Wireless Sensor Network Ethernet Gateway

NI WSN-9791 *NEW!*

- NI-WSN software provides easy network configuration and data extraction
- 2.4 GHz, IEEE 802.15.4 radio to communicate with measurement nodes
- 10/100 Mbits/s Ethernet port for flexible connectivity to Windows PCs or LabVIEW Real-Time programmable automation controllers (PACs)
- Up to 300 m outdoor range with line of sight
- Supports up to 36 measurement nodes
- 9 to 30 VDC power input
- Industrial ratings:
  - -30 to 70 °C operating temperature
  - 50 g shock, 5 g vibration
- Panel and DIN-rail mounting options available

Operating Systems

- Windows Vista/XP/2000
- LabVIEW Real-Time

Software Support

- LabVIEW

Driver and Configuration Software (included)

- NI-WSN software
- Measurement & Automation Explorer configuration utility

Overview

The NI WSN-9791 Ethernet gateway coordinates communication between distributed NI WSN-32xx measurement nodes and a host controller in your NI wireless sensor network (WSN). The gateway uses a 2.4 GHz, IEEE 802.15.4 radio to gather measurement data from the sensor network and a 10/100 Mbits/s Ethernet port to provide flexible connectivity to a Windows PC or NI LabVIEW Real-Time PAC, as seen in Figure 1.

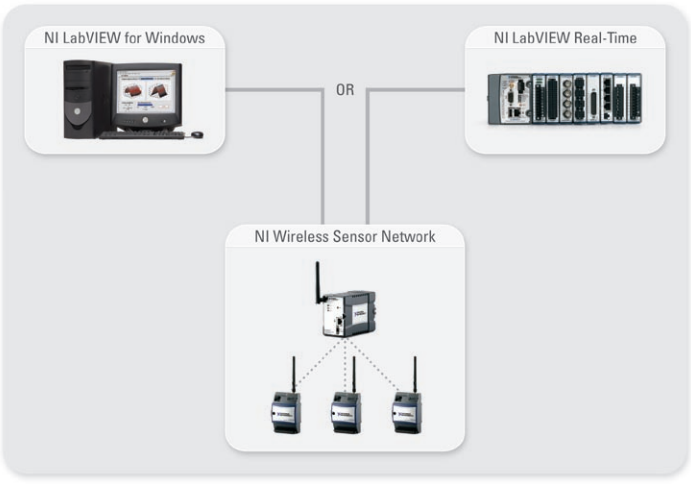

Figure 1. NI WSN systems provide flexible connectivity to Windows or LabVIEW Real-Time host controllers.

With this flexibility, you can create simple, stand-alone wireless monitoring networks or completely integrated wired and wireless measurement solutions that feature access to the full breadth of NI hardware and software platforms. LabVIEW integration with NI WSNs delivers a common development environment for your applications as well as rapid application development, easy network configuration, remote data access, and the ability to program and customize measurement node behavior.

The 9 to 30 VDC externally powered gateway offers -30 to 70 °C operating temperatures, 50 g shock ratings, and a compact, 2U form factor. Up to 36 measurement nodes can communicate with a single gateway, and you can configure the Ethernet settings of the gateway for DHCP, static, and link-local IP address configurations.

Wireless Networking

The NI WSN system is built on a low-power, reliable IEEE 802.15.4 network. The Ethernet 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 mesh 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.

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To save power and increase reliability, the network delivers a maximum theoretical throughput of 250 kbits/s. In general, this correlates to between 30 and 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 devices. The external, omnidirectional antenna and internal power amplifier offer up to 300 m outdoor range with line of sight.

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 add and remove measurement nodes and configure wireless settings. Upon connection, the WSN-9791 Ethernet gateway 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 connect, it executes a retry sequence with increasingly higher wait periods beginning with one minute between connect attempts and ending with 55 minutes between connect attempts. 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.

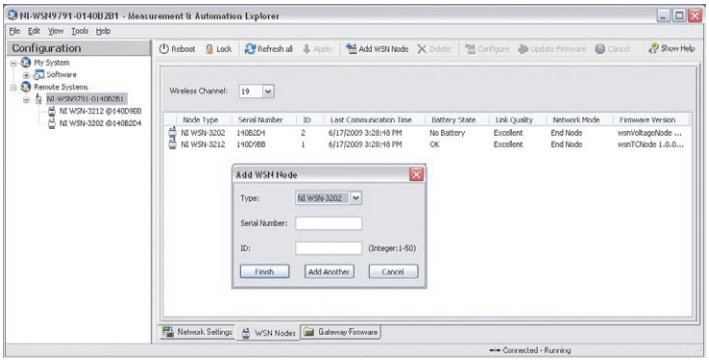

Figure 2. Network Configuration in MAX

Programming

You can integrate your NI WSN measurement data directly into LabVIEW. After adding the WSN Ethernet 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.

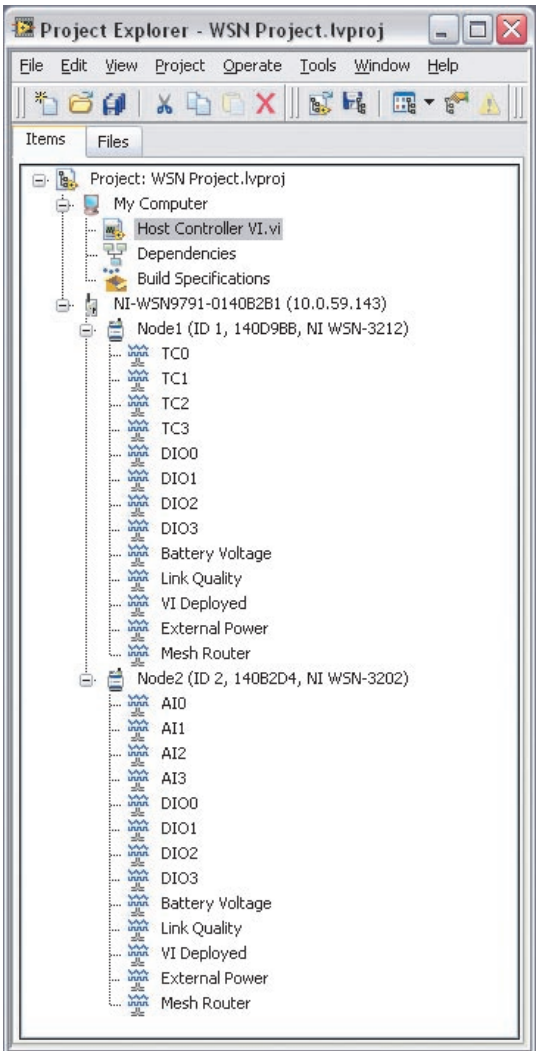

Figure 3. NI WSN System in a LabVIEW Project

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

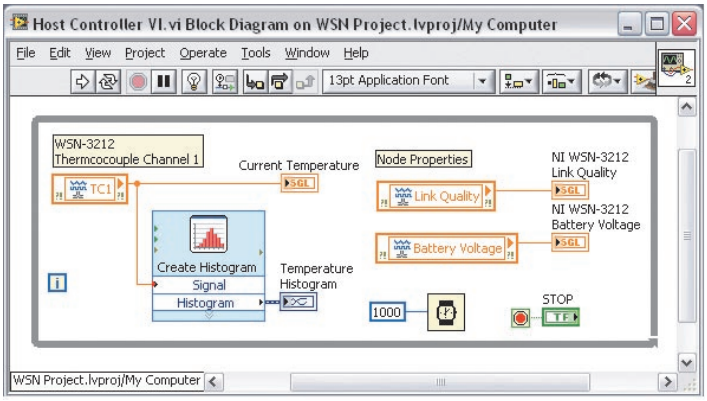

Figure 4. Extracting NI WSN Measurement Data Using LabVIEW

Advanced WSN Architectures

You can combine NI WSNs with other NI platforms to customize and enhance your measurement capabilities. You can complement your NI WSN with PACs, vision systems, or even human machine interfaces (HMIs) to create a fully integrated solution that meets your unique application needs.

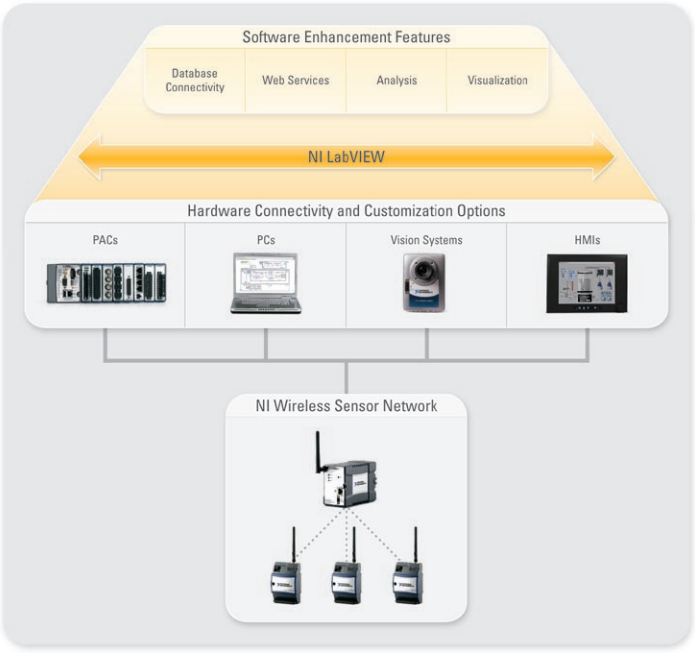

Figure 5. Customize and enhance your NI WSN system.

LabVIEW integration with NI WSNs also provides database integration, remote data access with Web services, and customizable analysis and visualization of your data. In addition, you can use other NI software such as DIAdem to provide advanced data processing and analysis or the LabVIEW Datalogging and Supervisory Control Module for integrated event detection and alarming.

Mechanical Information

The WSN-9791 Ethernet gateway measures approximately 4.6 by 2.3 by 3.5 in. (L by W by H). The front of the gateway offers power, status, and activity LEDs in addition to a reset button that you can use to reboot the device. The power connector and Ethernet port are located on the front, while the DIN-rail and panel mount plate screw holes are located on the back of the device. The gateway also includes integrated panel mount holes that are located on the side of the device. Consult the WSN-9791 user guide for detailed mechanical information.

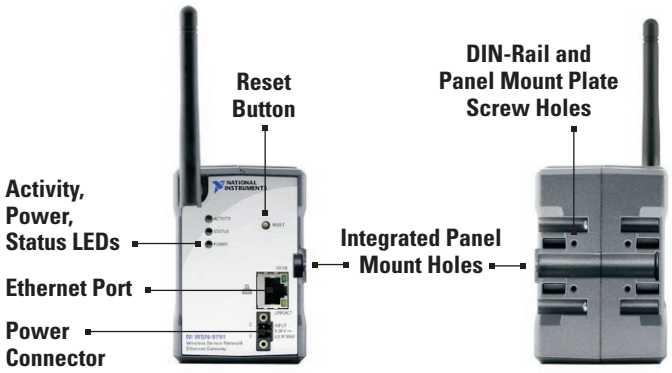

Figure 6. Gateway External Features

Accessories

NI WSN accessories feature options for gateway and measurement node mounting as well as a weatherproof enclosure for outdoor use of the measurement nodes. 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
NI WSN-3280	NI WSN node panel mount bracket with spring-loaded screw-locking mechanism and integrated strain relief
NI WSN-3281	NI WSN node magnetic panel mount bracket with spring-loaded screw-locking mechanism and integrated strain relief
NI WSN-3282	NI WSN DIN-rail mounting kit for nodes or gateway (includes four screws)
NI WSN-3283	NI WSN panel mount plate for nodes or gateway (recommended for gateway) with additional four keyholes for mounting to wall in multiple orientations (includes four screws)

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	This 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 2-position MINI-COMBICON connector; plugs directly into the WSN gateway or measurement nodes.
PS-5 Power Supply	This DIN-rail-mountable, 24 VDC power supply delivers up to 5 A of current and is rated for operation from -25 to 60 °C. Recommended for industrial installations.

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 power connector on the Ethernet gateway and measurement nodes.

Accessory	Description
Power Connectors	Extra 2-position MINI-COMBICON power connectors – quantity 4
Power Connector Backshell	Strain relief attachment for the 2-position power connector on the measurement nodes and gateway that clips to the connector and includes a zip tie to hold the power cable in place

Table 3. Connectivity Accessories

Ordering Information

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

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

Power Accessories

Desktop supply 780703-01
U.S. power cord 763000-01
PS-5 industrial supply 778805-90

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
Power connectors 780702-01
Power connector backshell kit 196375-01

Outdoor Enclosure and Accessories

NI WSN-3291 780994-01
NI WSN-3292 195712-01
NI WSN-3293 195738-01

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 complete specifications, see the *NI WSN-9791 User Guide and Specifications* manual at **ni.com/manuals**.

Wireless Characteristics

Radio mode ..... IEEE 802.15.4
RF data rate ..... 250 kbits/s
Indoor range ..... Up to 90 m
Outdoor range ..... Up to 300 m
Frequency band[1] ..... ISM 2.4 GHz (2400 to 2483.5 MHz)
Channels[2] ..... 11 to 24

[1]Due to regulations, the frequency bands depend on the country of operation.
[2]Due to regulations, the valid channels depend on country of operation.

TX power

Version	Maximum Radio Output
Americas	+17 dBm max (50 mW)
Europe/Asia	+10 dBm max

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

Ethernet

Network interface ..... 100BASE-TX, full-duplex; 100BASE-TX, half-duplex; 10BASE-T, full-duplex; 10BASE-T, half-duplex
Network protocols ..... TCP/IP, UDP
Network IP configuration ..... DHCP + Link–Local, DHCP, Static, Link–Local
Communication rates ..... 10/100 Mbits/s, autonegotiated
Maximum cabling distance ..... 100 m/segment

Power Requirements

Caution: Use the WSN-9791 with a 24 VDC, UL-listed, limited power source (LPS) supply. The power supply bears the UL-listed mark, LPS. It must also meet any safety and compliance requirements for the country of use.

Input voltage range ..... 9 to 30 V
Maximum required input power ..... 4.5 W

Physical Characteristics

Weight ..... Approx. 250 g (8.8 oz)
Weight with antenna ..... Approx. 259 g (9.1 oz)
Dimensions ..... See the *NI WSN-9791 User Guide and Specifications* manual for device dimensions.

Environmental

The WSN-9791 device is intended for indoor use only. For outdoor use, mount the system in a suitably rated enclosure.

Operating temperature ..... -30 to 70 °C (IEC-60068-2-1 and IEC-60068-2-2)
Storage temperature ..... -40 to 70 °C (IEC-60068-2-1 and IEC-60068-2-2)
Operating humidity ..... 10 to 90% RH, noncondensing (IEC-60068-2-56)
Storage humidity ..... 5 to 90% RH, noncondensing (IEC-60068-2-56)
Maximum altitude ..... 2,000 m
Pollution degree ..... 2 (IEC 60664)

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)

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Calibration Services

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