

# High-Performance Real-Time Embedded Controllers for PXI

## NI PXI-8184 RT, NI PXI-8186 RT, NI PXI-8187 RT

- Execution target for LabVIEW Real-Time applications
- Reliable and deterministic operation
- Ethernet control of PXI
- 43 kHz single PID loop rate, maximum

### Development System Requirements

- LabVIEW for Windows or Mac OS X
- LabVIEW Real-Time Module for Windows or Mac OS X

### Deployment Software (included)

- LabVIEW Real-Time embedded software

**NEW**



## Overview

National Instruments RT Series PXI embedded controllers deliver a flexible, rugged platform for your deterministic, real-time measurement and control applications. The NI PXI-8184 RT, NI PXI-8186 RT, and NI PXI-8187 RT controllers offer a high-performance platform, ideal for real-time test and control applications. You develop your LabVIEW application with the NI LabVIEW Real-Time Module on Windows or Mac OS X, and then download the program to your RT Series PXI embedded controller via Ethernet. The embedded code executes on a real-time operating system. Thus, you use the powerful and flexible development tools of LabVIEW to build reliable, real-time solutions.

LabVIEW Real-Time applications running on PXI systems achieve microsecond loop rates with only 3 to 4 ns of system jitter. These real-time measurement and control systems capitalize on Intel processors coupled with the advanced timing, triggering, and I/O synchronization benefits of PXI. Furthermore, NI-DAQmx Measurement Services software extends the timing capabilities of PXI to deliver tight integration with LabVIEW Real-Time applications through operations such as hardware-timed software loops.

## Connect to Any I/O

The modularity of PXI and open development environment of LabVIEW make it easy to integrate a variety of I/O within your application. Create a custom real-time embedded solution using an RT Series PXI embedded controller with any number and combination of PXI/CompactPCI plug-in modules.

Built-in LabVIEW libraries help you create applications with data acquisition, dynamic signal acquisition, motion control, image acquisition, and reconfigurable I/O. Communicate with peripheral

devices through CAN, GPIB, Ethernet, or serial protocols. Use NI-VISA to integrate third-party PXI/CompactPCI modules in your application.

In addition, the RT Series PXI embedded controllers include an external SMB connection for use as a trigger input, output, or watchdog timer. Use the external SMB to pass trigger and timing signals into and out of the PXI trigger bus in your PXI system.

## Create Reliable Stand-Alone Systems

To ensure reliable operation, embedded LabVIEW applications continue to run even if the host PC is interrupted or rebooted. Because RT Series PXI embedded controllers run in a separate chassis with a dedicated power supply, the operator can shut down the host computer entirely without disrupting the real-time program.

For stand-alone operation, you can permanently embed code in the system so it starts automatically when the system boots, requiring no human interaction. Use the LabVIEW Professional Development System and LabVIEW Real-Time Module to compile your LabVIEW application to an executable and download it to your RT Series PXI embedded controller.

Model	PXI-8187 RT	PXI-8186 RT	PXI-8184 RT
Processor	2.5 GHz P4-M	2.2 GHz P4-M	850 MHz Celeron
RAM, standard	256 MB	256 MB	128 MB
RAM, maximum	1 GB	1 GB	512 MB
Storage, hard drive	40 GB <sup>1</sup>	40 GB <sup>1</sup>	40 GB
Storage, solid-state	— <sup>2</sup>	— <sup>2</sup>	— <sup>2</sup>
GPIB interface	✓	✓	—
Ethernet port (10/100BaseTX)	✓	✓	✓
Serial ports (RS232)	2	2	1
Built-in us hardware timing	✓	✓	✓
Watchdog/trigger SMB	✓	✓	✓

<sup>1</sup>30 GB for PXI-8186 RT and PXI-8187 RT Extended Temperature versions. <sup>2</sup>Optional 128 or 512 MB solid-state drives can replace the hard drives.

Table 1. PXI RT Series Controller Selection Guide



# High-Performance Real-Time Embedded Controllers for PXI

## Dual-Boot Option

NI PXI embedded controllers can be configured to boot into Windows or the real-time OS. NI Measurement & Automation Explorer includes features for installing and configuring PXI embedded controllers as LabVIEW Real-Time targets. The controllers use a hardware switch or BIOS setting to boot into the desired OS.

The result is a PXI controller that can run embedded LabVIEW Real-Time or Windows applications. When the controller is in real-time mode, you need another Windows or Mac OS X computer to develop and debug the LabVIEW Real-Time code for the PXI controller. To enable a Windows PXI embedded controller to dual-boot with the real-time OS, you must purchase the LabVIEW Real-Time embedded software for the controller.

## Extended Temperature Option

The PXI-8186 RT and PXI-8187 RT controllers are available in two versions to address different environmental conditions. The standard version has an operating temperature of 5 to 40 °C with a storage temperature of -20 to 60 °C. The extended temperature version has an operating temperature of 0 to 55 °C with a storage temperature of -40 to 85 °C.

The extended temperature option uses a hard drive designed for reliability in the low and high-temperature extremes. This extended temperature hard drive has a capacity of 30 GB (minimum), versus 40 GB (minimum) on the standard controller. Refer to the specifications section for additional details, including chassis-specific temperature specifications.

NI Hardware	Benchmark	Processing	Channels	File Write	Network Transfer	Maximum Loop Rate (kHz)		
						PXI-8187 RT	PXI-8186 RT	PXI-8184 RT
E Series DAQ	Analog Input and Output	PID	1	–	–	43	42	23
	Analog Input and Output	PID	8	–	–	9	9	9
	Analog Input and Output	PID	1	✓ <sup>1</sup>	–	35	31	18
	Analog Input and Output	PID	1	–	✓ <sup>2</sup>	38	24	15
PXI-6533	Digital Input and Output <sup>3</sup>	–	8	–	–	179	153	78
	Digital Input and Output <sup>3</sup>	–	16	–	–	124	104	58
	Digital Output <sup>4</sup>	–	16	–	–	380	298	141
PXI-6602	Counter Read <sup>5</sup>	–	1	–	–	144	140	87
	Counter Read <sup>5</sup>	–	4	–	–	35	34	21
None	Data Analysis	FFT <sup>6</sup>	1 array	–	–	5.1	5	0.7

<sup>1</sup>One data value per iteration written to an open file. <sup>2</sup>TCP transfers of 512 bytes per transfer. <sup>3</sup>Static (non-buffered, unstrobed) digital read and write. <sup>4</sup>Static (non-buffered, unstrobed) digital write. <sup>5</sup>Read current value of counter register. <sup>6</sup>FFTs per second based on test of 1000 FFTs using one array of 2048 double-precision data points with Hanning windowing and no averaging.

Table 2. Maximum Loop Rates for LabVIEW Real-Time PXI Systems (All benchmarks use LabVIEW 7 Real-Time Module and traditional NI-DAQ 7.0 and adhere to the NI recommended architecture for LabVIEW Real-Time applications. Contact National Instruments for additional details regarding these and other benchmarks.)

## Ordering Information

To order a complete PXI system based on a LabVIEW Real-Time embedded controller, visit [ni.com/pxiadvisor](http://ni.com/pxiadvisor).

### Step 1. Select Controller

NI PXI-8184 RT .....	778824-33
NI PXI-8186 RT .....	778755-33
NI PXI-8186 RT, Extended Temperature.....	778842-33
NI PXI-8187 RT .....	779755-33
NI PXI-8187 RT, Extended Temperature.....	779842-33

### Step 2. Select Memory Upgrades

256 MB RAM for PXI-8184 RT.....	778469-256
512 MB RAM for PXI-8184 RT.....	778469-512
512 MB DDR RAM for PXI-8186 RT, PXI-8187 RT .....	778763-512
1 GB DDR RAM for PXI-8186 RT, PXI-8187 RT .....	778763-1024

### Step 3. Select Solid-State Storage Options

128 MB Solid-State HDD for PXI-8184 RT, PXI-8186 RT, PXI-8187 RT .....	779175-128
512 MB Solid-State HDD for PXI-8184 RT, PXI-8186 RT, PXI-8187 RT .....	779175-512

### Step 4. Select Accessories

Micro-GPIB to GPIB cable (0.2 m).....	183285-0R2
Micro-GPIB to GPIB cable (1 m) .....	183285-01
Micro-GPIB to GPIB cable (2 m) .....	183285-02
NI PXI-8252 FireWire (IEEE 1394) interface module .....	778925-01

## BUY NOW!

For complete product specifications, pricing, and accessory information, call (800) 813-3693 (U.S. only) or go to [ni.com/pxi](http://ni.com/pxi)

# High-Performance Real-Time Embedded Controllers for PXI

## Specifications

### Physical

Slot Requirements	
PXI-8184 RT .....	1 system slot, 2 controller expansion slots
PXI-8186 RT and PXI-8187 RT .....	1 system slot, 3 controller expansion slots
Dimensions	
PXI-8184 RT .....	6.1 by 13 by 21.6 cm (2.4 by 5.1 by 8.5 in.), 3U
PXI-8186 RT and PXI-8187 RT .....	8.1 by 13 by 21.6 cm (3.2 by 5.1 by 8.5 in.), 3U
Weight	
PXI-8184 RT .....	0.64 kg (1.14 lb), typical
PXI-8186 RT and PXI-8187 RT .....	1.0 kg (2.2 lb), typical
Mean Time Between Failures (MTBF)	
PXI-8184 RT .....	226,000
PXI-8186 RT and PXI-8187 RT .....	170,248
(Predictions in accordance with Belcore methods)	

### Peripherals

Ethernet .....	10/100BaseTX, RJ-45 connector
Serial port (RS232)	
PXI-8184 RT .....	1
PXI-8186 RT and PXI-8187 RT .....	2
GPIB port	
PXI-8186 RT and PXI-8187 RT .....	PCI-GPIB/TNT, Micro D25 connector (adapter not included), IEEE 488 and HS488 protocols
RAM	
PXI-8184 RT .....	128 MB standard, 512 MB maximum, 7.5 ns SDRAM, 1 SO-DIMM socket
PXI-8186 RT and PXI-8187 RT .....	256 MB standard, 1 GB maximum, DDR SDRAM, 1 SO-DIMM socket
Nonvolatile Memory	
PXI-8184 RT, PXI-8186 RT, and PXI-8187 RT .....	40 GB minimum, Internal 2.5 in, Fast Ultra ATA100 Interface
PXI-8186 RT and PXI-8187 RT extended temperature .....	30 GB minimum, Internal 2.5 in, Fast Ultra ATA100 Interface

### Power Requirements

PXI-8184 RT

Voltage (V)	Current (A)	
	Typical	Maximum
+3.3	3.0	4.0
+5	4.5	6.0
+12	0.001	0.04
-12	0	0

PXI-8186 RT, PXI-8187 RT

Voltage (V)	Current (A)			
	PXI-8186 RT		PXI-8187 RT	
	Typical	Maximum	Typical	Maximum
+3.3	4.0	5.0	4.0	5.0
+5	6.5	8.0	7.0	9.0
+12	0.15	0.20	0.15	0.20
-12	0	0	0	0

### Shock and Vibration

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 to 500 Hz, 0.3 grms (with solid-state hard drive)
Nonoperating .....	5 to 500 Hz, 2.4 grms (Tested in accordance with IEC-60068-2-64. Nonoperating test profile exceeds the requirements of MIL-PRF-28800F, Class 3)

### Operating Environment

Ambient Temperature

Chassis	Temperature (°C)		
	PXI-8184 RT	PXI-8186 RT, PXI-8187 RT	Extended Temperature
PXI-1000B	5 to 50	5 to 40	0 to 55
PXI-1002	5 to 40	5 to 40	0 to 50
PXI-1006	5 to 50	5 to 45	0 to 55
PXI-1010	5 to 35	Not Recommended	0 to 35
PXI-1011	5 to 50	5 to 40	0 to 55
PXI-1042	5 to 50	5 to 40	0 to 55
PXI-1045	5 to 55	5 to 45	0 to 55

(Tested in accordance with IEC-60068-2-1 and IEC-60068-2-2)

Relative Humidity .....	10 to 90%, noncondensing (IEC-60068-2-56)
Altitude .....	2000 m (at 25 °C ambient temperature)

### Storage Environment

Ambient Temperature

PXI-8184 RT, PXI-8186 RT, and PXI-8187 RT .....	-20 to 65 °C (IEC-60068-2-1 and IEC-60068-2-2)
PXI-8186 RT and PXI-8187 RT extended temperature .....	-40 to 85 °C (IEC-60068-2-1 and IEC-60068-2-2)
Relative Humidity .....	5 to 95%, noncondensing (IEC-60068-2-56)

### Safety Compliance

EN 61010-1, IEC 61010-1

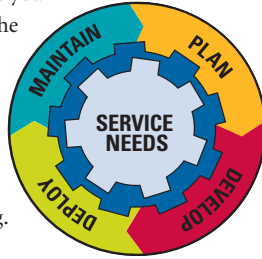
### Electromagnetic Compatibility

Refer to the Declaration of Conformity (DoC) for regulatory compliance information. To obtain the DoC for this product, click Declaration of Conformity at [ni.com/hardref.usf](http://ni.com/hardref.usf).

\*Specifications subject to change without notice

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NI has the services and support to meet your needs around the globe and through the application life cycle – from planning and development through deployment and ongoing maintenance. We offer services and service levels to meet customer requirements in research, design, validation, and manufacturing. Visit [ni.com/services](http://ni.com/services).



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## Hardware Services

### NI Factory Installation Services

NI Factory Installation Services (FIS) is the fastest and easiest way to use your PXI or PXI/SCXI™ combination systems right out of the box. Trained NI technicians install the software and hardware and configure the system to your specifications. NI extends the standard warranty by one year on hardware components (controllers, chassis, modules) purchased with FIS. To use FIS, simply configure your system online with [ni.com/pxiadvisor](http://ni.com/pxiadvisor).

### Calibration Services

NI recognizes the need to maintain properly calibrated devices for high-accuracy measurements. We provide manual calibration procedures, services to recalibrate your products, and automated calibration software specifically designed for use by metrology laboratories. Visit [ni.com/calibration](http://ni.com/calibration).

### Repair and Extended Warranty

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