielded, 30 m maximum length (limited by EMC/surge)

Note RS-485 is capable of 1.2 km (4,000 ft) length without surge limitation.

USB Ports

Port 1: ⛢

Type	USB Type-A, host port
USB interface	USB 2.0, Hi-Speed
Maximum data rate	480 Mb/s
Maximum current	900 mA

Port 2: *SS⟷* ⬚DP

Type	USB Type-C, host port
USB interface	USB 3.1 Gen1, SuperSpeed
Maximum data rate	5 Gb/s
Maximum current	900 mA
Alternate modes	DisplayPort

Port 3: *SS⟷*

Type	USB Type-C, dual role port (device or host)
USB interface	USB 3.1 Gen1, SuperSpeed
Maximum data rate	5 Gb/s
Maximum current	900 mA

DisplayPort over USB Type-C

Maximum resolution	3840 × 2160 at 60 Hz

Supported standard	DisplayPort 1.2
Supported USB ports	Port 2: $SS\rightarrow$ DP

SD Card Slot

SD card support	SD and SDHC standards
Supported interface speeds	UHS‑I SDR50 and DDR50

> **⊘ Notice** Full and high speed SD cards are prohibited for use with the cRIO-9043.

Memory

Nonvolatile memory (SSD)	8 GB
Nonvolatile memory (SSD) type	Planar SLC NAND

> **✎ Note** Visit ni.com/info and enter the Info Code ssdbp for information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory.

Volatile memory (DRAM)	
Density	2 GB
Type	DDR3L
Maximum theoretical data rate	12.8 GB/s

Reconfigurable FPGA

FPGA type	Xilinx Kintex-7 7K160T
Number of flip-flops	202,800
Number of 6-input LUTs	101,400
Number of DSP slices (18 × 25 multipliers)	600
Available block RAM	11,700 kbits
Number of DMA channels	16
Number of logical interrupts	32

Internal Real-Time Clock

Accuracy	200 ppm; 40 ppm at 25 °C

Controller PFI 0

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

I/O standard compatibility	5 V TTL
I/O voltage protection	±30 V

Maximum operating conditions

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

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 1. DC Input 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

Table 2. DC Output Characteristics

Real-Time Streaming Performance

Data throughput is dependent on the application, system, and performance of the removable storage media. For information about optimizing data throughput on the cRIO-9043 visit ni.com/info and enter Info Code optdata.

Data throughput from system memory to target

SD card	40 MB/s
USB Type-C	100 MB/s

Real-Time (NI-DAQmx) Mode

The following specifications are applicable for modules and slots programmed in Real-Time (NI-DAQmx) mode. For more information about using modules in LabVIEW FPGA mode or Real-Time Scan (I/O Variables) mode, visit ni.com/r/swsupport.

Analog Input

Input FIFO size	253 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	12.5 ns
Number of channels supported	Determined by the C Series module or modules
Number of hardware-timed tasks	8

Analog Output

Hardware-timed tasks	
Number of hardware-timed tasks	8
Number of channels supported	

Onboard regeneration	16
Non-regeneration	Determined by the C Series module or modules

Non-hardware-timed tasks

Number of non-hardware-timed tasks	Determined by the C Series module or modules
Number of channels supported	Determined by the C Series module or modules

Maximum update rate	1.6 MS/s

Note Streaming applications are limited by system-dependent factors and the capability of C Series modules.

Timing accuracy	50 ppm of sample rate
Timing resolution	12.5 ns
Waveform onboard regeneration FIFO	8,191 samples shared among channels used
Waveform streaming FIFO	253 samples per slot

Digital Waveform

Waveform acquisition (DI) FIFO

Parallel modules	255 samples per slot
Serial modules	127 samples per slot

Waveform onboard regeneration (DO) FIFO

Parallel modules	2,047 samples shared among slots used

Waveform streaming (DO) FIFO

Parallel modules	255 samples per slot
Serial modules	127 samples per slot

Sample clock frequency

Digital input	0 MHz to 10 MHz

Digital output

ot0:6 timing engine	0 MHz to 3.5 MHz
ot7 timing engine	0 MHz to 10 MHz

> **Note** Streaming applications are limited by system-dependent factors and the capability of C Series modules.

Timing accuracy	50 ppm
Number of digital input hardware-timed tasks	8
Number of digital output hardware-timed tasks	8

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, controller 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 controller PFI or module PFI terminal

Module PFI

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 controller 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	6

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

CMOS Battery

Typical battery life with power applied to power connector	10 years
Typical battery life when stored at temperatures up to 25 °C	7.8 years
Typical battery life when stored at temperatures up to 85 °C	5.4 years

Power Requirements

> **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 Real-Time (DAQmx) Mode.

Voltage input range (measured at the cRIO-9043 power connector)

V1	9 V to 30 V

V2	9 V to 30 V
Maximum power consumption	60 W

> **Note** The C terminal of the power connector is functionally isolated from chassis ground to prevent ground loops, but does not meet IEC 61010-1 for safety isolation

> **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 and USB devices consuming the maximum allowed power.

Typical standby power consumption	3.4 W at 24 V DC input
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	0.4 mA
At 30 V	1.93 mA

> **Notice** Do not connect V2 to a DC Mains supply or to any supply that requires 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. V1 may be connected to DC Mains.

> **(!) Notice** Include a switch or circuit breaker in the installation to disconnect the system from DC Mains. The switch or circuit breaker must be suitably rated, accessible, and marked as the disconnecting device for the system.

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-position, 3.5 mm pitch, pluggable screw terminal with screw locks, Sauro CTF04BV8-AN000A

Battery Guidelines

> **⚠ Caution** Fire, explosion, and severe burn hazard. Do not open, crush, insert improperly, recharge or disassemble the battery. Do not heat the battery or the product above 100 °C. Do not incinerate the battery or the product. Do not expose the battery contents to water. Take precautions to ensure correct polarity of the battery in the product. Risk of explosion if battery is replaced by an incorrect type. Dispose of used batteries according to the instructions.

> **⚠ Attention** Risque d'incendie, d'explosion et de brûlures graves. Ne pas ouvrir, écraser, recharger ou démonter la pile. Ne pas chauffer la pile ou le produit au-dessus de 100 °C. Ne pas incinérer la pile ou le produit. Éviter tout contact du contenu de la pile avec de l'eau. Prenez des précautions pour vous assurer que la polarité de la batterie dans le produit est correcte. Risque d'explosion si la pile est remplacée par un type de pile incorrect. Reportez-vous à la documentation de l'appareil sur ni.com/manuals pour obtenir des informations sur le remplacement, l'élimination et le recyclage de sa pile.

> ⚠ **Caution** The battery must be replaced by a trained service technician. Refer to the product documentation on ni.com/manuals for instructions for replacing the battery.

> ⚠ **Attention** La pile doit être remplacée par un technicien de maintenance qualifié. Reportez-vous à la documentation du produit sur ni.com/manuals pour obtenir les instructions pour changer la pile.

Battery Rating	
Manufacturer	Tadiran
Model	TLH-2450/P
Quantity	1
Cell chemistry system	Lithium Thionyl Chloride

Physical Characteristics

Weight (unloaded)	1,800 g (3 lb, 15 oz)
Dimensions (unloaded)	219.5 mm × 88.1 mm × 121.2 mm (8.64 in. × 3.47 in. × 4.77 in.)
Power connector wiring	
Gauge	0.5 mm^2 to 2.1 mm^2 (20 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	0.20 N · m to 0.25 N · m (1.8 lb · in. to 2.2 lb · in.)

Insulation rating	300 V, maximum

Safety Voltages

Connect only voltages that are below these limits.

V1 terminal to C terminal	30 V, maximum
V2 terminal to C terminal	30 V, maximum
Chassis ground to C terminal	30 V, maximum

Environmental Characteristics

Temperature	
Operating	-40 °C to 70 °C
Storage	to
Storage	-40 °C to 85 °C

Humidity	
Operating	10% RH to 90% RH, noncondensing

Storage	5% RH to 95% RH, noncondensing

Ingress protection	IP20
Pollution Degree	2
Maximum altitude	5,000 m

Shock and Vibration

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

To meet these shock and vibration specifications, you must panel mount the system.

Environmental Standards

This product meets the requirements of the following environmental standards for electrical equipment.

- IEC 60068-2-1 Cold
- IEC 60068-2-2 Dry heat
- IEC 60068-2-30 Damp heat cyclic (12 + 12h cycle)
- IEC 60068-2-64 Random operating vibration
- IEC 60068-2-6 Sinusoidal operating vibration
- IEC 60068-2-27 Operating shock

> ✏️ **Note** To verify marine approval certification for a product, refer to the product label or visit ni.com/certification and search for the certificate.

Hazardous Locations Certifications

U.S. (UL)	Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx ec IIC T4 Gc
Canada (C-UL)	Class I, Division 2, Groups A, B, C, D, T4; Ex ec IIC T4 Gc
Europe (ATEX) and International (IECEx)	Ex ec IIC T4 Gc; ⬡ II 3 G UL 21 ATEX 2518X; IECEx UL 21.0013X

C E

Safety Compliance 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, EN 60079-7
- IEC 60079-0, IEC 60079-7
- UL 60079-0, UL 60079-7
- CSA C22.2 No. 60079-0, CSA C22.2 No. 60079-7

> ✏️ **Note** For safety certifications, refer to the product label or the Product Certifications and Declarations 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
- AS/NZS CISPR 11: Group 1, Class A emissions

> **Note** In Europe, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in non-residential 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.

> **Notice** For EMC declarations and certifications, and additional information, refer to the Product Certifications and Declarations section.

CE Compliance $C\,E$

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)
- 2011/65/EU; Restriction of Hazardous Substances (RoHS)

Product Certifications and Declarations

Refer to the product Declaration of Conformity (DoC) for additional regulatory compliance information. To obtain product certifications and the DoC for NI

products, visit ni.com/product-certifications, search by model number, and click the appropriate link.

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 **Engineering a Healthy Planet** 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.

EU and UK Customers

- ☒ Waste Electrical and Electronic Equipment (WEEE)—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 product contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized NI 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.

电子信息产品污染控制管理办法（中国 RoHS）

- ⊚⊚⊚ 中国 RoHS— NI 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 NI 中国 RoHS 合规性信息，请登录 ni.com/environment/

rohs_china。 (For information about China RoHS compliance, go to ni.com/ environment/rohs_china.)

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NI corporate headquarters is located at 11500 N Mopac Expwy, Austin, TX, 78759-3504, USA.

[1] LabVIEW FPGA Module is not required when using Real-Time Scan (I/O Variables) mode or Real-Time (NI-DAQmx) mode. To program the user-accessible FPGA on the cRIO-9043, the LabVIEW FPGA Module is required.

[2] C/C++ Development Tools for NI Linux Real-Time is an optional interface for C/C++ programming of the cRIO-9043 processor. Visit ni.com/info and enter Info Code RIOCdev for more information about the C/C++ Development Tools for NI Linux Real-Time.

[3] Network synchronization is system-dependent. For information about network synchronization accuracy, visit ni.com/info and enter Info Code criosync.

[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.

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