cRIO-9053 Specifications

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cRIO-9053 Specifications

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 -20 °C to 55 °C unless otherwise noted.

Processor

CPU	Intel Atom E3805
Number of cores	2
CPU frequency	1.33 GHz
On-die L2 cache	1 MB (shared)

Software

Note For minimum software support information, visit ni.com/r/SWsupport.

Supported operating system	NI Linux Real-Time (64-bit)
Supported C Series module programming modes	Real-Time (NI-DAQmx) mode Real-Time Scan (I/O Variables) LabVIEW FPGA
Application software	
LabVIEW	LabVIEW 2018 or later, LabVIEW Real-Time Module 2018 or later, LabVIEW FPGA Module 2018 or later

Note 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-9053, the LabVIEW FPGA Module is required.

Note C/C++ Development Tools for NI Linux Real-Time is an optional interface for C/C++ programming of the cRIO-9053 processor. Visit ni.com/r/RIOCdev for more information about the C/C++ Development Tools for NI Linux Real-Time. For information on setting up a C/C++ based toolchain, visit ni.com/r/NILRTCrossCompile.

Driver software	NI CompactRIO and Drivers 18.1 or later

Network/Ethernet Port

Number of ports	1
Network interface	10Base-T, 100Base-TX, and 1000Base-T Ethernet
Compatibility	IEEE 802.3
Communication rates	10 Mb/s, 100 Mb/s, 1,000 Mb/s, auto-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
Network synchronization accuracy	<1 µs

Note Network synchronization is system-dependent. For information about network synchronization accuracy, visit ni.com/r/criosync.

Note The cRIO-9053 employs time-aware transmission support.

USB Ports

Port 1:	
Type	USB Type-C, device port with Console Out
USB interface	USB 2.0, Hi-Speed
Maximum data rate	480 Mb/s
Maximum current (from host)	250 mA
Console Out	
Baud rate	115,200 b/s
Data bits	8
Stop bits	1
Parity	None
Flow control	None
Port 2:	
Type	USB Type-C, host port
USB interface	USB 3.1 Gen1, SuperSpeed

Maximum data rate	5 Gb/s
Maximum current	900 mA

SD Association MicroSD Card Slot

MicroSD card support	MicroSD and MicroSDHC standards
Supported interface speeds	Full speed, high speed, UHS‑I SDR50, and DDR50

Memory

Nonvolatile memory (SSD)	4 GB
Nonvolatile memory (SSD) type	Planar SLC NAND

Note Visit ni.com/r/ssdbp for information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory.

Volatile memory (DRAM)	
Density	1 GB
Type	DDR3L

Maximum theoretical data rate	8.533 GB/s

Reconfigurable FPGA

FPGA type	Xilinx Artix-7 A50T
Number of flip-flops	65,200
Number of 6-input LUTs	32,600
Number of DSP slices (18 × 25 multipliers)	120
Available block RAM	2,700 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

Table 1. 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 2. 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

Real-Time Streaming Performance

Data throughput is dependent on the application, system, and performance of the removable storage media.

Data throughput from system memory to target	
MicroSD 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	Determined by the C Series module or modules
Timing accuracy	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

Note Maximum sample rate performance is dependent on type of installed C Series module and number of channels in the task.

Note Timing accuracy does not include group delay. For more information, refer to the documentation for each C Series module.

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	Any module PFI, controller PFI, analog trigger, many internal signals

inputs	
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	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

Note Actual available timing output source signals are dependent on type of installed C Series module.

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	3.66 years
Typical battery life when stored at temperatures up to 85 °C	3.20 years

Battery

Replace the battery with the following battery or an equivalent one.

Manufacturer	Rayovac
Model	BR2032

Quantity	1
Cell chemistry system	Lithium carbon mono-fluoride (BR)
IEC number	BR2032
Minimum reverse charge current	3 mA

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-9053 power connector)	9 V DC to 30 V DC
Maximum power consumption	30 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	60 W, 24 V DC

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 voltage input as described in IEC 61000	Short lines, long lines, and DC distributed networks
Power input connector	2-position, 3.5 mm pitch, pluggable screw terminal with screw locks, Sauro CTF02BV8-AN000A

Physical Characteristics

Weight (unloaded)	1,148 g (2 lb 9 oz)
Dimensions (unloaded)	221.4 mm × 82.5 mm × 189.6 mm (8.72 in. × 3.25 in. × 3.53 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.

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

Environmental Characteristics

Temperature

Operating	-20 °C to 55 °C
Storage	-40 °C to 85 °C
Humidity	
Operating	10% RH to 90% RH, noncondensing
Storage	5% RH to 95% RH, noncondensing
Ingress protection	IP40
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.