

SPECIFICATIONS

# NI roboRIO

RIO Device for Robotics

This document provides specifications for the NI roboRIO. These specifications are typical for the 0° C to 40° C operating temperature range unless otherwise noted.

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## Processor

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Type.....	Xilinx Z-7020 All Programmable SoC dual-core ARM Cortex-A9
Speed.....	667 MHz
Cores.....	2

# Memory

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Nonvolatile.....512 MB

DDR3

Amount.....256 MB

Clock frequency.....533 MHz

Data bus width.....16 bits

For information about the life span of the nonvolatile memory and about best practices for using nonvolatile memory, visit [ni.com/info](http://ni.com/info) and enter the Info Code SSDBP.

# FPGA

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Type.....Xilinx Z-7020

# Network

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Network interface.....10BaseT and 100BaseTX Ethernet

Compatibility.....IEEE 802.3

Communication rates.....10 Mbps, 100 Mbps, auto-negotiated

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

# USB Ports

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Host

Number of ports.....2

Type.....USB 2.0 Hi-Speed

VBus current.....900 mA maximum per port

Device

Number of ports.....1

Type.....USB 2.0 Hi-Speed

# Analog Input

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Aggregate sample rate.....500 kS/s

Resolution.....12 bits

Overvoltage protection.....	±16 V
Expansion port configuration.....	4 single-ended channels
Integrated AI connector.....	4 single-ended channels
configuration	
Input impedance.....	>500 kΩ acquiring at 500 kS/s, 1 MΩ powered on and idle, 4.7 kΩ powered off
Recommended source impedance.....	3 kΩ or less
Nominal range.....	0 V to +5 V
Absolute accuracy.....	±50 mV
Bandwidth.....	20 kHz minimum, >50 kHz typical

## Analog Output

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Aggregate maximum update rate.....	345 kS/s
Resolution.....	12 bits
Overload protection.....	±16 V
Startup voltage.....	0 V after FPGA initialization
Configuration.....	2 single-ended channels on expansion port
Range.....	0 V to +5 V
Absolute accuracy.....	50 mV
Current drive.....	3 mA
Slew rate.....	0.3 V/μs

## Digital I/O

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Number of lines	
Expansion port.....	16 DIO lines; one UART
Integrated DIO, I <sup>2</sup> C, and SPI bus	
DIO lines.....	10 DIO lines
I <sup>2</sup> C lines.....	1 SDA and 1 CLK
SPI lines.....	Drives up to four devices

Direction control.....	Each DIO line individually programmable as input or output
Logic level.....	5 V compatible LVTTL input; 3.3 V LTTL output
Input logic levels	
Input low voltage, $V_{IL}$ .....	0.0 V min; 0.8 V max
Input high voltage, $V_{IH}$ .....	2.0 V min; 5.25 V max
Output logic levels	
Output low voltage, $V_{OL}$ ,.....	0.0 V min; 0.4 V max sinking 4 mA
Output high voltage, $V_{OH}$ ,.....	2.4 V min; 3.465 V max sourcing 4 mA
Minimum pulse width.....	20 ns
Maximum frequencies for secondary digital functions	
SPI.....	4 MHz
I <sup>2</sup> C.....	400 kHz
UART lines	
Maximum baud rate.....	230,400 bps
Data bits.....	5, 6, 7, 8
Stop bits.....	1, 2
Parity.....	Odd, Even, Mark, Space
Flow control.....	XON/XOFF

## RS-232 Serial Port

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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

Logic level	
Standard.....	Meets or exceeds TIA/EIA-232-F voltage levels
Receiver input voltage.....	+30 V maximum
Driver output high voltage.....	5 V minimum
Driver output low voltage.....	-5 V maximum

## PWM and Relay Lines

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PWM port.....	10 PWM lines
Relay port.....	4 forward; 4 reverse
Direction control.....	Output only
Logic level.....	5 V output
Maximum output current	
PWM.....	15.0 mA
Relay.....	7.5 mA
Series resistor in each output path	
PWM.....	330 $\Omega$
Relay.....	680 $\Omega$
Output high voltage, $V_{OH}$	
PWM sourcing 0.1 mA.....	4.75 V min; 5.25 V max
Relay sourcing 0.1 mA.....	4.75 V min; 5.25 V max
Output low voltage, $V_{OL}$	
PWM sinking 0.1 mA.....	0.0 V min; 0.25 V max
Relay sourcing 0.1 mA.....	0.0 V min; 0.25 V max
Maximum frequency.....	150 kHz

## RSL

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RSL port.....	Switched VIN output
Voltage range.....	7 V to 16 V (VIN)
Current range.....	120 mA max

## Accelerometer

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Number of axes.....	3
Range.....	±8 g
Resolution.....	12 bits
Sample rate.....	800 S/s
Noise.....	3.9 mg <sub>ms</sub> typical at 25° C

## Power Output

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### +6.0 V power output

Output voltage.....	5.5 V to 6.1 V
Output voltage with.....	5.75 V to 6.1 V
load > 360 mA	
Maximum current.....	2.2 A total

### +5.0 V power output

Output voltage with and.....	4.7 V to 5.25 V
without load	
Maximum current.....	1.0 A total

### +3.3 V power output

Output voltage with and.....	3.1 V to 3.465 V
without load	
Maximum current.....	1.225 A total

## Power Requirements

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The NI roboRIO requires a power supply connected to the power connector.

Power supply voltage range.....	7 VDC to 16 VDC
Maximum power consumption.....	45 W
Typical idle power consumption.....	5 W

# Environmental

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Local ambient temperature near device (IEC 60068-2-1, IEC 600682-2)	0° C to 40° C
Storage temperature (IEC 60068-2-1, IEC 60068-2-2)	-20° C to 70° C
Operating humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Storage humidity (IEC 60068-2-56)	10% to 90% RH, noncondensing
Pollution Degree (IEC 60664)	2
Maximum altitude	2,000 m
Indoor use only.	

# Shock and Vibration

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Operating vibration	
Random (IEC 60068-2-64)	5 grms, 10 Hz to 500 Hz
Sinusoidal (IEC 60068-2-6)	5 g, 10 Hz to 500 Hz
Operating shock (IEC 60068-2-27)	50 g, 3 ms half sine, 30 g, 11 ms half sine, 18 shocks at 6 orientations

# Physical Characteristics

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Weight	330 g (11.64 oz)
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# Safety Standards

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This product is designed to meet the requirements of the following standards of safety for electrical equipment for measurement, control, and laboratory use:

- IEC 61010-1, EN 61010-1
- UL 61010-1, CSA 61010-1



**Note** For UL and other safety certifications, refer to the product label or the *Online Product Certification* section of this document.



**Caution** Using the NI roboRIO in a manner not described in this document may impair the protection the NI roboRIO provides.

## Hazardous Locations

This device is not certified for use in hazardous locations.

## Electromagnetic Compatibility

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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; Basic immunity
- EN 55011 (CISPR 11): Group 1, Class A emissions
- AS/NZS CISPR 11: Group 1, Class A emissions
- FCC 47 CFR Part 15B: Class A emissions
- ICES-001: Class A emissions



**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** 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** For EMC declarations and certifications, refer to the *Online Product Certification* section of this document.

## CE Compliance C €

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This product meets the essential requirements of applicable European Directives, as follows:

- 2006/95/EC; Low-Voltage Directive (safety)
- 2004/108/EC; Electromagnetic Compatibility Directive (EMC)

## Online Product Certification

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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](https://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.



# Environmental Management

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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](https://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](https://ni.com/environment/weee).

## 电子信息产品污染控制管理办法（中国 RoHS）



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