NI Wireless Sensor Network Programmable Gateway

NI 9792 *NEW!*

Programmable Controller
- Execution target for LabVIEW Real-Time applications
- 533 MHz Freescale MPC8347 real-time processor
- 2 GB onboard storage for local data logging
- Integrated Web (HTTP) and file (FTP) server
- 256 MB DDR2 RAM
- Dual Ethernet ports

Industrial Ratings
- Redundant 9 to 35 VDC power input
- -40 to 70 °C operating temperature, 50 g shock, 5 g vibration

Integrated WSN Radio
- 2.4 GHz, IEEE 802.15.4 radio for communication with NI WSN measurement nodes
- Up to 300 m outdoor range with line of sight
- Supports up to 36 measurement nodes in a mesh configuration

Operating System
- LabVIEW Real-Time (VxWorks)

Driver and Configuration Software
- NI-WSN for wireless measurement systems
- Measurement & Automation Explorer (MAX)

Product	DRAM Memory (MB)	Internal Nonvolatile Storage (GB)	Ethernet	RS232 Serial Port	USB Port	LEDs	DIP Switches	Power Supply Input Range	Backup Power Input	Remote Panel Web Server	FTP Server	WSN Radio
WSN-9791	–	–	1: 10/100	–	–	3	–	9 to 30 VDC	–	–	–	✓
NI 9792	256	2	1: 10/100/1000, 1: 10/100	✓	Hi-Speed	4	5	9 to 35 VDC	✓	✓	✓	✓

Overview

The NI 9792 controller, which is programmable with the NI LabVIEW Real-Time Module, can communicate with NI wireless sensor network (WSN) devices as well as other hardware through a variety of open communication standards. This high-performance controller features a 533 MHz processor and a 2.4 GHz IEEE 802.15.4 radio to communicate with up to 36 distributed NI WSN measurement nodes (in a mesh configuration). The NI 9792 also features dual Ethernet ports to provide flexible connectivity to other devices in your measurement system, such as enterprise-level networks or wired I/O systems. With this flexibility, you can create a complete wired and wireless measurement solution that meets your unique application needs, as seen in Figure 1.

Local Data Logging

You can target and program this controller with LabVIEW Real-Time to collect, analyze, and present data from your wireless measurements. With 2 GB of onboard storage, the NI 9792 is well-suited for embedded data-logging applications for which you need to aggregate data from distributed wireless measurement nodes and/or wired I/O systems. The NI 9792 also features a Hi-Speed USB host port to which you can connect external USB-based storage media for embedded logging applications requiring more data storage. In addition, the NI 9792 incorporates a fault-tolerant file system that provides increased reliability for data logging.

Remote Access and Open Communication

The NI 9792 also features integrated Web (HTTP) and file (FTP) servers so that you can host measurement data for remote access anywhere with an Internet connection. With the 10/100 Mbits/s and 10/100/1000 Mbits/s Ethernet and serial ports, you can communicate via TCP/IP, UDP, Modbus/TCP, and serial protocols.

Wireless Networking

The NI WSN system is built on a low-power, reliable IEEE 802.15.4 network. The NI 9792 gateway coordinates the wireless network, performing functions such as device authentication, message buffering, and network topology administration.

The gateway, routers, and end nodes work together to form a wireless network. Measurement nodes can operate as routers or end nodes, providing the flexibility to extend the range of your sensor network. When nodes are configured as routers, they can repeat messages from end nodes and extend network range while acquiring measurement data.

To save power and increase reliability, the network delivers a maximum theoretical throughput of 250 kbits/s. In general, this correlates to 30 to 60 samples per minute per channel on the WSN measurement nodes.

You can configure the network to operate on any of the 14 wireless communication channels to optimize performance and ensure coexistence with other wireless

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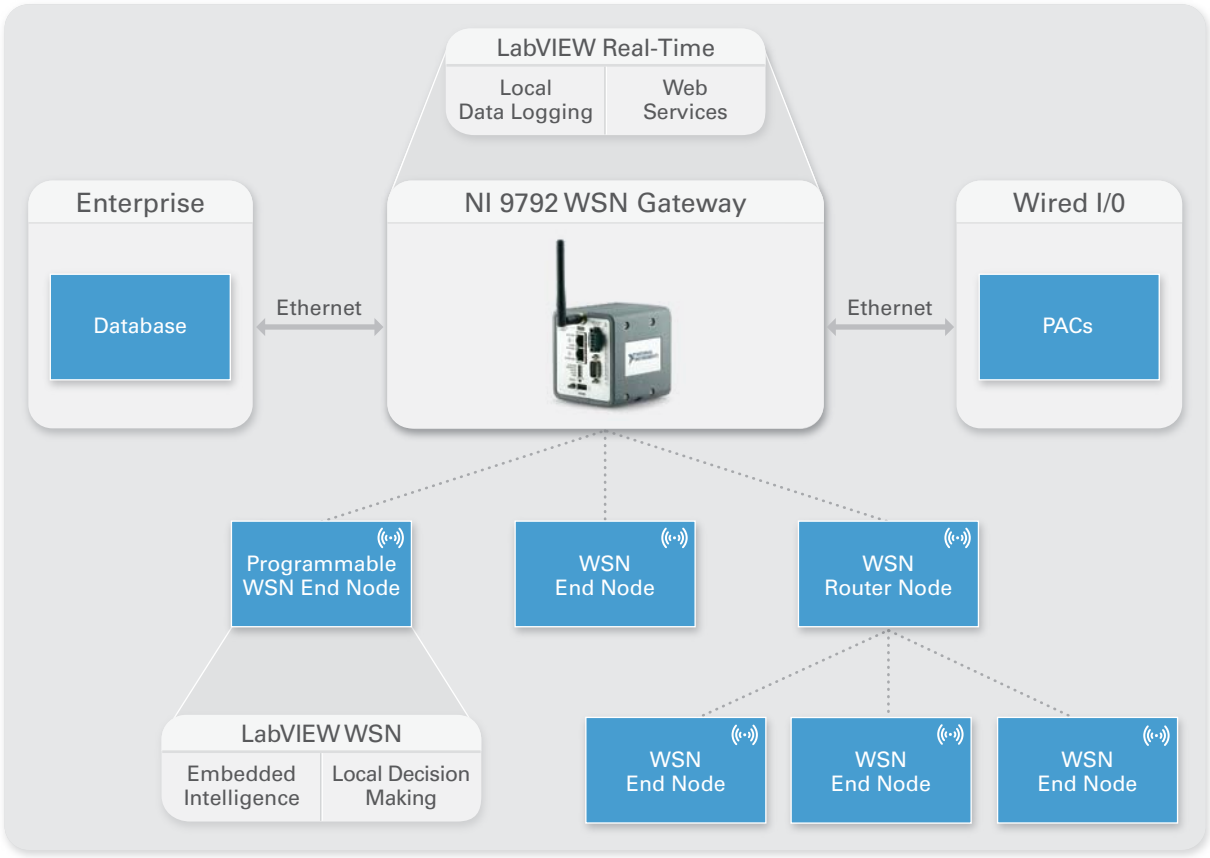

Figure 1. NI WSN systems provide flexible connectivity to other devices in your application.

devices. The external, omnidirectional antenna and internal power amplifier provide up to 300 m outdoor range with line of sight (150 m in Europe/Asia version).

Software Overview

With NI-WSN software, you can easily configure your sensor network in the NI Measurement & Automation Explorer (MAX) configuration utility and quickly extract measurement data from your wireless sensor network with the LabVIEW graphical development environment.

Network Configuration

MAX offers an intuitive user interface to help you add and remove measurement nodes and configure wireless settings. Upon connection, the NI 9792 is autodetected under Remote Systems in MAX, and you can assign measurement nodes to the gateway. The gateway maintains a list of nodes (by serial number) that have been authorized for network access. When a node powers up, it scans for available networks, locates either a gateway or router, and attempts to join it. If the gateway has the node in its list, the node joins the network, downloads the latest configuration from the gateway, and begins its normal operation of acquiring measurement data and controlling digital I/O. If a node is unable to immediately connect, it executes a retry sequence with increasingly higher wait periods. This preserves battery power if a gateway is offline.

MAX also offers an overview of the nodes connected to your network including their last communication time, battery status, and link quality. In addition, MAX provides an interface to set the wireless communication channel, configure the gateway IP address, and wirelessly update firmware on the measurement nodes.

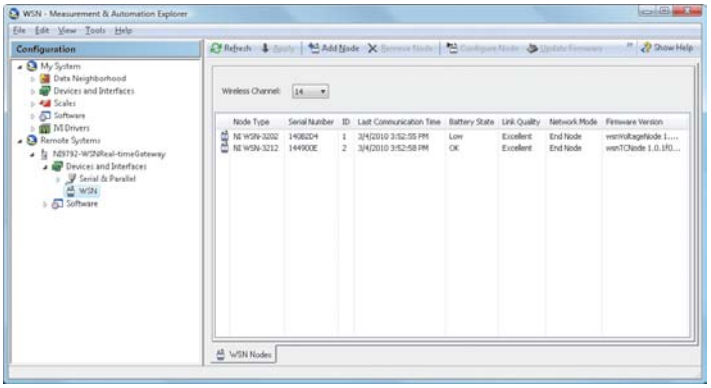

Figure 2. Network Configuration in MAX

Programming

You can integrate your NI WSN measurement data directly into LabVIEW. After adding the gateway to a LabVIEW project, the nodes configured with the gateway in MAX are automatically added underneath the gateway in the project, giving you instant access to their I/O and properties.

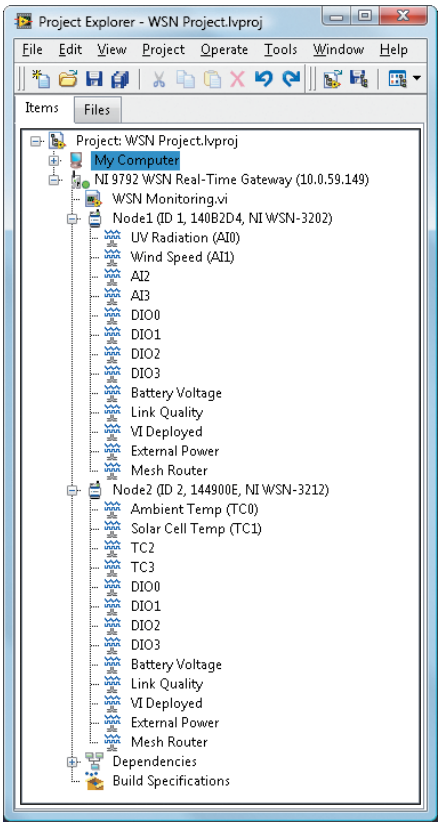

Figure 3. NI WSN System in the LabVIEW Project

Simply drag and drop I/O variables from the LabVIEW project to a LabVIEW block diagram for data extraction, logging, analysis, and presentation.

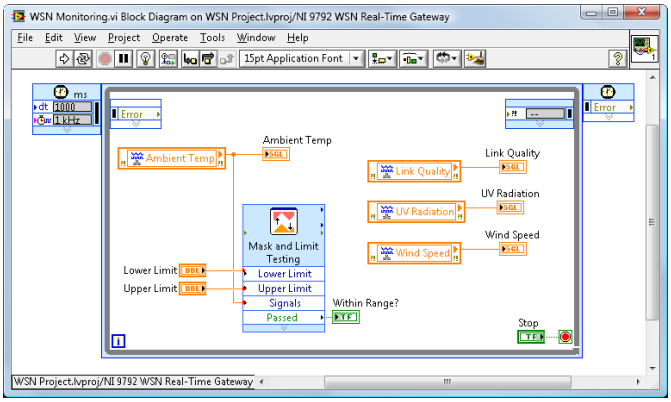

Figure 4. Extracting NI WSN Measurement Data Using LabVIEW

LabVIEW Real-Time Programming

The LabVIEW Real-Time Module helps you use LabVIEW graphical programming to create applications that run on embedded hardware targets such as the NI 9792. You can use most of the built-in math and signal processing algorithms that come with LabVIEW in your real-time applications, and add embedded data logging and communication. In addition, you can run textual math scripts on your real-time system with the optional LabVIEW MathScript RT Module.

Developing real-time programs in LabVIEW is nearly identical to developing standard LabVIEW applications for your PC. Your embedded, real-time program can provide the following capabilities:

- Remote configuration, data access, alarms, and notifications using the onboard Web server
- Open communication through TCP/IP, Modbus, serial, shared variables, and Web services
- Third-party connectivity to other WSN gateways/vendors
- Remote communication through e-mail and FTP protocols
- Watchdog functions to automatically restart some hardware targets if your program stops running

Mechanical Information

The NI 9792 gateway measures approximately 3.5 by 3.3 by 3.75 in. (L by W by H). The front of the gateway features power, status, activity, and user LEDs, along with a DIP switch bank to perform actions such as IP address reset and SAFE mode configuration. Redundant power supply connections and dual Ethernet ports complement the RS232 port and Hi-Speed USB port, each of which provides strain relief. The back of the device offers DIN-rail and panel mount plate screw holes in addition to a grounding screw on the bottom of the device. Consult the NI 9792 user guide for detailed mechanical information.

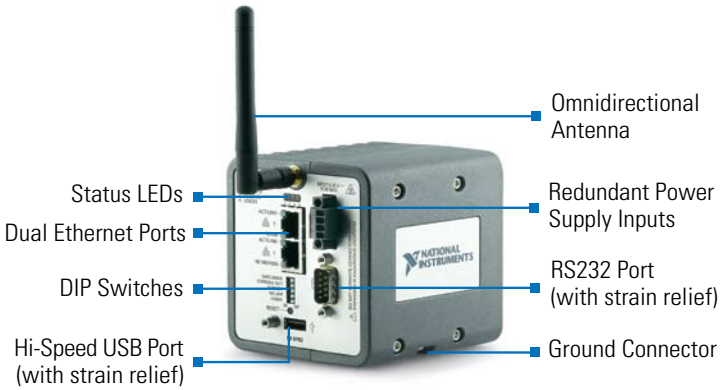

Figure 5. NI 9792 External Features

WSN Accessories

NI WSN accessories feature options for gateway and measurement node mounting as well as weatherproof enclosures for the outdoor use of WSN measurement nodes and the NI WSN-9791 Ethernet gateway. Available mounting accessories include options to panel mount and DIN-rail mount WSN measurement nodes and gateways. The NI WSN-3281 magnetic panel mount kit provides easy setup and takedown on virtually any metal surface. For high shock and vibration applications, NI recommends a panel mounting configuration rather than DIN-rail.

Accessory	Description
WSN-3280	NI WSN Node panel mount bracket with spring-loaded screw locking mechanism and integrated strain relief
WSN-3281	NI WSN Node magnetic panel mount bracket with spring-loaded screw locking mechanism and integrated strain relief
WSN-3282	NI WSN DIN-rail mounting kit for nodes or gateways (includes four screws)
WSN-3283	NI WSN panel mount plate for nodes or gateways (recommended for gateways) with additional four keyholes for mounting to wall in multiple orientations (includes four screws)
WSN-3291	Outdoor enclosure for NI WSN measurement nodes; includes external antenna and two customizable I/O glands
WSN-3294	Outdoor enclosure for WSN-9791 Ethernet gateway; includes external antenna and two customizable I/O glands

Table 1. Mounting Kits

You can choose from several power accessories that provide external power to the WSN Ethernet gateway or WSN measurement nodes.

Accessory	Description
Desktop Power Supply	Provides 12 VDC power up to 1.25 A/15 W, and is rated for 0 to 70 °C. The supply terminates with a two-position MINI-COMBICON connector that plugs directly into the WSN-9791 Ethernet gateway or NI WSN-32xx measurement nodes.
PS-15 Power Supply	This DIN-rail-mountable, 24 to 28 VDC power supply delivers up to 5 A of current and is rated for operation from -25 to 60 °C. Recommended for industrial installations and the NI 9792 programmable gateway.

Table 2. External Power Supplies

The connectivity accessories for NI WSN products include additional screw-terminal kits for the measurement nodes and a power connector backshell kit that contains a strain relief attachment for the two-position and four-position power connectors.

Accessory	Description
Two-Position Power Connectors	Extra two-position MINI-COMBICON power connectors (WSN-32xx nodes and WSN-9791 Ethernet gateway) – quantity 4
Two-Position Power Connector Backshell	Strain relief attachment for the two-position power connector that clips to the connector and includes a zip tie to hold the power cable in place (WSN-32xx nodes and WSN-9791 Ethernet gateway)
Four-Position Power Connectors	Extra four-position power connectors (for NI 9792) – quantity 4
Four-Position Power Connector Backshell	Strain relief attachment for the four-position power connector that clips to the connector and includes a zip tie to hold the power cable in place (NI 9792)

Table 3. Connectivity Accessories

NI Wireless Sensor Network Programmable Gateway

Ordering Information

NI WSN Starter Kit (Americas) 781080-01
NI WSN Starter Kit (Europe/Asia) 781080-11

Programmable Gateway

NI 9792 (Americas) 781294-01
NI 9792 (Europe/Asia) 781294-11

Ethernet Gateway

NI WSN-9791 (Americas) 780996-01
NI WSN-9791 (Europe/Asia) 780996-11

Programmable Measurement Nodes

NI WSN-3202 (Americas) 780997-02
NI WSN-3202 (Europe/Asia) 780997-12
NI WSN-3212 (Americas) 780998-02
NI WSN-3212 (Europe/Asia) 780998-12

Nonprogrammable Measurement Nodes

NI WSN-3202 (Americas) 780997-01
NI WSN-3202 (Europe/Asia) 780997-11
NI WSN-3212 (Americas) 780998-01
NI WSN-3212 (Europe/Asia) 780998-11

Outdoor Enclosure and Accessories

NI WSN-3291 780995-01
NI WSN-3292 781078-01
NI WSN-3293 781079-01
NI WSN-3294 199975-01

Power Accessories

Desktop supply 780703-01
U.S. power cord 763000-01
PS-15 industrial supply 781093-01

Mounting Accessories

NI WSN-3280 780999-01
NI WSN-3281 781073-01
NI WSN-3282 781074-01
NI WSN-3283 781075-01

Connectivity Accessories

NI WSN-3284 781076-01
NI WSN-3285 781077-01
Two-position power connectors 780702-01
Two-position power connector backshell kit 196375-01
Four-position power connectors 196938-01
Four-position power connector backshell kit 196939-01

BUY NOW

For complete product specifications, pricing, and accessory information, call 800 813 3693 (U.S.) or go to **ni.com/wsn**.

Specifications

These specifications are typical at 25 °C unless otherwise noted. For the NI WSN-32xx specifications, refer to the device user guides.

Environmental

The NI 9792 device is intended for indoor use only.

Operating temperature	-40 to 70 °C (IEC-60068-2-1 and IEC-60068-2-2)
Storage temperature	-40 to 85 °C (IEC-60068-2-1 and IEC-60068-2-2)
Ingress protection	IP 40
Operating humidity	10 to 90% RH, noncondensing (IEC-60068-2-56)
Storage humidity	5 to 95% RH, noncondensing (IEC-60068-2-56)
Maximum altitude	2,000 m
Pollution degree (IEC 60664)	2

Physical Characteristics

If you need to clean the NI 9792, wipe it with a dry towel.

Screw-terminal wiring	12 to 18 AWG copper conductor wire with 10 mm (0.39 in.) of insulation stripped from the end
Torque for screw terminals	0.5 to 0.6 N · m (4.4 to 5.3 lb · in.)
Weight	Approx. 833 g (29.4 oz)
Weight with antenna	Approx. 842 g (29.7 oz)
Dimensions	Refer to user guide for device dimensions

Shock and Vibration

Operating vibration, random	5 g_{rms}, 10 to 500 Hz (IEC 60068-2-64)
Operating shock	30 g, 11 ms half sine, 50 g, 3 ms half sine, 18 shocks at 6 orientations (IEC 60068-2-27)
Operating vibration, sinusoidal	5 g, 10 to 500 Hz (IEC 60068-2-6)

Network Interface

Ethernet port 1	10BASE-T, 100BASE-TX, 1000BASE-TX Ethernet
Ethernet port 2	10BASE-T, 100BASE-TX Ethernet
Compatibility	IEEE 802.3
Communication rates	
Ethernet port 1	10, 100, and 1000 Mbits/s – autonegotiated
Ethernet port 2	10, 100 Mbits/s – autonegotiated
Maximum cabling distance	100 m/segment

RS232 DTE Serial Port

Baud rate	300 to 230,400 bits/s
Data bits	5, 6, 7, 8
Stop bits	1, 1.5, 2
Parity	Odd, even, mark, space, none
Flow control	RTS/CTS, XON/XOFF, DTR/DSR, none

USB Port

Maximum data rate	480 Mbits/s
Maximum current	500 mA

Memory

Nonvolatile	2 GB

Use the following formula to determine the minimum life span in years of the nonvolatile memory:

Memory life span in years = *Amount of memory in NI 9792 (MB)* × 100,000/365 days]/[*file size (MB)* × *write rate (per day)*]

DRAM	256 MB

Internal Real-Time Clock

Accuracy	35 ppm at 25 °C

Integrated Voltage Input Monitor

The integrated voltage input monitor underreports the voltage at the power connector by up to 400 mV because of voltage drops across internal circuits.

Wireless Characteristics

Radio mode	IEEE 802.15.4
RF data rate	250 kbits/s
Frequency band[1]	ISM 2.4 GHz (2400 to 2483.5 MHz)
Channels[2]	11 to 24

TX power

Version	Maximum Radio Output	Outdoor Range
Americas	+17 dBm max (50 mW)	Up to 300 m
Europe/Asia	+10 dBm max (10 mW)	Up to 150 m

Modulation type	DSSS (O-QPSK)
Receiver sensitivity	-102 dBm

Antenna

Connector	Female RP-SMA connector
VSWR	MAX 2.0
Impedance	50 Ω
Directivity	Omni
Nominal gain	1.5 dBi

[1] Due to regulations, the frequency bands depend upon the country of operation.

[2] Due to regulations, the valid channels depend upon country of operation.

Power Requirements

Caution: Use the NI 9792 with a 9 to 35 VDC output, UL Listed, limited power source (LPS) supply. The power supply must bear the UL Listed and LPS marks. The power supply must also meet any safety and compliance requirements for the country of use.

Recommended power supply	15 W secondary, 35 VDC max
Power consumption	9.5 W
Maximum power consumption	15 W
Voltage requirement	
On power-up	9 to 35 V
After power-up	6 to 35 V

Note: The NI 9792 is guaranteed to power up when 9 V is applied to V and C. After power-up, it can operate on as little as 6 V.

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