

# Getting Started with the NI 783xR

This document explains how to install and configure the National Instruments 783xR.

## Introduction

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The NI 783xR devices are R Series Reconfigurable I/O (RIO) devices with 16-bit analog input (AI) channels, 16-bit analog output (AO) channels, and digital I/O (DIO) lines.

- The NI PXI-7830R and NI PCI-7830R have four independent AI channels, four independent AO channels, and 56 DIO lines.
- The NI PXI-7831R/7833R and NI PCI-7831R/7833R have eight independent AI channels, eight independent AO channels, and 96 DIO lines.

Traditional I/O devices have a fixed functionality provided by an application-specific integrated circuit (ASIC), but the NI 783xR has a field-programmable gate array (FPGA) that allows you to define device functionality and timing.

You can use the LabVIEW FPGA Module to graphically design the NI 783xR timing and functionality without having to learn a low-level programming language or a hardware description language (HDL) traditionally used for FPGA design. With the LabVIEW FPGA Module, you create or download a custom virtual instrument (VI) to the FPGA. You can reconfigure the NI 783xR with a new VI at any time.

You can use the LabVIEW Real-Time Module to communicate with and control the NI 783xR while performing additional tasks, such as real-time floating-point processing and data logging.



**Note** If you are using LabVIEW but not the LabVIEW FPGA Module, you can create VIs that run in LabVIEW to control existing FPGA VIs, but you cannot create new FPGA VIs.

The NI 783xR has Flash memory that you can use to store a startup VI. You can configure the VI to load to the FPGA and to run when the device powers up.

# Required Components

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This section lists the items necessary for using the NI 783xR with Windows 2000/XP and the LabVIEW Real-Time Module.

## Documentation

The *NI 783xR User Manual* describes the electrical and mechanical aspects of the NI 783xR and contains information about device operation and programming. This document is included on the NI-RIO CD and is also available at [ni.com/manuals](http://ni.com/manuals).

*LabVIEW Help* is available in LabVIEW by selecting **Help»VI, Function, & How-To Help**.

## Hardware and Software

### PXI-783xR with Windows 2000/XP

The following items are necessary to set up and use the PXI-783xR on a computer running Windows 2000/XP:

- NI PXI-783xR.
- The following software packages:
  - LabVIEW 7.1 or later.
  - LabVIEW FPGA Module 1.1 or later—required to develop custom FPGA VIs.
  - NI-RIO 1.3 or later—included with the PXI-783xR.



**Note** The PXI-7831R supports LabVIEW 7.0 or later, LabVIEW FPGA Module 1.0 or later, and NI-RIO 1.0 or later.

- PXI/CompactPCI chassis and PXI/CompactPCI embedded controller running Windows 2000/XP, or a computer running Windows 2000/XP and a MXI-3 link to a PXI/CompactPCI chassis.
- At least one cable and device for connecting signals to the PXI-783xR.

## PXI-783xR with the LabVIEW Real-Time Module (ETS)

The following items are necessary to set up and use the PXI-783xR with the LabVIEW Real-Time Module for ETS:

- NI PXI-783xR.
- The following software packages:
  - LabVIEW 7.1 or later.
  - LabVIEW FPGA Module 1.1 or later—required to develop custom FPGA VIs.
  - LabVIEW Real-Time Module 7.1 or later.
  - NI-RIO 1.3 or later—included with the PXI-783xR.
  - Ardence (formerly Venturcom) Phar Lap Embedded Tool Suite (ETS).



**Note** The PXI-7831R supports LabVIEW 7.0 or later, LabVIEW FPGA Module 1.0 or later, and NI-RIO 1.0 or later.

- Host computer running Windows 2000/XP for developing your application.
- PXI/CompactPCI chassis and real-time embedded controller running the Phar Lap ETS real-time operating system.
- CAT 5 Ethernet crossover cable if the real-time PXI system is not configured on a network. To connect the PXI system to a network port, use a standard CAT 5 10/100Base-T Ethernet cable.
- At least one cable and device for connecting signals to the PXI-783xR.

## PXI-783xR with the LabVIEW Real-Time Module (RTX)

The following items are necessary to set up and use the PXI-783xR with the LabVIEW Real-Time Module for RTX:

- NI PXI-783xR.
- The following software packages:
  - LabVIEW 7.1 or later.
  - LabVIEW FPGA Module 1.1 or later—required to develop custom FPGA VIs.

- LabVIEW Real-Time Module 7.1 or later.
- NI-RIO 1.3 or later—including with the PXI-783xR.
- Ardence (formerly Venturcom) RTX 5.5 or later.



**Note** The PXI-7831R supports NI-RIO 1.1 or later.

- PXI/CompactPCI chassis and real-time embedded controller running Windows 2000/XP and RTX.
- CAT 5 Ethernet crossover cable if the real-time PXI system is not configured on a network. To connect the PXI system to a network port, use a standard CAT 5 10/100Base-T Ethernet cable.
- At least one cable and device for connecting signals to the PXI-783xR.

## PCI-783xR with Windows 2000/XP

The following items are necessary to set up and use the PCI-783xR on a computer running Windows 2000/XP:

- PCI-783xR.
- The following software packages:
  - LabVIEW 7.1 or later.
  - LabVIEW FPGA Module 1.1 or later—required to develop custom FPGA VIs.
  - NI-RIO 1.3 or later—including with the PCI-783xR.



**Note** The PCI-7831R supports NI-RIO 1.1 or later.

- Development computer running Windows 2000/XP.
- At least one cable and device for connecting signals to the PCI-783xR.

## PCI-783xR with the LabVIEW Real-Time Module (ETS)

The following items are necessary to set up and use the PCI-783xR with the LabVIEW Real-Time Module for ETS:

- PCI-783xR.
- The following software packages:
  - LabVIEW 7.1 or later.
  - LabVIEW FPGA Module 1.1 or later—required to develop custom FPGA VIs.
  - LabVIEW Real-Time Module for ETS 7.1 or later.
  - NI-RIO 1.3 or later—included with the PCI-783xR.
  - Ardence (formerly Venturcom) Phar Lap Embedded Tool Suite (ETS).



**Note** The PCI-7831R supports NI-RIO 1.1 or later.

- Host computer running Windows 2000/XP for developing your application.
- Target computer running the Phar Lap ETS real-time operating system.
- At least one cable and device for connecting signals to the PCI-783xR.

## PCI-783xR with the LabVIEW Real-Time Module (RTX)

The following items are necessary to set up and use the PCI-783xR with the LabVIEW Real-Time Module for RTX:

- PCI-783xR.
- The following software packages:
  - LabVIEW 7.1 or later.
  - LabVIEW FPGA Module 1.1 or later—required to develop custom FPGA VIs.
  - LabVIEW Real-Time Module for RTX 7.1 or later.
  - NI-RIO 1.3 or later—included with the PCI-783xR.
  - Ardence (formerly Venturcom) RTX 5.5 or later.



**Note** The PCI-7831R supports NI-RIO 1.1 or later.

- Computer running Windows 2000/XP and RTX.



**Note** RTX 5.5 does not support Hyper-Threading enabled processors. Refer to the RTX documentation for information about disabling multiprocessor access.

- At least one cable and device for connecting signals to the PCI-783xR.

## Installing Software

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Complete the following sets of steps in the order listed to successfully install LabVIEW, the LabVIEW Real-Time Module, the LabVIEW FPGA Module, and the NI-RIO device drivers.

If you are using NI-RIO without LabVIEW, skip these steps and proceed to the [NI-RIO Device Drivers Installation](#) section.

### LabVIEW Installation

Complete the following steps to install LabVIEW. Refer to the *LabVIEW Release Notes* for additional information about installing LabVIEW.

1. Insert the LabVIEW CD into the CD-ROM drive to display the LabVIEW installation screen.
2. Click **Install LabVIEW**.
3. Follow the installer prompts through the rest of the installation.

### LabVIEW Real-Time Module Installation

Complete the following steps to install the LabVIEW Real-Time Module. Refer to the *LabVIEW Real-Time Module Release Notes* for additional information about installing the LabVIEW Real-Time Module.



**Note** If you are using the NI 783xR with Windows 2000/XP only, it is not necessary to install the LabVIEW Real-Time Module.

1. Insert the LabVIEW Real-Time Module CD into the CD-ROM drive to display the LabVIEW Real-Time Module installation screen.
2. Click **Install LabVIEW Real-Time Module**.
3. Follow the installer prompts through the rest of the installation.

## LabVIEW FPGA Module Installation

Complete the following steps to install the LabVIEW FPGA Module. Refer to the *LabVIEW FPGA Module Release Notes* for additional information about installing the LabVIEW FPGA Module.

1. Insert the LabVIEW FPGA Module CD into the CD-ROM drive to display the LabVIEW FPGA Module installation screen.
2. Click **Install LabVIEW FPGA Module**.
3. Follow the installer prompts through the rest of the installation.

## NI-RIO Device Drivers Installation

Complete the following steps to install the NI-RIO device drivers that are included with the NI 783xR device.



**Note** You must install LabVIEW and the LabVIEW modules you will use *before* you install the NI-RIO device drivers.

1. Run `setup.exe` from the NI-RIO CD and follow the setup instructions.
2. Follow the on-screen instructions until the Feature Tree window appears.
3. In the Feature Tree window, select the components to install. You must install NI-VISA, NI-RIO, and NI Measurement & Automation Explorer (MAX).
4. Follow the on-screen instructions to complete the driver installation.
5. Restart the computer.

# Installing Hardware

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This section describes how to unpack and install the PXI-783xR and PCI-783xR devices.



**Note** You must install the NI-RIO device drivers before installing the NI 783xR.

## Unpacking

The NI 783xR is shipped in an antistatic package to prevent electrostatic discharge from damaging device components. To prevent such damage when handling the device, take the following precautions:

- Ground yourself using a grounding strap or by holding a grounded object, such as your computer chassis.
- Touch the antistatic package to a metal part of the computer chassis before removing the device from the package.



**Caution** *Never* touch the exposed pins of connectors.

Remove the device from the package and inspect the devices for loose components or any other sign of damage. Notify NI if the device appears damaged in any way. Do *not* install a damaged device into the computer.

Store the NI 783xR in the antistatic envelope when not in use.

## PXI-783xR Installation

You can install the PXI-783xR in any available peripheral slot in the PXI or CompactPCI chassis. Complete the following instructions to install the PXI-783xR:



**Note** You must install the software before installing the hardware. For software installation instructions, refer to the [Installing Software](#) section.

1. Power off and unplug the PXI or CompactPCI chassis.
2. Make sure there are no lit LEDs on the chassis. Wait for any lit LEDs to go out before continuing the installation.
3. Remove the filler panel for the peripheral slot.
4. Ground yourself using a grounding strap or by touching a grounded object, such as the PXI or CompactPCI chassis.
5. Insert the PXI-783xR into the slot. Use the injector/ejector handle to fully inject the PXI-783xR into place.

6. Screw the front panel of the PXI-783xR to the front panel mounting rails of the chassis.
7. Visually verify the installation. Make sure the PXI-783xR is not touching other devices or components and that the PXI-783xR is fully inserted into the slot.
8. Plug in and power on the PXI or CompactPCI chassis.

## PCI-783xR Installation

You can install the PCI-783xR in any available PCI expansion slot in the computer. To achieve the best noise performance, leave as much room as possible between the PCI-783xR and other boards.

Complete the following instructions to install the PCI-783xR:



**Note** You must install the software before installing the hardware. For software installation instructions, refer to the *Installing Software* section.

1. Power off and unplug the computer.



**Caution** To protect both yourself and the computer from electrical hazards, the computer must remain off and unplugged until the PCI-783xR is completely installed.

2. Remove the computer cover. Make sure there are no lit LEDs on the motherboard. Wait for any lit LEDs to go out before continuing the installation.
3. Touch the metal part of the power supply case inside the computer to discharge any static electricity that might be on your clothes or body.
4. Locate the metal bracket that covers the cut-out in the back panel of the chassis for the slot you have selected. Remove and save the bracket-retaining screw and the bracket cover.
5. Align the PCI-783xR card-edge connector with the expansion slot receptacle. Using slow, evenly distributed pressure, press the PCI-783xR straight down until it seats in the expansion slot.
6. Reinstall the bracket-retaining screw to secure the PCI-783xR to the back panel rail.
7. Visually verify the installation.
8. Replace the computer cover, and plug the computer in.

# Using the NI 783xR with the LabVIEW Real-Time Module for RTX

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You can use the LabVIEW Real-Time Module for RTX with the NI 783xR. After you have installed RTX, the LabVIEW Real-Time Module for RTX, and RTX support from the NI-RIO Driver CD, complete the following steps:



**Note** The NI-RIO device drivers and NI 783xR must be installed before adding RTX support for the R Series device.

1. If necessary, close all NI software.
2. Select **Start»Program Files»Ardenne RTX»RTX»RTX Properties**.
3. On the **Plug and Play** tab, right-click the name of your device and select **Add RTX INF Support**.
4. Click the **Apply** button. RTX Properties returns a Warning dialog box. Click **OK**.
5. In the RTX Properties window, click **OK**.
6. Right-click **My Computer** and select **Properties**.
7. Select the **Hardware** tab and click **Device Manager**.
8. For Windows XP, expand NI-RIO Devices, right-click the name of your device and select **Update Driver**. In the Hardware Update Wizard window, select **Install the software automatically** and click **Next**. When the wizard finishes installing the software, click **Finish**.  
For Windows 2000, expand NI-RIO Devices, right-click the name of your device, and select **Properties**. On the **Driver** tab, click **Update Driver**. In the **Upgrade Device Driver Wizard** window, click **Next**. Select **Search for a suitable driver for my device** and click **Next** three times. When Windows finishes installing the software, click **Finish**.
9. In the Device Manager window, select **View»Resources by connection**.
10. In the Device Manager window, expand **Interrupt Request (IRQ)**. Make sure that the NI 783xR is not sharing an IRQ with any other devices. Refer to the *RTX Runtime Help* for information about modifying a device.
11. Reboot your computer.
12. Select **Start»Run**. In the Run window, enter `net start nirtrtx` and click **OK**.

The NI 783xR now supports RTX. When you launch LabVIEW, the NI 783xR appears in the **LabVIEW Execution Target** menu as **FPGA Device [device name] visa://localhost::RTRTX::0/RIO0::INSTR.**

## Removing RTX Support

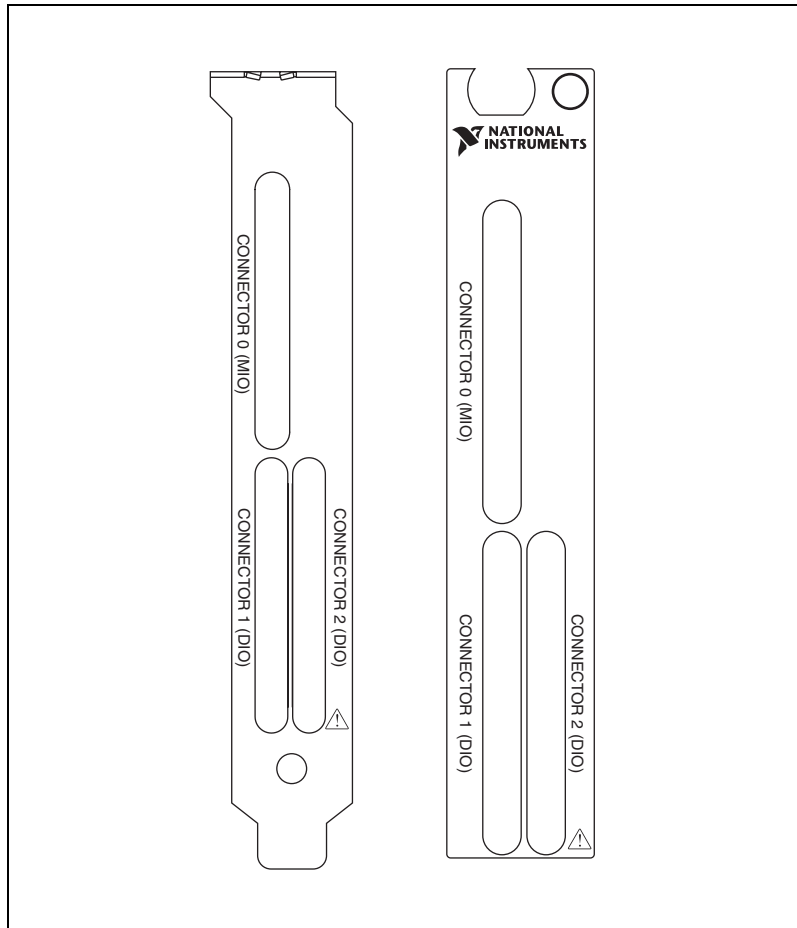
Complete the following steps to remove RTX support from the NI 7831R.

1. Close all NI software.
2. Select **Start»Program Files»Ardence RTX»RTX»RTX Properties.**
3. On the **Plug and Play** tab, right-click the name of your device and select **Remove RTX INF Support.**
4. Click **Apply.** RTX Properties returns a Warning dialog box. Click **OK.**
5. In the RTX Properties window, click **OK.**
6. Right-click **My Computer** and select **Properties.**
7. Select the **Hardware** tab and click **Device Manager.**
8. For Windows XP, expand **RTX Drivers,** right-click [*device name*] **RTX Supported** and select **Update Driver.**

You have removed RTX support for the NI 783xR.

# Connecting Signals

Figure 1 shows the I/O connector locations for the NI PXI-783xR and the NI PCI-783xR. The NI PXI-7830R and NI PCI-7830R do not have Connector 2 (DIO).



**Figure 1.** NI 783xR Connector Locations

Figure 2 shows the I/O connector pin assignments for the I/O connectors on the NI 783xR. The DIO connector pin assignment applies to connector 1 on the NI 7830R and connectors <1..2> on the NI 7831R/7833R.

DIO39	68	34	DIO38	AI0+	68	34	AI0-	AI0+	68	34	AI0-
DIO37	67	33	DIO36	AIGND0	67	33	AIGND1	AIGND0	67	33	AIGND1
DIO35	66	32	DIO34	AI1+	66	32	AI1-	AI1+	66	32	AI1-
DIO33	65	31	DIO32	AI2+	65	31	AI2-	AI2+	65	31	AI2-
DIO31	64	30	DIO30	AIGND2	64	30	AIGND3	AIGND2	64	30	AIGND3
DIO29	63	29	DIO28	AI3+	63	29	AI3-	AI3+	63	29	AI3-
DIO27	62	28	+5V	No Connect	62	28	No Connect	AI4+	62	28	AI4-
DIO26	61	27	+5V	AIGND4	61	27	AIGND5	AIGND4	61	27	AIGND5
DIO25	60	26	DGND	No Connect	60	26	No Connect	AI5+	60	26	AI5-
DIO24	59	25	DGND	No Connect	59	25	No Connect	AI6+	59	25	AI6-
DIO23	58	24	DGND	AIGND6	58	24	AIGND7	AIGND6	58	24	AIGND7
DIO22	57	23	DGND	No Connect	57	23	No Connect	AI7+	57	23	AI7-
DIO21	56	22	DGND	AISENSE	56	22	No Connect	AISENSE	56	22	No Connect
DIO20	55	21	DGND	AO0	55	21	AOGND0	AO0	55	21	AOGND0
DIO19	54	20	DGND	AO1	54	20	AOGND1	AO1	54	20	AOGND1
DIO18	53	19	DGND	AO2	53	19	AOGND2	AO2	53	19	AOGND2
DIO17	52	18	DGND	AO3	52	18	AOGND3	AO3	52	18	AOGND3
DIO16	51	17	DGND	No Connect	51	17	AOGND4	AO4	51	17	AOGND4
DIO15	50	16	DGND	No Connect	50	16	AOGND5	AO5	50	16	AOGND5
DIO14	49	15	DGND	No Connect	49	15	AOGND6	AO6	49	15	AOGND6
DIO13	48	14	DGND	No Connect	48	14	AOGND7	AO7	48	14	AOGND7
DIO12	47	13	DGND	DIO15	47	13	DIO14	DIO15	47	13	DIO14
DIO11	46	12	DGND	DIO13	46	12	DIO12	DIO13	46	12	DIO12
DIO10	45	11	DGND	DIO11	45	11	DIO10	DIO11	45	11	DIO10
DIO9	44	10	DGND	DIO9	44	10	DIO8	DIO9	44	10	DIO8
DIO8	43	9	DGND	DIO7	43	9	DGND	DIO7	43	9	DGND
DIO7	42	8	DGND	DIO6	42	8	DGND	DIO6	42	8	DGND
DIO6	41	7	DGND	DIO5	41	7	DGND	DIO5	41	7	DGND
DIO5	40	6	DGND	DIO4	40	6	DGND	DIO4	40	6	DGND
DIO4	39	5	DGND	DIO3	39	5	DGND	DIO3	39	5	DGND
DIO3	38	4	DGND	DIO2	38	4	DGND	DIO2	38	4	DGND
DIO2	37	3	DGND	DIO1	37	3	DGND	DIO1	37	3	DGND
DIO1	36	2	DGND	DIO0	36	2	DGND	DIO0	36	2	DGND
DIO0	35	1	DGND	+5V	35	1	+5V	+5V	35	1	+5V

NI 783xR DIO  
Connector Pin Assignment

NI 7830R MIO  
Connector Pin Assignment

NI 7831R/7833R MIO  
Connector Pin Assignment

Figure 2. NI 783xR I/O Connector Pin Assignments



**Caution** Connections that exceed any of the maximum ratings of input or output signals on the NI 783xR can damage the NI 783xR and the computer. NI is *not* liable for any damage resulting from such signal connections. Refer to the *NI 783xR User Manual* for the maximum input ratings for each signal.

For detailed information about connecting I/O signals, refer to the *NI 783xR User Manual*.

# Cabling Options

Accessing the signals on the I/O connectors requires at least one cable and one signal accessory. Table 1 summarizes the National Instruments cables available for use with the NI 783xR device.

**Table 1.** Cabling Options

Cable	Connector	Description
SH68-C68-S	MIO/DIO	For connecting signals from the MIO or DIO connector to the NI SCB-68 terminal block.
SHC68-68-RMIO	MIO	For connecting signals from the MIO connector to the SCB-68 terminal block.  Improves signal integrity and noise immunity. Provides shielding on all AI channels and an overall analog shield to reduce digital-to-analog crosstalk.
NSC68-262650	MIO	For direct connection of the NI 783xR to 5B and SSR analog and digital signal conditioning backplanes.  Routes signals to connectors that attach directly to 5B backplanes (for analog signals) and SSR backplanes (for digital signals).
NSC68-5050	DIO	For direct connection of the NI 783xR and SSR backplanes.  Routes signals to connectors that attach directly to SSR backplanes.

## Related Documentation

Refer to the following documentation for information about the LabVIEW FPGA Module, R Series hardware, and VIs necessary for your application.

- *LabVIEW FPGA Module Release Notes*—describes the software installation and other known software issues.
- *LabVIEW FPGA Module User Manual*—describes the LabVIEW FPGA Module software and techniques for building applications in LabVIEW with the LabVIEW FPGA Module.
- *NI 783xR User Manual*—describes the electrical and mechanical aspects of the NI 783xR and contains information about its operation and programming.

- *LabVIEW Help*—describes the VIs and function reference information.
- *CompactRIO R Series Expansion System Installation Instructions*—describes how to install the CompactRIO R Series Expansion chassis and CompactRIO I/O modules.

## Where to Go from Here

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Refer to the *LabVIEW FPGA Module Release Notes* for information about getting started with LabVIEW FPGA VIs and host VIs. This document also provides examples for verifying that your software and hardware are properly installed. To access this document, select **Start»Programs»National Instruments»LabVIEW»Module Documents**.

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