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Requirements and Compatibility | Ordering Information | Detailed Specifications | Pinouts/Front Panel Connections
For user manuals and dimensional drawings, visit the product page resources tab on ni.com.

Last Revised: 2014-11-06 07:14:36.0

NI R Series Multifunction RIO

Integrated Analog and Digital I/O with FPGA Technology





- Onboard FPGA chip, programmable with the LabVIEW FPGA Module
- User-defined triggering, timing, and decision making in hardware with 25 ns resolution
- Up to 8 analog inputs, independent sampling rates up to 750 kHz, 16-bit resolution
- Up to 8 analog outputs, independent update rates up to 1 MHz, 16-bit resolution
- Up to 160 digital lines configurable as inputs, outputs, counters, or custom logic at rates up to 40 MHz
- Direct memory access (DMA) channels for high-speed data streaming
- Implement custom control logic, inline signal processing, and digital communication protocols

Overview

National Instruments reconfigurable I/O (RIO) technology gives you the ability to define your own custom measurement hardware circuitry using reconfigurable field-programmable gate array (FPGA) chips and NI LabVIEW graphical development tools. NI R Series multifunction RIO devices offer the best combination of value and performance by integrating this FPGA technology with eight analog inputs, eight analog outputs, and 96 digital I/O lines, all into a single device that is offered on standard PC form factors such as PCI, PCI Express, and PXI/CompactPCI. Using the LabVIEW FPGA Module, you can create your own hardware personalities for custom data acquisition, high-speed control, digital communications protocols, sensor simulation, hardware-in-the-loop test, and onboard signal processing without in-depth knowledge of hardware description languages.

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Requirements and Compatibility

OS Information

- Windows 7
- Windows 7 32-bit
- Windows 7 64-bit
- Windows Server 2003 R2 32-bit
- Windows Server 2008 R2 64-bit
- Windows Vista 32-bit
- Windows Vista 64-bit
- Windows XP

Driver Information

- NI-RIO

Software Compatibility

- LabVIEW FPGA Module

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Comparison Tables

Product	Bus/Form Factor	FPGA	Analog Inputs (16-bit)	Max Sampling Rate per Channel (kS/s)	Analog Outputs (16-bit)	Max Update Rate per Channel (MS/s)	Digital I/O
Multifunction R Series							
NI 7851R	PCI Express, PCI	Virtex-5 LX30	8	750	8	1	96

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Product	Bus/Form Factor	FPGA	Analog Inputs (16-bit)	Max Sampling Rate per Channel (kS/s)	Analog Outputs (16-bit)	Max Update Rate per Channel (MS/s)	Digital I/O
NI 7852R	PCI Express, PXI	Virtex-5 LX50	8	750	8	1	96
NI 7853R	PXI	Virtex-5 LX85	8	750	8	1	96
NI 7854R	PXI	Virtex-5 LX110	8	750	8	1	96
NI 7855R	USB	Kintex-7 70T	8	1000	8	1	48
NI 7856R	USB	Kintex-7 160T	8	1000	8	1	48
NI 7841R	PCI Express, PXI	Virtex-5 LX30	8	200	8	1	96
NI 7842R	PCI Express, PXI	Virtex-5 LX50	8	200	8	1	96
NI 7845R	USB	Kintex-7 70T	8	500	8	1	48
NI 7846R	USB	Kintex-7 160T	8	500	8	1	48
Digital R Series							
NI 7811R	PCI, PXI	Virtex-II 1M Gates	-	-	-	-	160
NI 7813R	PCI, PXI	Virtex-II 3M Gates	-	-	-	-	160

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Application and Technology

Graphical Programming with LabVIEW FPGA

The LabVIEW FPGA Module uses LabVIEW embedded technology to extend LabVIEW graphical development and target FPGAs on NI RIO hardware. LabVIEW is distinctly suited for FPGA programming because it clearly represents parallelism and data flow. With LabVIEW FPGA, you can create custom measurement and control hardware without low-level hardware description languages or board-level design. You can use this custom hardware for unique timing and triggering routines, ultrahigh-speed control, interfacing to digital protocols, digital signal processing (DSP), and many other applications requiring high-speed hardware reliability and tight determinism.

Low-Cost Signal Conditioning and Channel Expansion

The NI 9151 R Series expansion chassis connects directly to any digital connector on R Series devices and houses up to four C Series I/O modules for industrial signal conditioning, I/O channel expansion, and direct sensor connectivity.

New Virtex-5 FPGAs

The new NI 784xR and NI 785xR devices use new Virtex-5 FPGAs with improved optimization capabilities that provide faster code execution and increased code capacity. These Virtex-5 FPGAs feature a new six-input lookup table (LUT) architecture for substantially improved resource utilization as well as DSP48 slices that make it possible for you to implement more complex digital signal processing at faster rates. Previous-generation Virtex-II FPGAs use four-input LUTs for up to 16 combinations of digital logic values. The new Virtex-5 FPGAs use six-input LUTs for up to 64 combinations, increasing the amount of logic that you can implement per slice. In addition, the slices themselves are placed in closer proximity to each other to reduce the propagation delay of electrons and increase overall execution rates. The single-cycle timed loop structure in LabVIEW FPGA takes full advantage of six-input LUTs for substantially improved resource utilization. This means you can optimize more LabVIEW FPGA code to fit within Virtex-5 FPGAs and perform more operations per clock cycle.

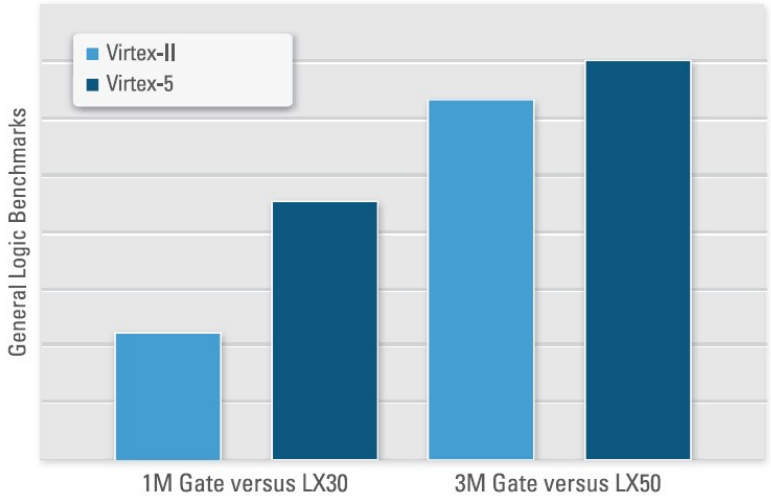


Figure 1. General logic benchmarks show that Virtex-5 FPGAs offer larger sizes when compared to Virtex-II FPGAs.

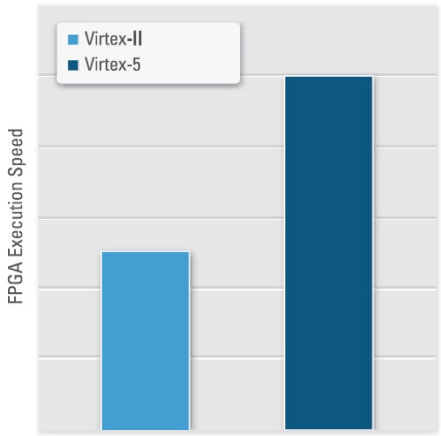


Figure 2. Execution speed benchmarks show that Virtex-5 FPGAs feature faster processing capabilities when compared to Virtex-II FPGAs.

For more information on LabVIEW FPGA benchmarks for Virtex-5 FPGAs, visit **ni.com/info** and enter **lvfpgabenchmarks**.

Required Software for R Series Multifunction RIO

- NI 781xR and 783xR devices require the LabVIEW FPGA Module 7.1 or later and NI-RIO 1.3 or later driver software.
- PXI-7841R/42R/51R/52R modules require the LabVIEW FPGA Module 8.5.1 or later and NI-RIO 2.4 or later.
- PXI-7853R/54R modules require the LabVIEW FPGA Module 8.6 or later and NI-RIO 3.0 or later.
- NI PCIe-7841R/42R/51R/52R boards require the LabVIEW FPGA Module 8.5.1 or later and NI-RIO 3.1 or later.

Recommended Accessories

High Performance

SHC68-68-RMIO - High-performance shielded 68-conductor cable terminated with a VHDCI 68-pin male connector at one end and a 68-pin female 0.050 D-type connector at the other end that has been specifically designed for the multifunction I/O connector on R Series multifunction RIO devices.
1 m 189588-01
2 m 189588-02

SHC68-68-RDIO - High-performance shielded 68-conductor cable terminated with a VHDCI 68-pin male connector at one end and a 68-pin female 0.050 D-type connector at the other end that has been specifically designed for the digital I/O connector on R Series multifunction RIO devices.
1 m 191667-01

SCB-68 - Shielded I/O connector block for rugged, very low-noise signal termination for connecting to 68-pin devices. The SCB-68 also includes two general-purpose breadboard areas.
Dimensions - 19.5 by 15.2 by 4.5 cm (7.7 by 6.0 by 1.8 in.)
SCB-68 776844-01

Low Cost

SH68-C68-S - General-purpose shielded cable that connects any type of R Series connector to 68-pin connector blocks.
0.5 m.....186381-0R5
1 m 186381-01
2 m 186381-02

Custom Cabling

SHC68-NT-S - Shielded 68-conductor cable terminated with a 68-pin male VHDCI connector at one end and unterminated bare wires at the other. Use this cable, ideal for OEM applications, to create custom cabling solutions for R Series devices.
2 m 189041-02

NSC68-262650 - Shielded cable terminated with a VHDCI 68-pin male connector at one end and two 26-pin ribbon connectors and one 50-pin ribbon connector on the other; designed to connect the R Series RMIO connector to standard ribbon cable accessories.
1 m 189151-01

NSC68-5050 - Shielded cable terminated with a VHDCI 68-pin male connector at one end and two 50-pin ribbon connectors on the other; designed to connect R Series RDIO connectors to standard ribbon cable accessories.
1 m 189152-01

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Ordering Information

For a complete list of accessories, visit the product page on ni.com.

Products	Part Number	Recommended Accessories	Part Number
		No accessories required.	

		No accessories required.	
NI 9503 Motion Module			
NI 9503	783285-01	No accessories required.	
NI PXI-7811R			
NI PXI-7811R Requires: 1 Cables , 1 Connector Blocks ;	778800-01	**Connector 0:**	
		Cables: Shielded - SHC68-68-RDIO Cable (1m) ***Also Available: [Unshielded]*	191667-01
		Connector Blocks: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 1:	
		Cables: Shielded - SHC68-68-RDIO Cable (1m) ***Also Available: [Unshielded]*	191667-01
		Connector Blocks: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 2:	
		Cables: - ***Also Available: [Unshielded]*	
		Connector Blocks: -	
		Connector 3:	
		Cables: - ***Also Available: [Unshielded]*	
		Connector Blocks: -	
NI PXI-7813R			
NI PXI-7813R Requires: 1 Cables , 1 Connector Blocks ;	779362-01	**Connector 0:**	
		Cables: Shielded - SHC68-68-RDIO Cable (1m) ***Also Available: [Unshielded]*	191667-01
		Connector Blocks: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 1:	
		Cables: Shielded - SHC68-68-RDIO Cable (1m) ***Also Available: [Unshielded]*	191667-01
		Connector Blocks: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 2:	
		Cables: - ***Also Available: [Unshielded]*	
		Connector Blocks: -	
		Connector 3:	
		Cables: - ***Also Available: [Unshielded]*	
		Connector Blocks: -	
NI PXI-7830R			
NI PXI-7830R Requires: 1 Cable , 1 Connector Block ;	779364-01	**Connector 0:**	
		Cable: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Block: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 1:	
		Cable: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Block: Spring-Screw_Terminals - SCB-68A	782536-01
NI PXI-7833R			
NI PXI-7833R Requires: 1 Cables , 1 Connector Blocks ;	779360-01	**Connector 0:**	
		Cables: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Blocks: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 1:	
		Cables: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Blocks: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 2:	

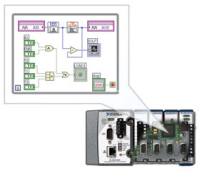
		Cables: - ***Also Available: [Unshielded]* **Connector Blocks:** -
NI PXI-7841R		
NI PXI-7841R Requires: 1 Cable , 1 Connector Block ;	780337-01	**Connector 0:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 1:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 2:** **Cable:** - ***Also Available: [Unshielded]* **Connector Block:** -
NI PXI-7842R		
NI PXI-7842R Requires: 1 Cable , 1 Connector Block ;	780338-01	**Connector 0:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 1:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 2:** **Cable:** - ***Also Available: [Unshielded]* **Connector Block:** -
NI PXI-7851R		
NI PXI-7851R Requires: 1 Cable , 1 Connector Block ;	780339-01	**Connector 0:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 1:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 2:** **Cable:** - ***Also Available: [Unshielded]* **Connector Block:** -
NI PXI-7852R		
NI PXI-7852R Requires: 1 Cable , 1 Connector Block ;	780340-01	**Connector 0:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 1:** **Cable:** Shielded - SHC68-68-RMIO Cable (2m) 189588-02 ***Also Available: [Unshielded]* **Connector Block:** Spring-Screw_Terminals - SCB-68A 782536-01 **Connector 2:** **Cable:** - ***Also Available: [Unshielded]* **Connector Block:** -
NI PXI-7853R		

NI PXI-7853R Requires: 1 Cables , 1 Connector Block ;	780341-01	**Connector 0:**	
		Cables: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Block: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 1:	
		Cables: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Block: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 2:	
		Cables: - ***Also Available: [Unshielded]*	
		Connector Block: -	
NI PXI-7854R			
NI PXI-7854R Requires: 1 Cables , 1 Connector Block ;	780342-01	**Connector 0:**	
		Cables: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Block: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 1:	
		Cables: Shielded - SHC68-68-RMIO Cable (2m) ***Also Available: [Unshielded]*	189588-02
		Connector Block: Spring-Screw_Terminals - SCB-68A	782536-01
		Connector 2:	
		Cables: - ***Also Available: [Unshielded]*	
		Connector Block: -	
NI cRIO-9067			
NI cRIO-9067 Requires: 1 Power Supply , 1 Mounting Accessories , 1 Cables ;	783170-01	**Power Supply:** Power_Supply - NI PS-15 Power Supply	781093-01
		Mounting Accessories: Mounting_Accessories - NI Panel Mount Kit	782863-01
		Cables: Ethernet_Cable - CAT-5E Ethernet Cable (2m)	151733-02

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Software Recommendations

NI LabVIEW FPGA Module



- Design FPGA applications for NI reconfigurable I/O (RIO) hardware targets
- Program with the same graphical environment used for desktop and real-time applications
- Execute control algorithms with loop rates up to 300 MHz
- Implement custom timing and triggering logic, digital protocols, and DSP algorithms
- Incorporate existing HDL code and third-party IP including Xilinx CORE Generator functions
- Included in the LabVIEW Embedded Control and Monitoring Suite

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Support and Services

System Assurance Programs

NI system assurance programs are designed to make it even easier for you to own an NI system. These programs include configuration and deployment services for your NI PXI, CompactRIO, or Compact FieldPoint system. The NI Basic System Assurance Program provides a simple integration test and ensures that your system is delivered completely assembled in one box. When you configure your system with the NI Standard System Assurance Program, you can select from available NI system driver sets and application development environments to create customized, reorderable software configurations. Your system arrives fully assembled and tested in one box with your software preinstalled. When you order your system with the standard program, you also receive system-specific documentation including a bill of materials, an integration test report, a recommended maintenance plan, and frequently asked question documents. Finally, the standard program reduces the total cost of owning an NI system by providing three years of warranty coverage and calibration service. Use the online product advisors at ni.com/advisor to find a system assurance program to meet your needs.

Calibration

NI measurement hardware is calibrated to ensure measurement accuracy and verify that the device meets its published specifications. To ensure the ongoing accuracy of your measurement hardware, NI offers basic or detailed recalibration service that provides ongoing ISO 9001 audit compliance and confidence in your measurements. To learn more about NI calibration services or to locate a qualified service center near you, contact your local sales office or visit ni.com/calibration.

Technical Support

Get answers to your technical questions using the following National Instruments resources.

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- **Discussion Forums** - Visit forums.ni.com for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit community.ni.com to find, contribute, or collaborate on customer-contributed technical content with users like you.

Repair

While you may never need your hardware repaired, NI understands that unexpected events may lead to necessary repairs. NI offers repair services performed by highly trained technicians who quickly return your device with the guarantee that it will perform to factory specifications. For more information, visit ni.com/repair.

Training and Certifications

The NI training and certification program delivers the fastest, most certain route to increased proficiency and productivity using NI software and hardware. Training builds the skills to more efficiently develop robust, maintainable applications, while certification validates your knowledge and ability.

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NI offers design-in consulting and product integration assistance if you need NI products for OEM applications. For information about special pricing and services for OEM customers, visit ni.com/oem.

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Our Professional Services Team is comprised of NI applications engineers, NI Consulting Services, and a worldwide National Instruments Alliance Partner program of more than 700 independent consultants and integrators. Services range from start-up assistance to turnkey system integration. Visit ni.com/alliance.

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Detailed Specifications

This document lists the specifications of the NI 781*x*R/783*x*R/784*x*R/785*x*R. These specifications are typical at 25 °C unless otherwise noted.

Analog Input (NI 783*x* R/784*x* R/785*x* R Only)	
Input Characteristics	
Number of channels	
NI 7830R	4
NI 7831R/7833R/7841R/7842R/7851R/7852R/7853R/7854R	8
Input modes	DIFF, RSE, NRSE (software-selectable; selection applies to all channels)
Type of ADC	Successive approximation
Resolution	16 bits, 1 in 65,536
Conversion time	
NI 783xR/NI 784xR	4 µs
NI 785xR	1 µs
Maximum sampling rate	
NI 783xR/784xR	200 kS/s (per channel)
NI 785xR	750 kS/s (per channel)
Input impedance	

Powered on	10 GΩ in parallel with 100 pF
Powered off/overload	4.0 kΩ min
Input signal range	±10 V
Input bias current	
NI 783xR	±2 nA
NI 784xR/785xR	±5 nA
Input offset current	
NI 783xR	±1 nA
NI 784xR/785xR	±5 nA
Input coupling	DC
Maximum working voltage (signal + common mode)	Inputs should remain within ±12 V of ground
Overvoltage protection	
Powered on	±42 V
Powered off	±35 V

Accuracy Information

NI 783*x*R										
Nominal Range (V)		Absolute Accuracy							Relative Accuracy	
		% of Reading		Offset (*µ*V)	Noise + Quantization (*µ*V)		Temp Drift (%/°C)	Absolute Accuracy at Full Scale (±mV)	Resolution (*µ*V)	
Positive Full Scale	Negative Full Scale	24 Hours	1 Year		Single Point	Averaged			Single Point	Averaged
10.0	–10.0	0.0496	0.0507	2,542	1,779	165	0.0005	7.78	2,170	217

Note Accuracies are valid for measurements following an internal calibration. Averaged numbers assume dithering and averaging of 100 single-channel readings. Measurement accuracies are listed for operational temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory-calibration temperature.

NI 784*x*R/NI 785*x*R										
Nominal Range (V)		Absolute Accuracy							Relative Accuracy	
		% of Reading		Offset (*µ*V)	Noise + Quantization (*µ*V)		Temp Drift (%/°C)	Absolute Accuracy at Full Scale (±mV)	Resolution (*µ*V)	
Positive Full Scale	Negative Full Scale	24 Hours	1 Year		Single Point	Averaged			Single Point	Averaged
10.0	–10.0	0.0186	0.0228	1,591	1,029	91.6	0.0005	3.97	1,205	121

Note Accuracies are valid for measurements following an internal calibration. Averaged numbers assume dithering and averaging of 100 single-channel readings. Measurement accuracies are listed for operational temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory-calibration temperature.

DC Transfer Characteristics

INL	
NI 783xR	±3 LSB typ, ±6 LSB max
NI 784xR/785xR	±1 LSB typ, ±3 LSB max
DNL	
NI 783xR	±1.0 to ±2.0 LSB max
NI 784xR/785xR	±0.4 LSB typ, ±0.9 LSB max
No missing codes	
NI 783xR	16 bits typ, 15 bits min
NI 784xR/785xR	16 bits guaranteed
CMRR, DC to 60 Hz	–86 dB

Dynamic Characteristics

Bandwidth	
NI 783xR	
Small signal (– 3 dB)	650 kHz
Large signal (1% of THD)	55 kHz
NI 784xR/NI 785xR	
Small signal (– 3 dB)	1 MHz
Large signal (1% of THD)	500 kHz
Settling Time	

Device	Step Size	Accuracy		
		±16 LSB	±4 LSB	±2 LSB
NI 783xR	±20.0 V	7.5 µs	10.3 µs	40 µs
	±2.0 V	2.7 µs	4.1 µs	5.1 µs
	±0.2 V	1.7 µs	2.9 µs	3.6 µs
NI 784xR/ 785xR	±20.0 V	2.1 µs	4.2 µs	8 µs
	±2.0 V	1.3 µs	1.6 µs	1.8 µs
	±0.2 V	0.8 µs	1.1 µs	1.2 µs

Crosstalk	–80 dB, DC to 100 kHz

Analog Output (NI 783*x* R/784*x* R/785*x* R Only)

Output Characteristics	
Output type	Single-ended, voltage output
Number of channels	
NI 7830R	4
NI 7831R/7833R/7841R/7842R/7851R/7852R/7853R/7854R	8
Resolution	16 bits, 1 in 65,536
Update time	1.0 µs
Maximum update rate	1 MS/s
Type of DAC	Enhanced R-2R
Accuracy Information	

Nominal Range (V)		Absolute Accuracy				Absolute Accuracy at Full Scale (±mV)
		% of Reading		Offset (µV)	Temp Drift (%/ °C)	
Positive Full Scale	Negative Full Scale	24 Hours	1 Year			
10.0	–10.0	0.0335	0.0351	2366	0.0005	5.88

Note Accuracies are valid for analog output following an internal calibration. Analog output accuracies are listed for operation temperatures within ±1 °C of internal calibration temperature and ±10 °C of external or factory calibration temperature. Temp Drift applies only if ambient is greater than ±10 °C of previous external calibration.

DC Transfer Characteristics	
INL	±0.5 LSB typ, ±4.0 LSB max
DNL	±0.5 LSB typ, ±1 LSB max
Monotonicity	16 bits, guaranteed
Voltage Output	
Range	±10 V
Output coupling	DC
Output impedance	

NI 783xR	1.25 Ω
NI 784xR/785xR	0.5 Ω
Current drive	±2.5 mA
Protection	Short-circuit to ground
Power-on state	User configurable
Dynamic Characteristics	

Settling time			
Step Size	Accuracy		
	±16 LSB	±4 LSB	±2 LSB
±20.0 V	6.0 µs	6.2 µs	7.2 µs
±2.0 V	2.2 µs	2.9 µs	3.8 µs
±0.2 V	1.5 µs	2.6 µs	3.6 µs

Slew rate	10 V/µs
Noise	150 μV_{rms}, DC to 1 MHz
Glitch energy at midscale transition	±200 mV for 3 µs

Digital I/O

Number of channels	
NI 781xR	160
NI 7830R	56
NI 7831R/7833R/7841R/7842R/7851R/7852R/7853R/7854R	96
Compatibility	TTL

Digital logic levels		
Level	Min	Max
Input low voltage (V_{IL})	0.0 V	0.8 V
Input high voltage (V_{IH})	2.0 V	5.5 V
Output low voltage (V_{OL}), where I_{OUT} = –4 mA	0 V	0.4 V
Output high voltage (V_{OH}), where I_{OUT} = 4 mA	2.4 V	3.3 V

Output current	
Source	4.0 mA
Sink	4.0 mA
Input leakage current	±10 µA
Power-on state	Programmable, by line
Protection	
Input	
NI 781xR/783xR	–0.5 to 7.0 V, single line
NI 784xR/785xR	–20.0 to 20.0 V, single line
Output	Short-circuit (up to eight lines may be shorted at a time)
Minimum pulse width	
Input	25 ns
Output	12.5 ns
Minimum sampling period	5 ns

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Reconfigurable FPGA	
NI 7811R/7830R/7831R	
FPGA type	Virtex-II V1000
Number of flip-flops	10,240
Number of 4-input LUTs	10,240
Number of 18 × 18 multipliers	40
Embedded block RAM	720 kbits
NI 7813R/7833R	
FPGA type	Virtex-II V3000
Number of flip-flops	28,672
Number of 4-input LUTs	28,672
Number of 18 × 18 multipliers	96
Embedded block RAM	1,728 kbits
NI 7841R/7851R	
FPGA type	Virtex-5 LX30
Number of flip-flops	19,200
Number of 6-input LUTs	19,200
Number of DSP48 slices (25 × 18 multipliers)	32
Embedded block RAM	1,152 kbits
NI 7842R/7852R	
FPGA type	Virtex-5 LX50
Number of flip-flops	28,800
Number of 6-input LUTs	28,800
Number of DSP48 slices (25 × 18 multipliers)	48
Embedded block RAM	1,728 kbits
NI 7853R	
FPGA type	Virtex-5 LX85
Number of flip-flops	51,840
Number of 6-input LUTs	51,840
Number of DSP48 slices (25 × 18 multipliers)	48
Embedded block RAM	3,456 kbits
NI 7854R	
FPGA type	Virtex-5 LX110
Number of flip-flops	69,120
Number of 6-input LUTs	69,120
Number of DSP48 slices (25 × 18 multipliers)	64
Embedded block RAM	4,608 kbits
Timebase	40, 80, 120, 160, or 200 MHz
Timebase reference sources	
NI PCI-781xR/783xR	Onboard clock only
NI PCIe-784xR/785xR	Onboard clock only
NI PXI-78xxR	Onboard clock, phase-locked to PXI 10 MHz clock
Timebase accuracy, onboard clock	±100 ppm, 250 ps peak-to-peak jitter
Phase locked to PXI 10 MHz Clock (NI PXI-78xxR only)	Adds 350 ps peak-to-peak jitter
Additional frequency-dependent peak-to-peak jitter	
NI 781xR/783xR	

40 MHz	None
80 MHz	400 ps
120 MHz	720 ps
160 MHz	710 ps
200 MHz	700 ps
NI 784*x*R/785*x*R	
40 MHz	None
80 MHz	460 ps
120 MHz	172 ps
160 MHz	172 ps
200 MHz	152 ps

Calibration (NI 783*x* R/784*x* R/785*x* R Only)

Recommended warm-up time	15 minutes
Calibration interval	1 year
Onboard calibration reference	
DC level	5.000 V (±3.5 mV) (actual value stored in Flash memory)
Temperature coefficient	±5 ppm/°C max
Long-term stability	±20 ppm/$\sqrt{1{,}000\ \text{h}}$

Note Refer to *Calibration Certificates* at ni.com/calibration to generate a calibration certificate for the NI 78*xx*R.

Bus Interface

PCI/PCIe/PXI	Master, slave
Data transfers	DMA, interrupts, programmed I/O
Number of DMA channels	3

Power Requirement

+5 VDC (±5%) [1]	
NI 781xR	9 mA typ
NI 7830R/7831R	330 mA typ
NI 7833R	364 mA typ
NI PXI-7841R/7851R	125 mA typ
NI PXI-7842R/7852R	136 mA typ
NI 7853R	460 mA typ
NI 7854R	484 mA typ
+3.3 VDC (±5%) [2]	
NI 7811R	650 mA typ
NI 7813R	850 mA typ
NI 7830R/7831R	462 mA typ
NI 7833R	727 mA typ
NI PCIe-7841R/7851R	847 mA typ
NI PCIe-7842R/7852R	984 mA typ
NI PXI-7841R/7851R	525 mA typ
NI PXI-7842R/7852R	604 mA typ
NI 7853R	640 mA typ
NI 7854R	843 mA typ
+12 V	
NI 784xR/785xR	0.5 A

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–12 V	
NI PXI-784xR/785xR	0.25 A
+5V terminal	
Connector 0	0.5 A max [3]
Connector 1	0.5 A max3 [3]
Connector 2	0.5 A max3 [3]
All connectors	1.5 A max3 [3], [4]

To calculate the total current sourced by the digital outputs, use the following equation:

$$\sum_{i=1}^{j}$$ current sourced on channel i

Power available at I/O connectors	4.50 to 5.25 VDC at 1 A total, 250 mA per I/O connector pin

Physical

Dimensions (not including connectors)	
NI PCI-781xR/783xR	17 cm by 11 cm (6.7 in. by 4.3 in.)
NI PCIe-784xR/785xR	17 cm by 11 cm (6.7 in. by 4.3 in.)
NI PXI-78xxR	16 cm by 10 cm (6.3 in. by 3.9 in.)
Weight	
NI PCI-781xR/783xR	112 g
NI PCIe-784xR/785xR	127 g
NI PXI-78xxR	152 g
I/O connectors	
NI 781xR	Four 68-pin female high-density VHDCI type
NI 7830R	Two 68-pin female high-density VHDCI type
NI 783xR/784xR/785xR	Three 68-pin female high-density VHDCI type
Disk drive power connector (PCIe devices)	Standard ATX peripheral connector (not serial ATA)

Maximum Working Voltage (NI 783*x*R/784*x*R/785*x*R Only)

Maximum working voltage refers to the signal voltage plus the common-mode voltage.

Channel-to-earth	±12 V, Measurement Category I
Channel-to-channel	±24 V, Measurement Category I

Caution Do *not* use the NI 783*x*R/784*x*R/785*x*R for connection to signals in Measurement Categories II, III, or IV.

Environmental

The NI 78*xx*R is intended for indoor use only.

Operating Environment	
NI 781xR	0 °C to 55 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
NI 7830R, NI 7831R	
40 MHz or 80 MHz timebase	0 °C to 55 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
NI PCI/PXI-7833R	
40 MHz timebase	0 °C to 55 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
80 MHz timebase	0 °C to 55 °C except the following: 0 °C to 45 °C when installed in an NI PXI-1000/B or NI PXI-101X, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
NI PXI-7841R/7842R/7851R/7852R/7853R/7854R	
40 MHz timebase	0 °C to 55 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
80 MHz timebase	0 °C to 55 °C except the following: 0 °C to 45 °C when installed in an NI PXI-1000/B or NI PXI-101X, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
NI PCIe-7841R/7842R/7851R/7852R	
40 MHz or 80 MHz timebase	0 °C to 40 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.

Relative humidity range	10% to 90%, noncondensing, tested in accordance with IEC-60068-2-56.
Altitude	2,000 m at 25 °C ambient temperature
Storage Environment	
NI PCI/PXI-781xR/783xR	–20 °C to 70 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
NI PCIe-784xR/785xR	–20 °C to 70 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
NI PXI-784xR/785xR	–40 °C to 70 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
Ambient temperature range	–20 °C to 70 °C, tested in accordance with IEC-60068-2-1 and IEC-60068-2-2.
Relative humidity range	5% to 95%, noncondensing, tested in accordance with IEC-60068-2-56.

Note Clean the device with a soft, non-metallic brush. Make sure that the device is completely dry and free from contaminants before returning it to service.

Shock and Vibration (for NI PXI-78*xx*R Only)	
Operational shock	30 g peak, half-sine, 11 ms pulse; tested in accordance with IEC-60068-2-27. Test profile developed in accordance with MIL-PRF-28800F.
Random vibration	
Operating	5 Hz to 500 Hz, 0.3 g_{rms}
Nonoperating	5 Hz to 500 Hz, 2.4 g_{rms}, tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3.

Safety

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.

Electromagnetic Compatibility

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

- EN 61326 (IEC 61326): 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 For the standards applied to assess the EMC of this product, refer to the Electromagnetic Compatibility section.

Note For EMC compliance, operate this device with shielded cabling.

CE Compliance

This product meets the essential requirements of applicable European Directives, as amended for CE marking, as follows:

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

Note For the standards applied to assess the EMC of this product, refer to the *Online Product Certification* section.

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 module number or product line, and click the appropriate link in the Certification column.

Environmental Management

National Instruments is committed to designing and manufacturing products in an environmentally responsible manner. NI recognizes that eliminating certain hazardous substances from our products is beneficial not only to the environment but also to NI customers.

For additional environmental information, refer to the *NI and the Environment* 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 their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit ni.com/environment/weee.htm.

[1] Does not include current drawn from the +5 V line on the I/O connectors.

[2] Does not include current sourced by the digital outputs.

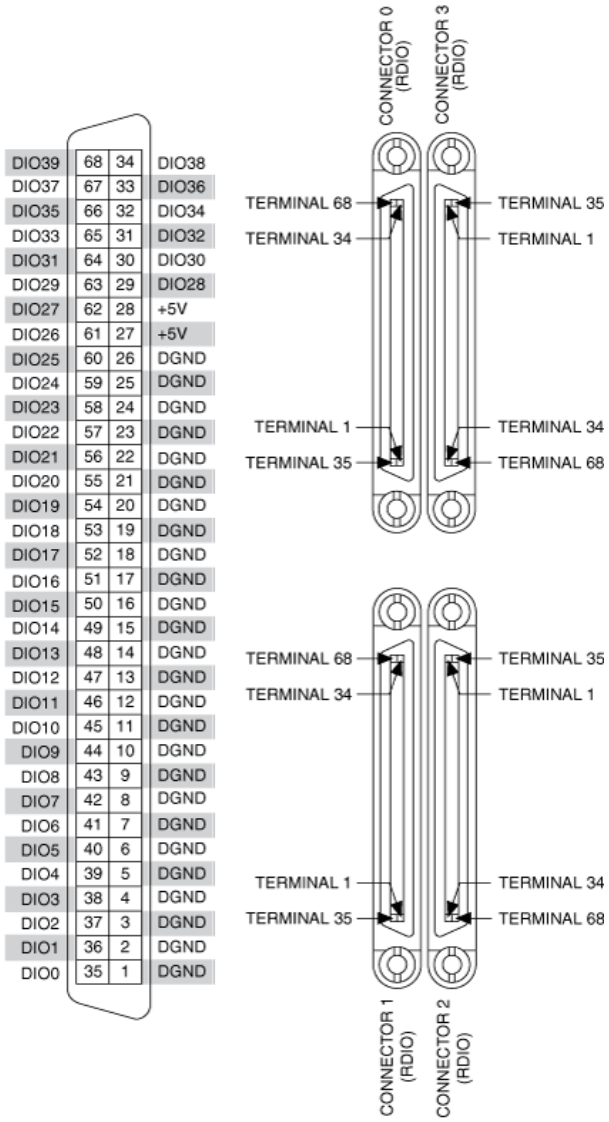
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[3] **(NI PCIe-78*xx*R only)** Total maximum terminal current for all connectors is 100 mA unless disk drive connector is attached.

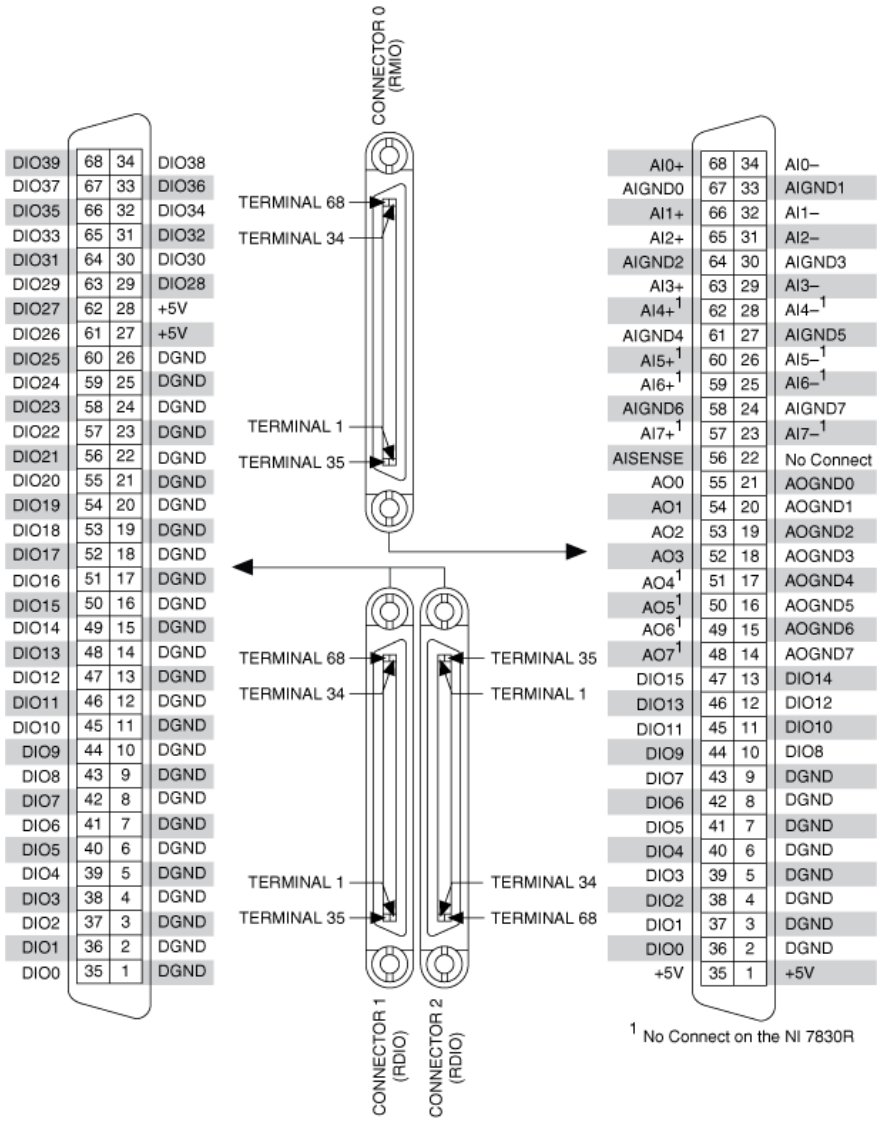
[4] **(NI 784*x*R/785*x*R only)** The NI 784*x*R/785*x*R has a user-replaceable socketed fuse that opens when current exceeds the current specification. Refer to the *NI R Series Multifunction RIO User Manual*, available at ni.com/manuals, for information about fuse replacement.

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Pinouts/Front Panel Connections



NI 781xR Connector Pin Assignments and Locations



NI 783xR/784xR/785xR Connector Pin Assignments and Locations

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