SPECIFICATIONS

NI cRIO-9038

Embedded CompactRIO Controller with Real-Time Processor and Reconfigurable FPGA

This document lists the specifications for the National Instruments cRIO-9038. The following specifications are typical for the -40 °C to 70 °C operating temperature range unless otherwise noted.

Caution Do not operate the cRIO-9038 in a manner not specified in this document. Product misuse can result in a hazard. You can compromise the safety protection built into the product if the product is damaged in any way. If the product is damaged, return it to NI for repair.

Processor

CPU.....Intel Atom E3825

Number of cores.....2

CPU frequency.....1.33 GHz

On-die L2 cache.....1 MB (shared)

Operating System

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)

NATIONAL INSTRUMENTS

Software requirements

Application software

LabVIEW.....LabVIEW 2014 or later,
LabVIEW Real-Time Module 2014 or later,
LabVIEW FPGA Module 2014 or later[1],

C/C++ Development Tools for NI Linux Real-Time[2].....Eclipse Edition 2014 or later

Driver software.....NI-RIO Device Drivers August 2014 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 Mbps, 100 Mbps, 1000 Mbps auto-negotiated

Maximum cabling distance.....100 m/segment

RS-232 Serial Port

Maximum baud rate.....115,200 bps

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

[1] LabVIEW FPGA Module is not required when using Scan Interface mode. To program the user-accessible FPGA on the cRIO-9038, 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-9038 processor. Visit *ni.com/info* and enter Info Code `RIOCdev` for more information about the C/C++ Development Tools for NI Linux Real-Time.

RS-485/422 (DTE) Serial Port

Maximum baud rate.....115,200 bps

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 VDC continuous, port to earth ground

Note The RS-485 serial port ground and shield are not connected to chassis ground. This isolation is intended to prevent ground loops and does not meet UL ratings 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

Number of ports

- Device ports.....1 standard B connector
- Host ports.....2 standard A connectors

Note The USB device port is intended for use in device configuration, application deployment, debugging, and maintenance.

USB interface.....USB 2.0, Hi-Speed

Maximum data rate.....480 Mb/s per port

Maximum current (USB host ports).....1 A (aggregate)

Mini DisplayPort

Maximum resolution.....2560 × 1600 at 60 Hz

SD Card Slot

SD card support.....SD and SDHC standards

Memory

Nonvolatile[3]

- SD removable (user supplied).....Up to 32 GB
- Solid-state drive.....8 GB

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

- Processor memory
  - Density.....2 GB
  - Type.....DDR3L
  - Maximum theoretical data rate.....8.533 GB/s

Data throughput

- System memory to SD removable storage[4].....10 MB/s
- Module slots to system memory.....20 MB/s, application- and system-dependent

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 x 25 multipliers).....600

Available block RAM.....11,700 kbits

[3] 1 MB is equal to 1 million bytes. 1 GB is equal to 1 billion bytes. The actual formatted capacity might be less.

[4] Consult the manufacturer specifications of your SD removable storage.

Number of DMA channels.....16

Number of logical interrupts.....32

Internal Real-Time Clock

Accuracy.....200 ppm; 40 ppm at 25 °C

CMOS Battery

Typical battery life with power.....10 years
applied to power connector

Typical battery life when stored at.....7.8 years
temperatures up to 25 °C

Typical battery life when stored at.....5.4 years
temperatures up to 85 °C

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.

Voltage input range (measured at the
cRIO-9038 power connector)

V1.....9 V to 30 V

V2.....9 V to 30 V

Maximum power consumption.....46 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 and USB devices consuming the maximum allowed power.

Typical standby power consumption.....3.4 W at 24 VDC input

Recommended power supply.....100 W, 24 VDC

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

Caution 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.

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

Physical Characteristics

If you need to clean the cRIO-9038, wipe it with a dry towel.

Tip For two-dimensional drawings and three-dimensional models of the cRIO-9038, visit *ni.com/dimensions* and search by module number.

Weight (unloaded).....2,250 g (4 lbs, 15 oz)

Dimensions (unloaded).....328.8 mm × 88.1 mm × 109.2 mm (12.94 in. × 3.47 in. × 4.30 in.)

Screw-terminal 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.)

Safety Voltages

Connect only voltages that are below these limits.

V1 terminal to C terminal.....30 VDC maximum, Measurement Category I

V2 terminal to C terminal.....30 VDC maximum, Measurement Category I

Chassis ground to C terminal.....30 VDC 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, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.

Caution Do not connect the cRIO-9038 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.....-40 °C to 70 °C

Storage.....-40 °C to 85 °C

Caution Failure to follow the mounting instructions in the user manual can cause temperature derating. Visit *ni.com/info* and enter Info Code `criomounting` for more information about mounting configurations and temperature derating.

Ingress protection.....IP20

Operating humidity.....10% RH to 90% RH, noncondensing (IEC 60068-2-56)

Storage humidity (IEC 60068-2-56).....5% RH to 95% RH, noncondensing

Pollution Degree (IEC 60664).....2

Maximum altitude.....5,000 m

Indoor use only.

Hazardous Locations

U.S. (UL).....Class I, Division 2, Groups A, B, C, D, T4;
Class I, Zone 2, AEx nA IIC T4

Canada (C-UL).....Class I, Division 2, Groups A, B, C, D, T4;
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 mount the cRIO-9038 system directly on a flat, rigid surface as described in the user manual, affix ferrules to the ends of the terminal wires, install an SD card cover (SD Door Kit, 783660-01), and use retention accessories for the USB host ports (NI Industrial USB Extender Cable, 152166-xx), USB device port (NI Locking USB Cable, 157788-01), and mini DisplayPort connector (NI Retention Accessory for Mini DisplayPort, 156866-01). All cabling should be strain-relieved near input connectors. Take care to not directionally bias cable connectors within input connectors when applying strain relief.

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 61010-1
- EN 60079-0:2012, EN 60079-15:2010
- IEC 60079-0: Ed 6, IEC 60079-15; Ed 4

- UL 60079-0; Ed 5, UL 60079-15; Ed 3
- 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 61000-6-2: 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)
- 94/9/EC; 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*.

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

Worldwide Support and Services

The National Instruments website is your complete resource for technical support. At *ni.com/support*, you have access to everything from troubleshooting and application development self-help resources to email and phone assistance from NI Application Engineers.

Visit *ni.com/services* for NI Factory Installation Services, repairs, extended warranty, and other services.

Visit *ni.com/register* to register your National Instruments product. Product registration facilitates technical support and ensures that you receive important information updates from NI.

A Declaration of Conformity (DoC) is our claim of compliance with the Council of the European Communities using the manufacturer's declaration of conformity. This system affords the user protection for electromagnetic compatibility (EMC) and product safety. You can obtain the DoC for your product by visiting *ni.com/certification*. If your product supports calibration, you can obtain the calibration certificate for your product at *ni.com/calibration*.

National Instruments corporate headquarters is located at 11500 North Mopac Expressway, Austin, Texas, 78759-3504. National Instruments also has offices located around the world. For telephone support in the United States, create your service request at *ni.com/support* or dial 1 866 ASK MYNI (275 6964). For telephone support outside the United States, visit the *Worldwide Offices* section of *ni.com/niglobal* to access the branch office websites, which provide up-to-date contact information, support phone numbers, email addresses, and current events.

375696B-02 Apr15