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## Wireless Sensor Network Programmable Analog Input Measurement Nodes

### NI WSN-3202, NI WSN-3212, NI WSN-3226



- Create a reliable network, with support for hundreds of nodes, to monitor your assets or environment
- Programmable with the LabVIEW Wireless Sensor Network (WSN) Module: customize node behavior to extend battery life, increase sample rates, save data locally, and perform local analysis and DIO control
- NI-WSN software provides easy network configuration, drag-and-drop LabVIEW programming, and support for logging, alarming, and web-based data visualization
- Low-power operation, with up to 3-year battery life
- 2.4 GHz, IEEE 802.15.4 radio that provides up to 300m outdoor range
- Four analog input channels per measurement node
- Bi-directional digital channels, configurable for input, sinking output, or sourcing output (2-4 DIO channels per node)
- Industrial ratings: -40 to 70 °C operating temperature and 50 g shock, 5 g vibration

### Overview

The National Instruments wireless sensor network (WSN) platform delivers low-power measurement nodes that offer industrial certifications, reliable networking, and optional weatherproof outdoor enclosures for long-term, remote monitoring applications. The measurement nodes have direct sensor connectivity and a 2.4 GHz radio to wirelessly transmit data to a WSN gateway. Each measurement node offers four analog input channels and two to four digital I/O channels that you can configure for input, sinking output, or sourcing output. With graphical LabVIEW software, you can easily configure your network, collect measurement data, trigger alarms through SMS or e-mail, and even view monitoring data within a Web browser. With the NI LabVIEW Wireless Sensor Network (WSN) Module, you can customize the behavior of programmable NI WSN measurement nodes. Use this module to optimize node behavior for your application: customize sample and transmission rates, perform onboard analysis or data reduction, respond to digital value changes, perform local control of DIO lines, and even store data to flash memory.

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### Comparison Tables

Model	Signal Type(s)	Analog Input Channels	Resolution (bits)	Minimum Sample Interval (seconds)	Input Range(s)	DIO Channels	DIO Voltage Range (V)	Maximum DIO Sourcing (aggregate)	Additional Features
NI WSN-3202	Voltage	4	16	1	±10, ±5, ±2, ±0.5 V	4 (sinking or sourcing)	5 to 30	1 A	12 V, 20 mA sensor power output
NI WSN-3212	Thermocouple, Voltage	4	24	2	±73 mV	4 (sinking or sourcing)	5 to 30	500 mA	Support for J, K, R, S, T, N, B, E thermocouple types
NI WSN-3226	Voltage, Resistance/RTD	4	20	1	±10V, 400Ω, 4kΩ, 100kΩ	2 (sinking or sourcing)	5 to 30	1A	12V, 50mA sensor power output, 50/60Hz rejection, battery backup support

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## Application and Technology

### Programmable WSN Measurement Nodes and the LabVIEW WSN Module

NI recommends the programmable versions of NI WSN measurement nodes. With programmable nodes and the LabVIEW WSN Module, you can use graphical programming to customize node firmware and optimize node operation for your applications.

You can use LabVIEW WSN applications to extend battery life, perform onboard analysis or data reduction, and even programmatically control DIO lines in response to analog data or network status changes. The programmable nodes also deliver access to the node's onboard flash memory, where you can store measurement data or other node parameters.

An example LabVIEW WSN application might be used to sample the analog inputs once an hour, store measurement data to flash, and transmit 24 data points at midnight each day. This same application could be used to turn on a relay or actuator if analog data rose above a specified threshold, such as turning on a fan if an acquired temperature was above a critical level. And because these applications are written in the LabVIEW graphical development environment, customizing node firmware is easy, without any need for low-level assembly or machine code knowledge. With the LabVIEW WSN Module, the custom applications are wirelessly downloaded to the node's onboard processor, where they can dictate sample and transmission rates, onboard data analysis, and how the node responds to network status changes or digital value changes.

### Power

You can power the NI WSN measurement nodes with four 1.5 V AA alkaline battery cells, delivering three-year battery-powered operation at a one-minute sample interval. The NI WSN-3226 also supports 1.5 V AA lithium cells. Each node features an external power port, so you can provide line power or use other forms of power such as solar or vibration energy harvesting. The WSN-3226 supports battery backup, meaning you can connect both external and battery power; the node defaults to external power and automatically switches to battery power in the event the external power drops below a voltage threshold. The external power input should be used to power NI WSN nodes operating in router mode, which is a feature that you can enable in software to set up a self-healing mesh network of nodes. Router nodes increase density, distance, and redundancy in your wireless network.

Each node offers bidirectional digital I/O channels for input, sinking output, or sourcing output. You must use an external power supply to provide sourcing output through the digital I/O channels, with a maximum total current output (aggregate on all channels) of 500 mA on the NI WSN-3212 and 1 A on the NI WSN-3202 and WSN-3226. The WSN-3202 and WSN-3226 also feature a 12 V sensor power output line that you can use to drive external sensors.

### Wireless and Mesh Networking

The measurement nodes and gateways communicate wirelessly using 2.4 GHz radios and the reliable NI-WSN protocol based on IEEE 802.15.4. The network accommodates up to 36 nodes per gateway, with access to 14 nonoverlapping wireless channels, so you can reliably configure fourteen 36-node networks (2,016 analog channels) in the same vicinity without sharing any wireless bandwidth. Each radio delivers an outdoor range of up to 300 m with line of sight, and up to 100 m indoors, performing reliably even in high EMI environments.

Gateways, 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 or density 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.

When a node powers up, it scans for available networks, locates either a gateway or router node, and attempts to join. When the node joins the network, it downloads the latest configuration from the gateway and begins its normal operation of acquiring measurement data, controlling digital I/O, and transmitting data back to the gateway for processing, alarming, and visualization.

### Software Overview

With NI-WSN software, you can easily configure your sensor network and quickly extract measurement data from your wireless sensor network with the LabVIEW graphical development environment.

NI WSN measurement nodes configured with a gateway are automatically added to your LabVIEW project, giving you instant access to their I/O and properties. Simply drag and drop I/O variables from a LabVIEW project to a LabVIEW block diagram for data extraction, analysis, and presentation. Using the drag-and-drop LabVIEW variables, you can monitor the analog and digital channels as well as other node attributes such as link quality, battery voltage, and whether a node is configured as a router or end node. Because of these properties, you can intelligently maintain your network and choose the best locations for your measurement nodes. The LabVIEW project interface also offers access to node property configuration utilities. You can modify node sample intervals, define the analog and digital channel parameters, and provide aliases.

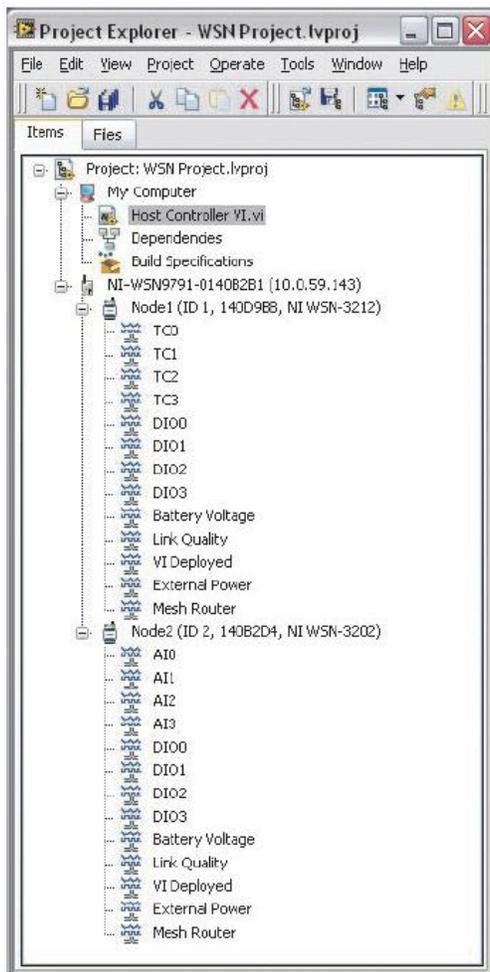


Figure 1. LabVIEW Project and NI WSN

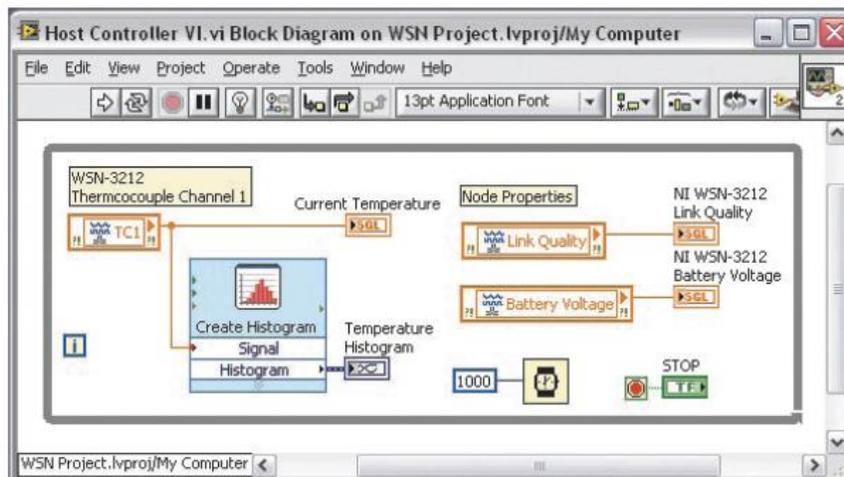


Figure 2. Extracting NI WSN Measurement Data Using LabVIEW

LabVIEW delivers a common development environment for all of your monitoring and control applications as well as rapid programming, easy network configuration, and open connectivity to a variety of third-party instruments and systems. And with a multitude of LabVIEW add-ons, you can visualize data in a Web browser, conduct advanced data processing and analysis, or perform integrated event detection and alarming

### Node Programming (LabVIEW WSN)

You can customize the behavior of programmable NI WSN measurement nodes with the LabVIEW WSN Module. Use this module to perform custom analysis, extend battery life, and embed local decision making on NI WSN measurement nodes.

With the LabVIEW WSN Module, you can significantly increase the battery life of your NI WSN measurement nodes while increasing performance and flexibility. By default, a node transmits every acquired value back to the gateway at the specified sample interval; however, in many applications, it is sufficient to simply monitor a given input for a threshold crossing or average values over a period of time. In these applications, powering the radio to transmit every acquired sample uses excessive power and reduces battery life. With LabVIEW WSN, you can add intelligence to the node to transmit data only when required. Additionally, you can monitor battery voltage and network status as well as modify the sample interval of the node to optimize behavior for specific operating conditions.

This also helps you achieve higher sample rates by customizing how the node acquires and transmits data. Exact sample rates depend on how many channels you are sampling, the analysis performed on each sample, and how many samples are transmitted back to the host, but programmable WSN nodes can achieve faster sample rates than those noted in the specifications. Refer to the LabVIEW WSN benchmarks white paper on NI Developer Zone for more information on increasing sample rates.

Using a subset of LabVIEW analysis functions and floating-point math operations, you can preprocess data acquired by NI WSN measurement nodes. A variety of analog and digital sensors can interface directly with these nodes, and you can use LabVIEW WSN to scale and convert raw sensor data into meaningful engineering units before transmitting.

With LabVIEW WSN, you can also embed intelligence on NI WSN measurement nodes, so decisions can be made autonomously without transmitting the stimulus and response to and from a host computer or embedded controller. You can use the digital output lines on an NI WSN measurement node to actuate relays and perform simple on/off control. For example, a programmed node can turn on a fan when a temperature threshold is exceeded, which reduces response time and increases reliability by removing the need for host interaction.

## NI WSN Applications and Architectures

NI wireless sensor networks are ideally suited for long-term remote monitoring applications for subjects such as the environment, water quality, structural health, energy quality and consumption, transportation, and machine condition. NI WSN measurement nodes can withstand outdoor and industrial environments and reliably monitor assets or surroundings to provide enhanced visibility into the overall health of your systems or processes.

The NI WSN platform can function as a simple, stand-alone wireless monitoring system, or be combined with other hardware components to achieve a complete wired and wireless measurement and control system. Through LabVIEW, you can combine NI wireless sensor network devices with other NI platforms to customize and enhance your measurement capabilities. You can complement your NI WSN with embedded NI CompactRIO systems, vision systems, or even human machine interfaces (HMIs) to create a fully integrated solution that meets the unique needs of your application.

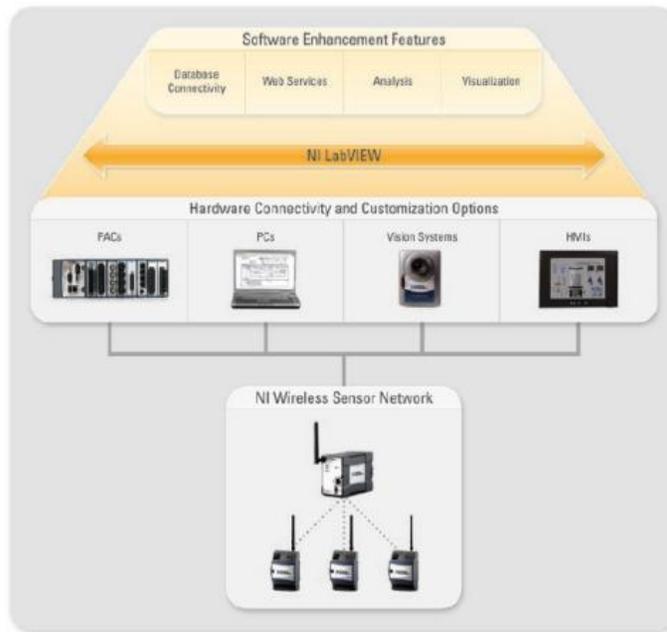


Figure 3. Customize and enhance your NI WSN system.

## Mechanical Information

The measurement node housing measures 5 by 3.3 by 1.5 in. (H by W by D), with the external antenna extending 4.25 in., resulting in a total height of 9.25 in. You can unscrew the faceplate of the measurement node to reveal the battery compartment, which holds four AA batteries and a reset button for manual reboots. Consult the user guide for detailed mechanical information.



Figure 4. Measurement Node External Features



Figure 5. Outdoor Enclosure With NI WSN Measurement Node (not included)

## Accessories

NI WSN accessories include options for gateway and measurement node mounting as well as weatherproof enclosures for outdoor use of the measurement nodes and gateways. Available mounting accessories offer 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.

The NI WSN-3291 is an outdoor, weatherproof enclosure for NI WSN measurement nodes. The enclosure features two I/O glands for routing power or sensor cables and is shipped with four I/O gland inserts and two I/O gland plugs so you can customize the glands for your application. The WSN-3291 offers an IP65 (Ingress Protection) rating to protect NI WSN measurement nodes for long-term, outdoor deployment.

Please view the WSN accessories data sheet for a complete list of WSN mounting accessories, outdoor enclosures, backshell kits, and power supplies.

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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
<b>Nonprogrammable Measurement Nodes</b>			
NI WSN-3202 Analog Input Node (Europe/Asia)	780997-11	No accessories required.	
NI WSN-3212 Thermocouple Input Node (Americas)	780998-01	No accessories required.	
NI WSN-3212 Thermocouple Input Node (Europe/Asia)	780998-11	No accessories required.	
NI WSN-3226 Voltage/RTD Combination Node (Americas)	781295-01	No accessories required.	
NI WSN-3226 Voltage/RTD Combination Node (Europe/Asia)	781295-11	No accessories required.	
NI WSN-3202 Analog Input Node (Americas)	780997-01	No accessories required.	
<b>Starter Kits</b>			
NI WSN Starter Kit (Europe/Asia)	781080-11	No accessories required.	
NI WSN Starter Kit (Americas)	781080-01	No accessories required.	
<b>Outdoor Enclosures</b>			
NI WSN-3291 Measurement Node Enclosure	780994-01	No accessories required.	
NI WSN-3294 Ethernet Gateway Enclosure	199975-01	No accessories required.	
<b>WSN Gateways</b>			
NI 9792 Programmable WSN Gateway (Europe/Asia)	781294-11	No accessories required.	
NI WSN-9791 Ethernet Gateway (Europe/Asia)	780996-11	No accessories required.	
NI 9792 Programmable WSN Gateway (Americas)	781294-01	No accessories required.	
NI WSN-9791 Ethernet Gateway (Americas)	780996-01	No accessories required.	
<b>Programmable Measurement Nodes</b>			
NI WSN-3226 Voltage/RTD Combination Node (Europe/Asia)	781295-12	No accessories required.	
NI WSN-3202 Analog Input Node (Europe/Asia)	780997-12	No accessories required.	
NI WSN-3212 Thermocouple Input Node (Americas)	780998-02	No accessories required.	
NI WSN-3212 Thermocouple Input Node (Europe/Asia)	780998-12	No accessories required.	
NI WSN-3226 Voltage/RTD Combination Node (Americas)	781295-02	No accessories required.	
NI WSN-3202 Analog Input Node (Americas)	780997-02	No accessories required.	

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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.

- **Support** - Visit ni.com/support to access the NI KnowledgeBase, example programs, and tutorials or to contact our applications engineers who are located in NI sales offices around the world and speak the local language.

- **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](http://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.

- **Classroom training in cities worldwide** - the most comprehensive hands-on training taught by engineers.
- **On-site training at your facility** - an excellent option to train multiple employees at the same time.
- **Online instructor-led training** - lower-cost, remote training if classroom or on-site courses are not possible.
- **Course kits** - lowest-cost, self-paced training that you can use as reference guides.
- **Training memberships** and training credits - to buy now and schedule training later.

Visit [ni.com/training](http://ni.com/training) for more information.

## Extended Warranty

NI offers options for extending the standard product warranty to meet the life-cycle requirements of your project. In addition, because NI understands that your requirements may change, the extended warranty is flexible in length and easily renewed. For more information, visit [ni.com/warranty](http://ni.com/warranty).

## OEM

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](http://ni.com/oem).

## Alliance

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](http://ni.com/alliance).

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## Detailed Specifications

The following specifications are typical for the range –40 to 70 °C unless otherwise noted.

For the gateway specifications, refer to the gateway documentation.

Analog Input	
Number of channels	4 single-ended channels
ADC resolution	16 bits
DNL	No missing codes guaranteed
INL	Refer to the <i>Absolute Accuracies Formulas</i> section
Minimum sample interval	1 second
Input coupling	DC
Nominal input ranges	±10 V, ±5 V, ±2 V, ±0.5 V
Minimum over range	4%
Input impedance (at DC)	
Powered on	>1 GΩ
Powered off/overload	10 kΩ
Input bias current	3 nA
Crosstalk (at 1 KHz)	
Adjacent channels	>100 dB
Non-adjacent channels	>100 dB
Analog bandwidth	7 kHz
Overvoltage protection	±30 V (one channel only)

## AI Absolute Accuracy Tables and Formulas

The values in the following tables are based on calibrated scaling coefficients, which are stored in the onboard EEPROM.

Accuracy Summary				
Nominal Range (V)	Maximum Absolute Accuracy (mV)* -40 to 70 °C	Typical Absolute Accuracy (mV)* 25 ° ±5 °C	Random Noise $\sigma$ ( $\mu\text{V}_{\text{rms}}$ )	Sensitivity† ( $\mu\text{V}$ )
±10	38.21	3.70	342	137
±5	22.91	2.40	172	68.5
±2	10.52	1.49	69	27.5
±0.5	2.69	0.29	18	7

\* Absolute accuracy values at full scale on the analog input channels computed using the specified temperature range and are valid for averaging 100 samples immediately following calibration. Refer to the *Absolute Accuracy Formulas* section for more information.

† Sensitivity is the smallest voltage change that can be detected. It is a function of noise.

Accuracy Details (Maximum Values)					
Nominal Range (V)	Residual Gain Error (ppm of Reading)	Gain Tempco (ppm/°C)	Residual Offset Error (ppm of Range)	Offset Tempco (ppm of Range/°C)	INL Error (ppm of Range)
±10	102	31	164	22	100
±5	137	41	240	22	100
±2	182	48	420	22	100
±0.5	160	50	300	24	100

## Absolute Accuracy Formulas

$AbsoluteAccuracy = Reading \cdot GainError + Range \cdot OffsetError + NoiseUncertainty$

$GainError = ResidualGainError + GainTempco \cdot TempChangeFromLastCal$

$OffsetError = ResidualOffsetError + OffsetTempco \cdot TempChangeFromLastCal + INL\_Error$

$NoiseUncertainty = (3 \cdot RandomNoise) / \sqrt{NumberOfReadings}$  for a coverage factor of  $3\sigma$  and averaging 100 points.

Absolute accuracy at full scale on the analog input channels is determined using the following assumptions:

$TempChangeFromLastCal = 45\text{ °C}$

$NumberOfReadings = 100$

$CoverageFactor = 3\sigma$

For example, on the 10 V range, the absolute accuracy at full scale is as follows:

$GainError = 10\text{ V} \cdot (102\text{ ppm} + 31\text{ ppm} \cdot 45) = 14.97\text{ mV}$

$OffsetError = 10\text{ V} \cdot (164\text{ ppm} + 22\text{ ppm} \cdot 45 + 100\text{ ppm}) = 12.54\text{ mV}$

$NoiseUncertainty = 3 \cdot 342\text{ }\mu\text{V} / 100^{0.5} = 0.103\text{ mV}$

$AbsoluteAccuracy = 27.61\text{ mV}$

## Sensor Power

Voltage

Typical (10 mA)	12.6 V
Minimum	11.5 V
Maximum	13.35 V
Output Current	17 mA maximum at -40 to 70 °C, 20 mA maximum at 25 °C
Delay from sensor power active to measurement	0 ms, 25 ms, 100 ms, 200 ms, always ON

## Digital I/O

Number of channels	4 bi-directional, individually settable
Modes (configurable per channel)	Drive High Only, Drive Low Only, Drive High and Low, and Tristate
Power-on output state	High Impedance, Tristate
DIO power supply voltage range ( $V_{\text{DIO\_PWR}}$ )	5 to 30 V

## Digital Output

Total DIO current (all channels)	1 A maximum
Output current (one channel)	0.5 A maximum

Output voltage	
Sourcing	$V_{DIO\ PWR} - 0.5\ V - (0.9\ \Omega \times I_{OUT})$ minimum
Sinking	$0.9\ \Omega \times I_{OUT}$ maximum
Protection	
Voltage	30 VDC maximum
Reversed voltage	30 VDC maximum
Short circuit	
Trip current	0.57 A minimum 3.5 A maximum
Trip time	2.5 s at 5 A typical at 25 °C
Switching time	
Sinking, 10 K $\Omega$ pull-up	15 $\mu$ s
Sourcing, 10 K $\Omega$ pull-down	3.5 ms
<b>Digital Input (Tristate Mode)</b>	
Input voltage range	0 to 30 V
Digital input logic levels	
High level input voltage	1.7 to 30 V
Low level input voltage	0 to 0.45 V
Input current (0 to 30 V)	-160 $\mu$ A to 400 $\mu$ A, maximum
Contact to ground detection	
Contact close resistance (to ground)	<2.5 K $\Omega$
Contact open resistance (to ground)	>40 K $\Omega$
Contact capacitance	<20 nF
<b>Node Resources for LabVIEW WSN</b>	
User flash size	248 Kbytes
Number of flash erase cycles per sector	100,000
<b>Wireless Characteristics</b>	
Radio mode	IEEE 802.15.4
RF data rate	250 kbit/s
Frequency band <sup>1</sup>	ISM 2.4 GHz (2400 MHz to 2483.5 MHz)
Channels <sup>2</sup>	11–24
TX power	
Americas	+17 db (50 mW)
International	+10 db (10 mW)
Range	
Americas	Up to 300 m
International	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 $\Omega$
Directivity	Omni
Nominal gain	1.5 dBi

## Power Requirements

 **Caution** Use the NI WSN-3202 with a 24 VDC, 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.

### Battery Power

The battery power specifications are typical at 25 °C. Do not use rechargeable batteries.

#### Internal battery

Type	4 AA, alkaline only
Voltage range	3.6–7.5 V
Power consumption <sup>3</sup>	
60 second sample interval	0.5 mW at 6 V
1 second sample interval	13.3 mW at 6 V

#### Battery life <sup>3</sup>

60 second sample interval	Up to 3 years
1 second sample interval	Up to 1 month

### External Power

External power	9 to 30 V
Power input mating connector	2-position mini-combicon, Phoenix Contact part number: 1714977
Power consumption	
End node mode	
60 second sample interval	16 mW at 24 V
1 second sample interval	33 mW at 24 V
Router mode <sup>4</sup>	300 mW at 24 V

## Physical Characteristics

Screw-terminal wiring	14 to 24 AWG wire
Torque for screw terminals	0.2 to 0.25 N · m
Dimensions	Refer to the <i>NI WSN-3202 Device Dimensions</i> figure in the <i>NI WSN-3202 User Guide and Specifications</i> for device dimensions
Weight	Approximately 242 g (8.5 oz)
Weight with antenna	Approximately 256 g (9 oz)

### Antenna Dimensions

Not attached	+5.71 mm (+0.225 in.)
Attached, fully extended	+108.7 mm (+4.28 in.)

 **Note** Refer to the *Dimensions* section of the *NI WSN-3202 User Guide and Specifications* for device dimensions with the antenna attached.

## Safety Standards

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

The NI WSN-3202 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

- EN 50371, 60215, & FCC 1.1310 Radiation Exposure Limits



**Note** For UL and other safety certifications, refer to the product label, or go to [ni.com/certification](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## Safety Voltages

Connect only voltages that are within these limits.

V terminal to C terminal	30 V max, Measurement Category I
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Measurement Category I is for measurements performed on circuits not directly connected to the electrical distribution system referred to as MAINS voltage. MAINS is a hazardous live electrical supply system that powers equipment. This category is for measurements of voltages from specially protected secondary circuits. Such voltage measurements include signal levels, special equipment, limited-energy parts of equipment, circuits powered by regulated low-voltage sources, and electronics.



**Caution** Do *not* connect the system to signals or use for measurements within Measurement Categories II, III, or IV.

## RF Safety Warning

This equipment complies with FCC radiation exposure limits set for uncontrolled equipment and meets the FCC radio frequency (RF) Exposure Guidelines in Supplement C to OET65. This product generates and radiates radio frequency energy. To comply with the radio frequency radiation exposure guidelines in an uncontrolled environment, this equipment should be installed and operated with at least 20 cm between the radiator and the person's body (excluding extremities: hands, wrists, feet, and legs).

## Environmental

The NI WSN-3202 is intended for indoor use only. For outdoor use, mount the system in a suitably rated enclosure.

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

## Shock and Vibration

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

## 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 61326-2-1 (IEC 61326-2-1): Class A emissions; Industrial 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



**Caution** Operate this product with shielded cables and accessories.



**Note** For EMC certification and additional information, refer to the product label or the *Online Product Certification* section.

## 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 (EMC) Directive
- 1999/5/EC; Radio and Telecommunications Terminal Equipment (R&TTE) Directive

## 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](http://ni.com/certification), search by model number or product line, and click the appropriate link in the Certification column.

## EU Regulatory Statements

National Instruments tímto prohlašuje, že tento NI WSN-3202 je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice
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 Český [Czech]	1999/5/ES.
 Dansk [Danish]	Undertegnede National Instruments erklærer herved, at følgende udstyr NI WSN-3202 overholder de væsentlige krav og øvrige relevante krav i direktiv 1999/5/EF.
 Deutsch [German]	Hiermit erklärt National Instruments, dass sich das Gerät NI WSN-3202 in Übereinstimmung mit den grundlegenden Anforderungen und den übrigen einschlägigen Bestimmungen der Richtlinie 1999/5/EG befindet.
 Eesti [Estonian]	Käesolevaga kinnitab National Instruments seadme NI WSN-3202 vastavust direktiivi 1999/5/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.
 English	Hereby, National Instruments, declares that this NI WSN-3202 is in compliance with the essential requirements and other relevant provisions of Directive 1999/5/EC.
 Español [Spanish]	Por medio de la presente National Instruments declara que el NI WSN-3202 cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 1999/5/CE.
 Ελληνική [Greek]	ΜΕ ΤΗΝ ΠΑΡΟΥΣΑ National Instruments ΔΗΛΩΝΕΙ ΟΤΙ ΝΙ WSN-3202 ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 1999/5/ΕΚ.
 Français [French]	Par la présente National Instruments déclare que l'appareil NI WSN-3202 est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 1999/5/CE.
 Italiano [Italian]	Con la presente National Instruments dichiara che questo NI WSN-3202 è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 1999/5/CE.
 Latvīski [Latvian]	Ar šo National Instruments deklarē, ka NI WSN-3202 atbilst Direktīvas 1999/5/EK būtiskajām prasībām un citiem ar to saistītajiem noteikumiem.
 Lietuvių [Lithuanian]	Šiuo National Instruments deklaruoja, kad šis NI WSN-3202 atitinka esminius reikalavimus ir kitas 1999/5/EB Direktyvos nuostatas.
 Nederlands [Dutch]	Hierbij verklaart National Instruments dat het toestel NI WSN-3202 in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 1999/5/EG.
 Malti [Maltese]	Hawnhekk, National Instruments, jiddikjara li dan NI WSN-3202 jikkonforma mal-htigijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 1999/5/EC.
 Magyar [Hungarian]	Alulírott, National Instruments nyilatkozom, hogy a NI WSN-3202 megfelel a vonatkozó alapvető követelményeknek és az 1999/5/EC irányelv egyéb előírásainak.
 Polski [Polish]	Niniejszym National Instruments. oświadcza, że NI WSN-3202 jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 1999/5/EC.
 Português [Portuguese]	National Instruments declara que este NI WSN-3202 está conforme com os requisitos essenciais e outras disposições da Directiva 1999/5/CE.
 Slovensko [Slovenian]	National Instruments izjavlja, da je ta NI WSN-3202 v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 1999/5/ES.
 Slovenský [Slovak]	National Instruments týmto vyhlasuje, že NI WSN-3202 spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 1999/5/ES.
 Suomi [Finnish]	National Instruments vakuuttaa täten että NI WSN-3202 tyyppinen laite on direktiivin 1999/5/EY oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.
 Svenska [Swedish]	Härmed intygar National Instruments att denna NI WSN-3202 står i överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 1999/5/EG.
Íslenska [Icelandic]	Hér með lýsir National Instruments yfir því að NI WSN-3202 er í samræmi við grunnkröfur og aðrar kröfur, sem gerðar eru í tilskipun 1999/5/EC.
 Norsk [Norwegian]	National Instruments erklærer herved at utstyret NI WSN-3202 er i samsvar med de grunnleggende krav og øvrige relevante krav i direktiv 1999/5/EF.

## Environmental Management

NI 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](http://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 the product life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers, National Instruments WEEE initiatives, and compliance with WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment, visit [ni.com/environment/weee.htm](http://ni.com/environment/weee.htm).

**Battery Replacement and Disposal**



**Battery Directive** This device contains a long-life coin cell battery. If you need to replace it, use the Return Material Authorization (RMA) process or contact an authorized National Instruments service representative. For more information about compliance with the EU Battery Directive 2006/66/EC about Batteries and Accumulators and Waste Batteries and Accumulators, visit [ni.com/environment/batterydirective](http://ni.com/environment/batterydirective).

**电子信息产品污染控制管理办法（中国 RoHS）**



**中国客户** National Instruments 符合中国电子信息产品中限制使用某些有害物质指令 (RoHS)。关于 National Instruments 中国 RoHS 合规性信息，请登录 [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china)。(For information about China RoHS compliance, go to [ni.com/environment/rohs\\_china](http://ni.com/environment/rohs_china).)

**Regulatory Information**

**United States**

This product generates and radiates radio frequency energy. To comply with the radio frequency radiation exposure guidelines in an uncontrolled environment, this equipment must be installed and operated while maintaining a minimum body-to-antenna distance of 20 cm.

This product complies with Part 15 of the FCC Rules. Operation is subject to these two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This product does not contain any user serviceable components. Any unauthorized product changes or modifications will invalidate the warranty and all applicable regulatory certifications and approvals.

**Canada**

This product complies with Industry Canada RSS-210.

Cet appareil est conforme aux norme RSS210 d'Industrie Canada.



**Europe—EU Declaration of Conformity**

Marking by the above CE symbol on the label indicates compliance with the Essential Requirements of the R&TTE Directive of the European Union (1999/5/EC). This equipment meets the following conformance standards: EN 300 893, EN300 328, EN301 489-17, EN60950.

**Europe – Restrictions for Use of 2.4 GHz Frequencies in European Community Countries**

België/ Belgique:	For private usage outside buildings across public grounds over less than 300m no special registration with IBPT/BIPT is required. Registration to IBPT/BIPT is required for private usage outside buildings across public grounds over more than 300m. For registration and license please contact IBPT/BIPT. Voor privé-gebruik buiten gebouw over publieke grond over afstand kleiner dan 300m geen registratie bij BIPT/IBPT nodig; voor gebruik over afstand groter dan 300m is wel registratie bij BIPT/IBPT nodig. Voor registratie of licentie kunt u contact opnemen met BIPT. Dans le cas d'une utilisation privée, à l'extérieur d'un bâtiment, au-dessus d'un espace public, aucun enregistrement n'est nécessaire pour une distance de moins de 300m. Pour une distance supérieure à 300m un enregistrement auprès de l'IBPT est requise. Pour les enregistrements et licences, veuillez contacter l'IBPT.
Deutschland:	License required for outdoor installations. Check with reseller for procedure to follow. Anmeldung im Outdoor-Bereich notwendig, aber nicht genehmigungspflichtig. Bitte mit Händler die Vorgehensweise abstimmen.
France:	Restricted frequency band: only channels 1 to 7 (2400 MHz and 2454 MHz respectively) may be used outdoors in France. Bande de fréquence restreinte : seuls les canaux 1- 7 (2400 et 2454 MHz respectivement) doivent être utilisés endroits extérieur en France. Vous pouvez contacter l'Autorité de Régulation des Télécommunications ( <a href="http://www.art-telecom.fr">http://www.art-telecom.fr</a> ) pour la procédure à suivre.
Italia:	License required for indoor use. Use with outdoor installations not allowed. E' necessaria la concessione ministeriale anche per l'uso interno. Verificare con i rivenditori la procedura da seguire.
Nederland:	License required for outdoor installations. Check with reseller for procedure to follow. Licentie verplicht voor gebruik met buitenantennes. Neem contact op met verkoper voor juiste procedure.

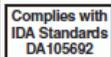
**Japan**

The certified radio equipment is embedded in this device.



201WW 08215142 本機器には認証済み無線設備が内蔵されています

**Singapore**



**Taiwan R.O.C.**

#### 低功率電波輻射性電機管理辦法

第十二條經型式認證合格之低功率射頻電機，非經許可，公司、商號或使用者均不得擅自變更頻率、加大功率或變更原設計之特性及功能。

第十四條低功率射頻電機之使用不得影響飛航安全及干擾合法通信；經發現有干擾現象時，應立即停用，並改善至無干擾時方得繼續使用。

前項合法通信，指依電信規定作業之無線電信。低功率射頻電機須忍受合法通信或工業、科學及醫療用電波輻射性電機設備之干擾。

<sup>1</sup> Due to regulations, the frequency bands depend upon the country of operation

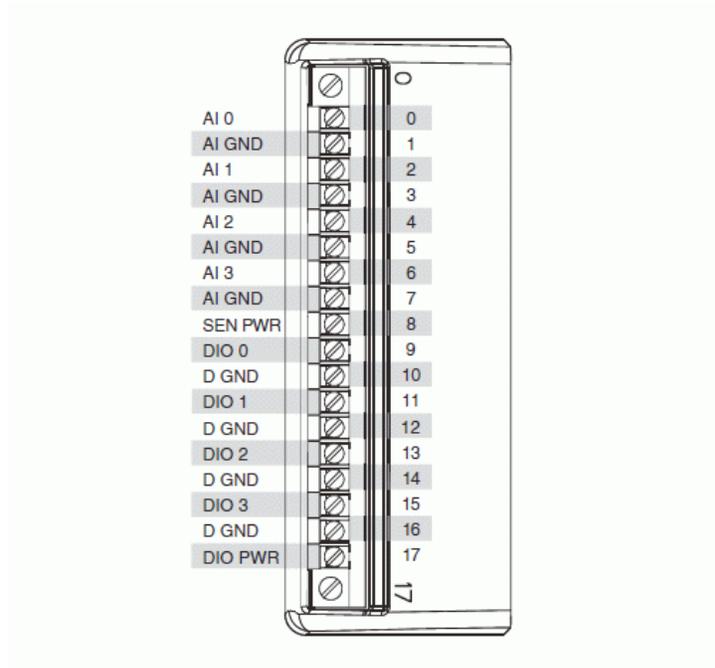
<sup>2</sup> Due to regulations, the valid channels depend upon country of operation.

<sup>3</sup> Device executing NI-WSN firmware. End node mode. Sensor power not used.

<sup>4</sup> Router connected directly to gateway. Routing messages for one end node at a one minute sample interval.

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## Pinouts/Front Panel Connections



NI WSN-3202 Connector Pinout

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