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**NI-7931**

## SPECIFICATIONS

# NI-7931R

## Controller for FlexRIO™

This document lists the specifications for the NI-7931R. Specifications are subject to change without notice. For the most recent device specifications, refer to [ni.com/manuals](http://ni.com/manuals). Refer to your adapter module documentation for the adapter module specifications.



**Note** Using the NI-7931R in a manner not described in this document might impair the protection the NI-7931R provides.



**Note** Typical values are representative of an average unit operating at room temperature. These specifications are typical at 25 °C unless otherwise noted.

## Contents

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Processor.....	2
CMOS Battery.....	2
Internal Reference Clock.....	2
General Characteristics.....	2
Typical Specifications.....	3
Network/Ethernet Port.....	3
USB Ports.....	3
SD Card Slot.....	3
REF IN.....	4
TRIG General Characteristics.....	4
Non-volatile Storage.....	5
Reconfigurable FPGA.....	5
FPGA Digital Input/Output.....	5
FPGA-Accessible DRAM.....	6
Power Requirements.....	6
Physical.....	7
Safety Voltages.....	7
Maximum Working Voltage at the FlexRIO Adapter Module Connector.....	8
Environment.....	8
Operating Environment.....	8
Storage Environment.....	8
Shock and Vibration.....	9
Compliance and Certifications.....	9
Safety.....	9
Electromagnetic Compatibility.....	9
CE Compliance.....	10

Online Product Certification.....	10
Environmental Management.....	10
Worldwide Support and Services.....	11

## Processor

Type	Xilinx Zynq-7020, XC7Z020 All Programmable SoC, CLG484
Architecture	ARM Cortex-A9
Speed	667 MHz
Cores	2
Real-time clock accuracy	5 ppm
Operating system	NI Linux Real-Time (32-bit)
Nonvolatile memory	512 MB <sup>1</sup> , SLC NAND Flash
Volatile memory (DRAM)	512 MB, DDR3
Flash reboot endurance	100,000 cycles <sup>2</sup>

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*.

## CMOS Battery

Typical battery life with power applied to power connector	10 years
Typical battery life in storage up to 70 °C	10 years

## Internal Reference Clock

### General Characteristics

Clock distribution part number	AD9511 <sup>3</sup> ; clock distribution
Oscillator type	VCXO
Oscillator model	Epson Toyocom TCO-2121U2

<sup>1</sup> Formatted capacity of nonvolatile memory may be slightly less than this value.

<sup>2</sup> You can increase the flash reboot endurance value by performing field maintenance on the device. If you expect that your application may exceed the maximum cycle count listed in this document, contact NI support for information about how to increase the reboot endurance value.

<sup>3</sup> For additional information about the AD9511, refer to the Analog Devices data sheet at [www.analog.com](http://www.analog.com).

Frequency	100 MHz <sup>4</sup>
Frequency pull range	± 100 ppm

## Typical Specifications

Frequency stability	
Temperature	±30 ppm over the operating temperature range
Aging	±5 ppm per year

## Network/Ethernet Port

Number of ports	1
Network interface	10Base-T, 100Base-TX, and 1000Base-T Ethernet
Compatibility	IEEE 802.3
Communication rates	10 Mbps, 100 Mbps, 1000 Mbps auto-negotiated, half/full-duplex
Maximum cabling distance	100 m/segment

## USB Ports

Number of ports	
USB device port	1 standard mini-B connector
USB host port	1 standard A connector
USB interface	USB 2.0, Hi-Speed
Maximum data rate	480 Mb/s per port
Maximum current (USB Host Port)	1 A

## SD Card Slot

SD card support	SD and SDHC standards
Non-volatile memory <sup>5</sup>	Up to 32 GB <sup>6</sup>

<sup>4</sup> Onboard PLL circuitry divides the 100 MHz onboard oscillator to 10 MHz for use by adapter modules.

<sup>5</sup> 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.

<sup>6</sup> 1 GB is equal to 1 billion bytes; formatted capacity might be less.

## REF IN

Number of channels	1, single-ended
Connector type	SMA
Frequency	10 MHz
Input impedance	50 $\Omega$
Input coupling	AC
Input voltage range	0.75 V <sub>pk-pk</sub> to 5.2 V <sub>pk-pk</sub>
Absolute maximum voltage	$\pm 8.0$ VDC, 8.0 V <sub>pk-pk</sub> AC
Duty cycle	40% to 60%

## TRIG General Characteristics

Number of channels	1, single-ended
Connector type	SMA
Coupling	DC
Impedance	
Input	10 k $\Omega$
Output	50 $\Omega$
Logic level	3.3V CMOS
Voltage	
V <sub>IH_MIN</sub>	2 V
V <sub>IL_MAX</sub>	0.8 V
V <sub>OH_MIN</sub> (unloaded)	3.1 V
V <sub>OL_MAX</sub> (unloaded)	0.2 V
Absolute maximum voltage	$\pm 20$ VDC, +21 dBm (7.1 V <sub>pk-pk</sub> )
Current	
I <sub>OH_MAX</sub>	12 mA
I <sub>OL_MAX</sub>	-12 mA

# Non-volatile Storage

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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.

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## Non-volatile memory

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SD removable (user supplied)	Up to 32 GB <sup>7</sup>
System memory	512 MB

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# Reconfigurable FPGA

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FPGA	Kintex-7 XC7K325T
LUTs	203,800
DSP48 Slices (25 × 18 multiplier)	840
Embedded Block RAM (kbits)	16,020
Default timebase	40 MHz
Timebase accuracy	±100 ppm, 250 ps peak-to-peak jitter
Data transfers	DMA, interrupts, programmed I/O
Number of DMA channels	16

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For detailed FPGA specifications, refer to Xilinx documentation.

# FPGA Digital Input/Output

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Number of general-purpose channels	136, configurable as 136 single-ended, 68 differential, or a combination of both <sup>8</sup>
Channels per bank	
Bank 0/Bank 1	48
Bank 2	40
Compatibility	Configured through the FPGA and based on the attached adapter module; 1.2 V, 1.5 V, 1.8 V, 2.5 V, and 3.3 V I/O standards (refer to <a href="http://xilinx.com">xilinx.com</a> ).
Protection	Refer to <a href="http://xilinx.com">xilinx.com</a> .
Current	Refer to <a href="http://xilinx.com">xilinx.com</a> .

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<sup>7</sup> 1 GB is equal to 1 billion bytes; formatted capacity might be less.

<sup>8</sup> The 136 channels span across three FPGA banks.

## Maximum I/O data rates

Single-ended	400 Mb/s
Differential	1 Gb/s for LVDS
Multi-region clock inputs	6
Single-region clock inputs	5
Connection resources	SMA connector (TRIGGER and REF CLK)

## FPGA-Accessible DRAM

Memory size	2 GB
Theoretical maximum data rate	10.5 GB/s

## Power Requirements

The NI-7931R requires a power supply connected to the power connector.



**Caution** You must use either the recommended power supply, or another UL listed ITE power supply with the NI-7931R.



**Caution** Exceeding the power limits may cause unpredictable behavior by the NI-7931R.

Voltage input range	9 V to 30 V (measured at the NI-7931R power connector)
Maximum power consumption <sup>9</sup>	60 W
Typical standby power consumption	11.4 W
Recommended power supply	>75 W, 12 VDC
EMC ratings for power input as described in IEC 61000	Short lines, long lines, and DC distributed networks

<sup>9</sup> The maximum power consumption specification is based on a fully populated system running a high-stress application at elevated ambient temperature, and with all controllers, adapter modules, and peripheral devices consuming the maximum allowed power.

## Power input connector

Power receptacle	Weidmuller OMNIMATE Signal, S2C-SMT 3.50/04/90LF 1.8AU BK BX, part number 1993840000
Power plug	Weidmuller OMNIMATE Signal, B2CF 3.50/04/180F AU BK BX, part number 1993830000

## Physical

Dimensions (not including connectors)	23.4 cm × 13.1 cm × 4.4 cm (9.21 in. × 5.14 in. × 1.73 in.)
Weight	1,170 g (41.27 oz.)

## Safety Voltages

Connect only voltages that are below these limits.

Positive terminal to negative terminal	30 VDC maximum, Measurement Category I
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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 NI-7931R to signals or use for measurements within Measurement Categories II, III, or IV.



**Note** Measurement Categories CAT I and CAT O (Other) are equivalent. The input circuits are not intended for direct connection to the MAINS building installations of Categories CAT II, CAT III, or CAT IV.



**Caution** You can impair the protection provided by the NI-7931R if you use it in a manner not described in this document.



# Maximum Working Voltage at the FlexRIO Adapter Module Connector

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**Note** Maximum working voltage refers to the signal voltage plus the common-mode voltage between the NI-7931R and the adapter module.

Channel-to-earth	0 V to 3.3 V, Measurement Category I
Channel-to-channel	0 V to 3.3 V, Measurement Category I



**Caution** Do not use this device for connecting to signals in Measurement Categories II, III, or IV.

## Environment

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Maximum altitude	2,000 m (800 mbar) (at 25 °C ambient temperature)
Pollution Degree	2

Indoor use only.

## Operating Environment

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Ambient temperature range	0 °C to 55 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 low temperature limit and MIL-PRF-28800F Class 2 high temperature limit.)
Relative humidity range	10% to 90%, noncondensing (Tested in accordance with IEC 60068-2-56.)

## Storage Environment

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Ambient temperature range	-40 °C to 71 °C (Tested in accordance with IEC 60068-2-1 and IEC 60068-2-2. Meets MIL-PRF-28800F Class 3 limits.)
Relative humidity range	5% to 95%, noncondensing (Tested in accordance with IEC 60068-2-56.)

# Shock and Vibration

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Operating shock	30 g peak, half-sine, 11 ms pulse (Tested in accordance with IEC 60068-2-27. Meets MIL-PRF-28800F Class 2 limits.)
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g <sub>rms</sub>
Nonoperating	5 Hz to 500 Hz, 2.4 g <sub>rms</sub> (Tested in accordance with IEC 60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.)

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# Compliance and Certifications

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## Safety

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



**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; Basic 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, certifications, and additional information, refer to the [Online Product Certification](#) section.

## CE Compliance

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)

## 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](https://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](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).

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375229A-01 Jul15