

Detailed Specifications

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## Wireless Sensor Network Serial Nodes NI WSN-3230 (RS232), NI WSN-3231 (RS485)



- Programmable, autonomous interface to serial sensors, instruments, and control boards
- Deploy embedded code to create a local communication loop between the node and serial device
- 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 that 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 300 m outdoor range
- 1 serial port per node with user-selectable baud rates, parity bits, stop bits, and flow control
- Two bidirectional digital channels configurable for input, sinking output, or sourcing output
- 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 serial node features one serial port and two digital I/O channels that you can configure for input, sinking output, or sourcing output. With NI LabVIEW graphical system design software, you can easily configure your network, collect measurement data, trigger alarms through SMS or email, 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 and create an autonomous interface to serial-based sensors, instruments, and control boards. 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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### Application and Technology

#### Autonomous, Programmable Serial Interface

The NI WSN-3230 and WSN-3231 measurement nodes deliver wireless connectivity to serial-based sensors, instruments, and control boards. Using the LabVIEW WSN Module and the LabVIEW Serial Compatibility API, you can deploy graphical code to embed command, query, and parse algorithms to the node, which creates a local, autonomous communication loop between the node and the serial device, as seen in Figure 1.

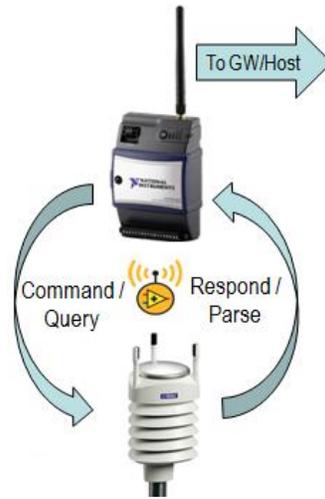


Figure 1. WSN Serial Node Communication Model

The LabVIEW Serial Compatibility API helps you configure baud rate, stop bits, parity bits, and flow control. Using the API, you can initialize the serial channel, send commands to the serial device, and then read back and parse the returned data, all locally without over-the-air communication and associated latency. Then you can send important data over the air back to the WSN gateway/host machine via user-defined I/O variables (UDVs).

With the LabVIEW WSN Module, the custom applications are wirelessly downloaded to the node's onboard processor, and because these applications are written in the LabVIEW graphical development environment, customizing node firmware is easy and does not require low-level assembly or machine code knowledge. With deployed LabVIEW WSN code, you can also conduct local data analysis, respond to digital value changes or network status changes, and perform local control of the two digital I/O lines. The digital I/O lines feature industrial ranges and can be configured for input, sinking output, and sourcing output.

### Power

You can power the NI WSN measurement nodes with four 1.5 V AA alkaline or lithium battery cells. The node also 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 nodes support 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 1 A. The serial nodes also feature a sensor power output channel, which delivers up to 50 mA at 12 V, and can be used to deliver power to external devices or sensors.

### Battery Lifetime

With the flexibility of the node, you can specify baud rates, packet lengths, parity bits, stop bits, and flow control. Using LabVIEW WSN, you can customize the node to modify transmit intervals (when data is passed back over the air to the gateway). These factors, among others, influence the battery-powered lifetime of the devices, as seen in the following graphs. Results are typical, and you can assume 25 °C operating temperature, alkaline cells, sensor power turned off, and a single node network.

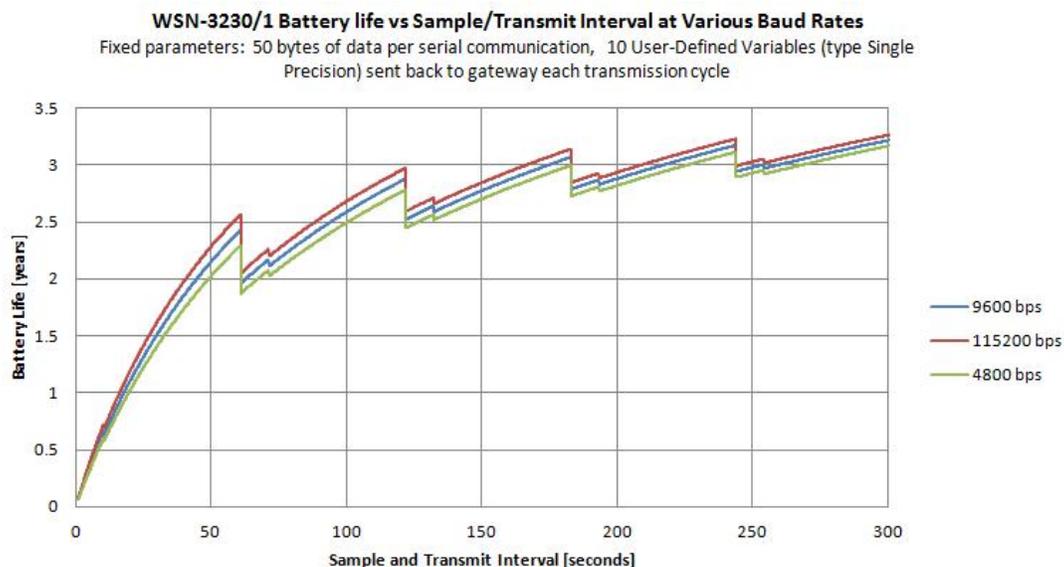


Figure 2. Serial Node Battery Life Versus Sample/Transmit Interval at Various Baud Rates

**WSN-3230/1 Battery life vs Sample/Transmit Interval for Various Data Type/Lengths Sent back to Gateway per Transmission Cycle**  
 Fixed parameters: 50 bytes of data per serial communication, 9600 bps baud rate

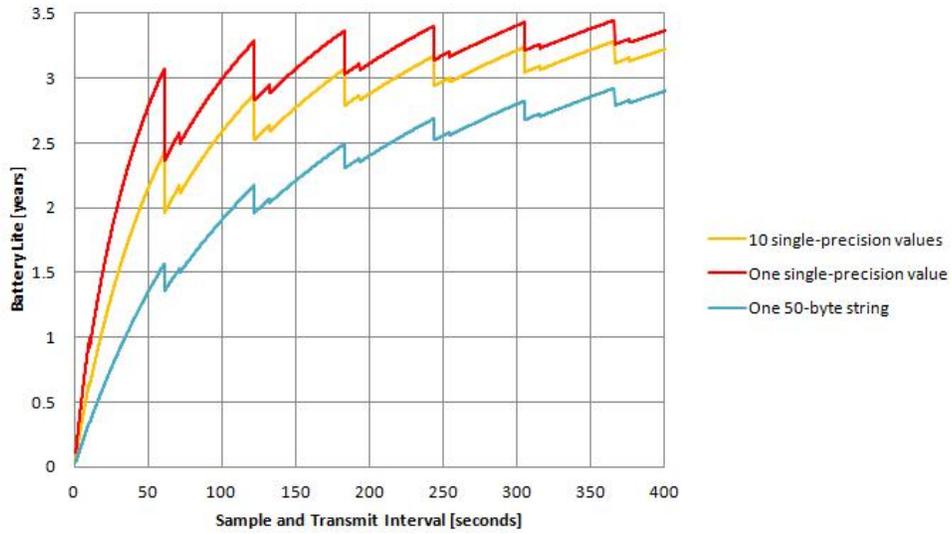


Figure 3. Serial Node Battery Life Versus Sample/Transmit Interval for Various Data Types/Lengths

**WSN-3230/1 Battery life vs Sample/Transmit Interval for Various Data Lengths per Serial Communication**  
 Fixed parameters: 9600 bps baud rate, 10 User-Defined Variables (type Single Precision) sent back to gateway each transmission cycle

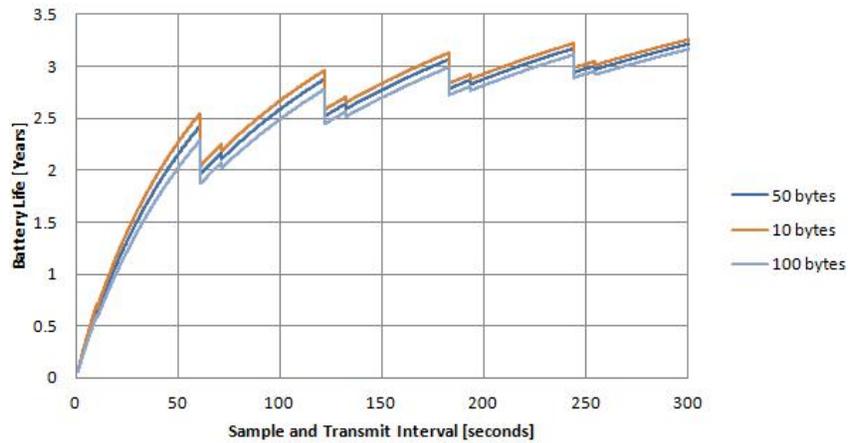


Figure 4. Serial Node Battery Life Versus Sample/Transmit Interval for Various Data Lengths

Using LabVIEW WSN to limit over-the-air transactions, you can achieve significant battery lifetime improvement, as shown Figure 5.

## WSN-3230/1 Battery Life vs Sample Interval at Various Transmit Intervals

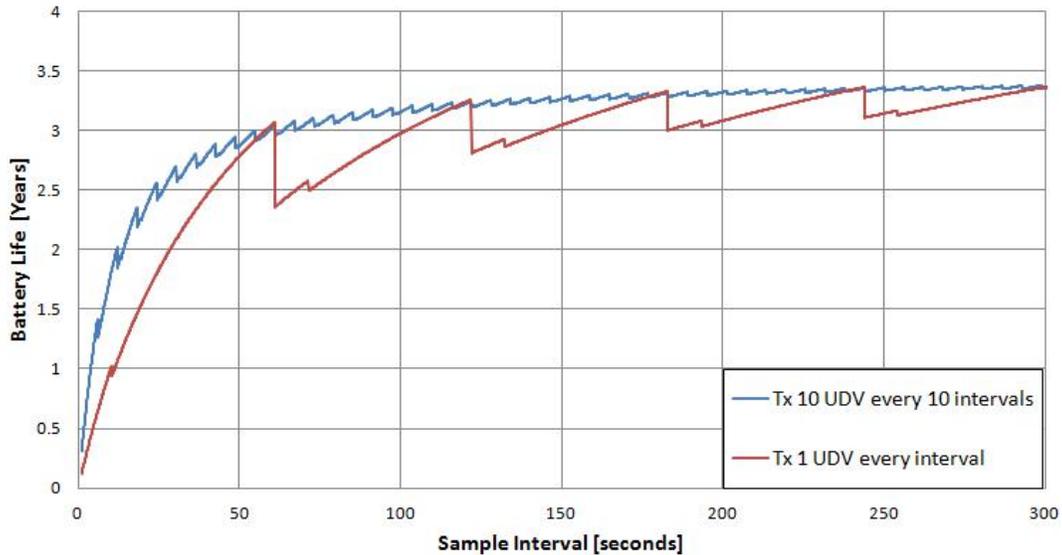


Figure 5. Using LabVIEW WSN can greatly increase battery life for sample intervals under 60 seconds.

### 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 that 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 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. These properties help you intelligently maintain your network and choose the best locations for your measurement nodes.

With the NI WSN serial nodes, you can determine when to send data back to the gateway. You can create custom I/O channels called user-defined I/O variables (UDVs) to transmit data from the node to the gateway/host. This could be string or numeric data, depending on the type of serial instrument you are interfacing with and the type of data returned by each serial command/query. These variables are created within the LabVIEW project, and can be written to or read from in LabVIEW.

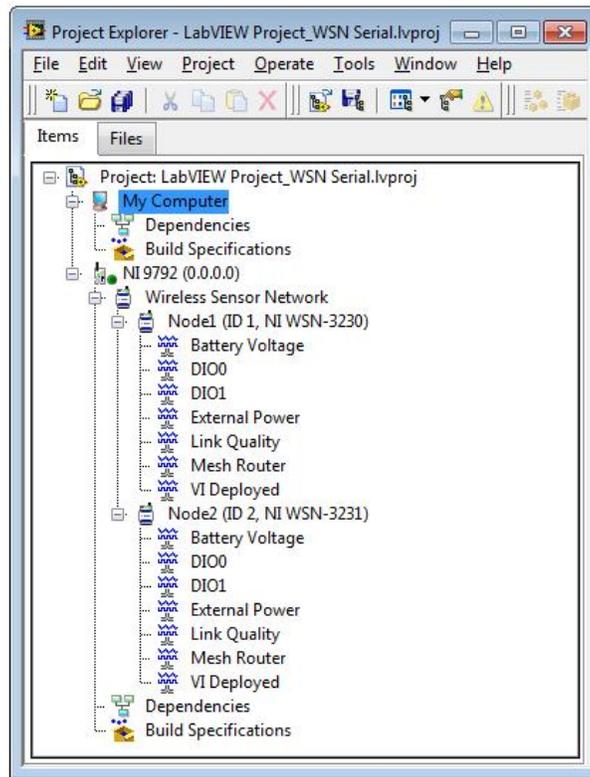


Figure 6. LabVIEW Project Window Showing Serial Node Hierarchy

### Node Programming (LabVIEW WSN)

The LabVIEW Serial Compatibility API helps you configure baud rate, stop bits, parity bits, and flow control. Using the API, you can initialize the serial channel, send commands to the serial device, and then read back and parse the returned data, all locally without over-the-air communication and associated latency. Then you can send important data over the air back to the WSN gateway/host machine via UDVs. Figure 7 shows an example. "Temperature," "Status," and "String from Sensor" are three different types of user-defined variables that contain information from the serial device.

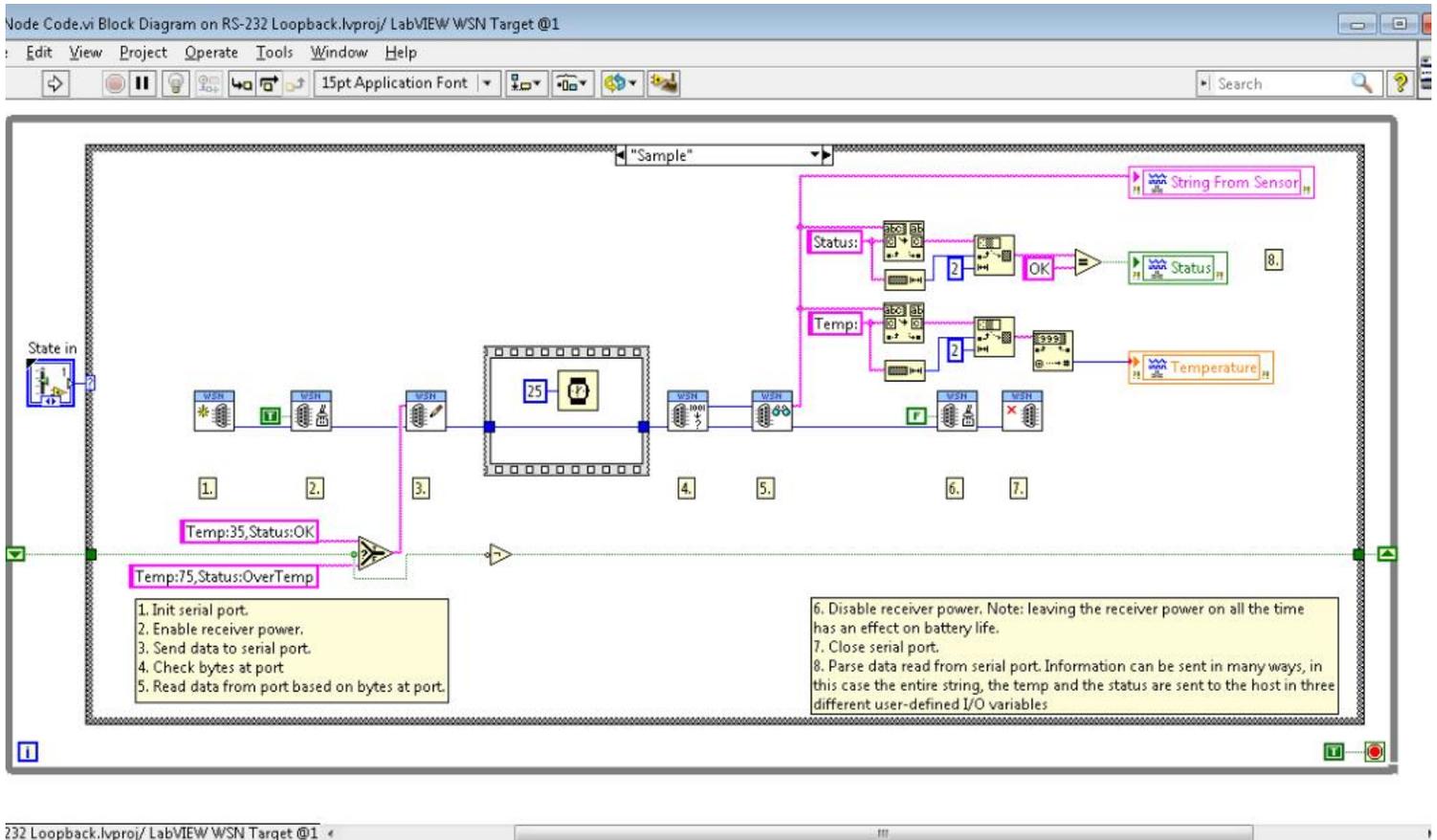


Figure 7. Use LabVIEW WSN to create a programmable serial interface to sensors, instruments, and control boards.

In addition to using the LabVIEW WSN Module to create a local, autonomous interface to serial devices, you can 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. Instead of transmitting every received string or value back to the gateway, 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.

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 such as environmental monitoring, water quality monitoring, structural health monitoring, energy quality and consumption monitoring, transportation, and machine condition monitoring. 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 WSN 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.

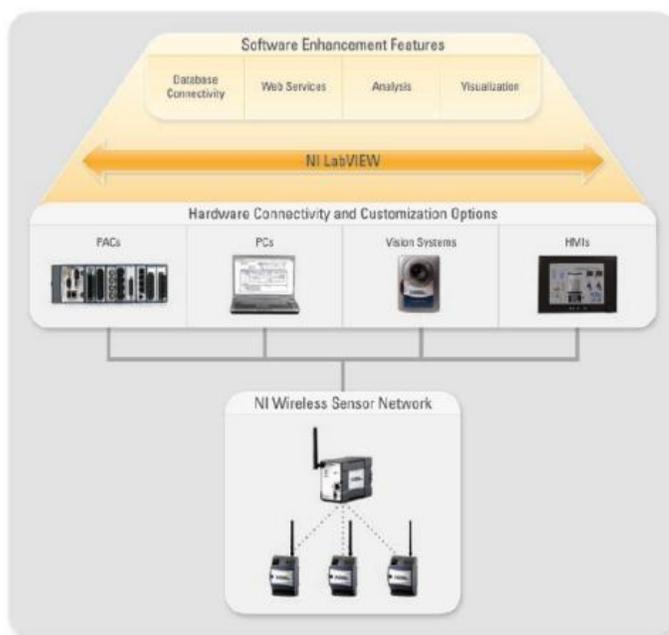


Figure 8. Complement NI WSN systems with additional hardware and software.

## 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 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.

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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## 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](http://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](http://ni.com/calibration).

## Technical Support

Get answers to your technical questions using the following National Instruments resources.

- **Support** - Visit [ni.com/support](http://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](http://forums.ni.com) for a diverse set of discussion boards on topics you care about.
- **Online Community** - Visit [community.ni.com](http://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

These specifications are typical from -40 to 70°C, unless otherwise noted. Refer to the LabVIEW WSN Pioneer Performance Benchmarks document, at [zone.ni.com](http://zone.ni.com) for more information. For the NI WSN gateway specifications, refer to the gateway documentation.

| RS-232   |  |
|--|--|
| Baud rate  | 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 56000, 57600, 115200, 128000, 153600, 230400 bps |
| Data bits  | 7 or 8   |
| Stop bits  | 1 or 2   |
| Parity   | Odd, even, or none   |
| Flow control   | Hardware (RTS/CTS), software (XON/XOFF), none  |
| Maximum cable length   | 2500 pF equivalent   |
|  <b>Note</b> Cable capacitance greater than 1000 pF may adversely affect the maximum baud rate. |  |
| Maximum RS-232 continuous voltage, (RX, CTS)   | ±15 V  |
| Data line ESD protection (human body model)  | ±8 kV  |

|   |  |
|---|--|
| Overvoltage protection                      | ±30 VDC  |
| <b>RS-485</b>                               |  |
| Maximum cable length                        | 1.2 km (4,000 ft)  |
| Baud rate                                   | 300, 600, 1200, 1800, 2400, 4800, 7200, 9600, 14400, 19200, 28800, 38400, 56000, 57600, 115200, 128000, 153600, 230400 bps |
| Supported modes                             | 4 wire, 2 wire auto  |
| Data bits                                   | 7 or 8   |
| Stop bits                                   | 1 or 2   |
| Parity                                      | Odd, even, or none   |
| Flow control                                | Software (XON/XOFF), none  |
| Maximum RS-485 common-mode voltage          | -7 V to +12 V  |
| Data line ESD protection (human body model) | ±8 kV  |
| Overvoltage protection                      | ±30 VDC  |
| <b>Sensor Power</b>                         |  |
| Voltage                                     | 12 V ±10%  |
| Current                                     | 50 mA maximum  |
| Protection                                  |  |
| Short circuit proof                         | Indefinitely   |
| Overvoltage protection                      | ±30 V  |
| <b>Digital I/O</b>                          |  |
| Number of channels                          | 2  |
| Power-on output state                       | High impedance   |
| DIO pin capacitance                         | 200 pF   |
| <b>Digital Input</b>                        |  |
| Modes (configurable per channel)            | 24V Sinking, 24V Sinking with Power Management, TTL Logic, Contact Closure   |
| Input voltage range                         | 0 to 30 VDC maximum  |
| Digital input logic level thresholds        |  |
| TTL Logic and Contact Closure modes         |  |
| High level (ON) input voltage               | ≥2 V   |
| Low level (OFF) input voltage               | ≤0.8 V   |
| 24V modes                                   |  |
| IEC 1131-2 compatibility                    | Type 1 and 3   |
| High level (ON) input voltage               | ≥10 V  |
| High level (ON) input current               | ≥2 mA  |
| High level (OFF) input voltage              | ≤6 V   |
| Low level (OFF) input current               | ≤1 mA  |
| Input current                               |  |
| TTL Logic and Contact Closure modes         | ≤375 μA at 30 V<br>≤110 μA at 5 V<br>≤80 μA at 3 V   |
| Contact Closure mode pull-up current        | ≤175 μA through closed contact   |
| 24V modes                                   | ≤6.4 mA at 30 V<br>≤3.2 mA at 15 V   |
| Minimum detectable pulse width              |  |
| TTL Logic mode                              | 30 μs  |
| 24 V modes                                  | 30 μs  |
| Contact closure mode                        | 100 μs   |

| <b>Digital Output</b>                     |   |
|---|---|
| Modes (configurable per channel)          | Drive High (Sourcing), Drive Low (Sinking), Drive High and Low (Sinking and Sourcing), and 3V TTL Logic (Open-Collector with Pull-Up) |
| DIO power supply voltage range (VDIO_PWR) | 3.3 to 24 V   |
| Sourcing current (one channel)            | 250 mA maximum  |
| Sinking current (per channel)             | 1 A maximum   |
| Output voltage                            |   |
| Sourcing                                  | >(VDIO_PWR-750 mV) with IOUT <0.25 A  |
| Sinking                                   | <90 mV with IOUT <1 A   |
| 3V TTL Logic mode pull-up                 | >2 V with IOUT <20 $\mu$ A  |
| DO protection                             |   |
| Voltage                                   | +30 VDC maximum   |
| Reversed voltage                          | None  |
| Short circuit (sourcing)                  |   |
| Trip current                              | 0.26 A minimum, 1.2 A maximum   |
| Trip time                                 | <250 $\mu$ s, at 1.2 A  |
| Overcurrent (sinking)                     | 6.5 A maximum   |
| DO propagation delay                      |   |
| Sinking                                   | 150 $\mu$ s   |
| Sourcing                                  | 2.5 ms  |

### Node Resources for LabVIEW WSN

|                      |                                      |
|----------------------|--------------------------------------|
| User flash size      | 188 Kbytes                           |
| RF data rate         | 250 Kbps                             |
| Range                |                                      |
| Americas             | Up to 300 m                          |
| International        | Up to 150 m                          |
| Frequency band       | ISM 2.4 GHz (2400 MHz to 2483.5 MHz) |
| Channels             | 11-24                                |
| TX power             |                                      |
| Americas             | +17 dBm maximum (50 mW)              |
| International        | +10 dBm maximum                      |
| Modulation type      | DSSS (O-QPSK)                        |
| Receiver sensitivity | -102 dBm                             |
| Antenna              |                                      |
| Connector            | Female RP-SMA connector              |
| VSWR                 | 2.0 maximum                          |
| Impedance            | 50 $\Omega$                          |
| Directivity          | Omni                                 |
| Nominal gain         | 1.5 dBi                              |

### Power Requirements

The following power requirements specifications are typical at 25 °C.

| <b>Battery Power</b>   |   |
|--|---|
|  Caution Do not use rechargeable batteries. |   |
| Internal battery   | 4 AA 1.5 V alkaline or lithium batteries  |
| Only use the following batteries   | Energizer E91 AA, alkaline<br>Duracell MN1500 AA, alkaline<br>Energizer L91 AA, lithium |
| Battery operating temperature range  |   |

|                           |                 |
|---------------------------|-----------------|
| Energizer E91             | -18 °C to 55 °C |
| Duracell MN1500           | -20 °C to 54 °C |
| Energizer L91             | -40 °C to 60 °C |
| <b>Power consumption</b>  |                 |
| Sleep mode                | 1 mW            |
| 60 second sample interval | 1 mW at 12 V    |
| 1 second sample interval  | 20 mW at 12 V   |
| Router mode               | 200 mW at 12 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 Figure 2 for device dimensions |
| Weight                     | Approx. 242 g (8.5 oz)                  |
| Weight with antenna        | Approx. 256 g (9 oz)                    |

### Safety Standards

The NI WSN-3230/3231 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



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

### Hazardous Locations

|                |  |
|----------------|--|
| U.S. (UL)      | Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, AEx nA IIC T4 |
| Canada (C-UL)  | Class I, Division 2, Groups A, B, C, D, T4; Class I, Zone 2, Ex nA IIC T4  |
| Europe (DEMKO) | Ex nA IIC T4   |

### 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).

This equipment complies with the European Council Recommendation (1995/519/EC) on the limitation of exposure of the general public to electromagnetic fields. Compliance was determined in accordance with the requirements in EN 50371.

### Environmental

For outdoor use, mount the system in a suitably rated enclosure.

|  |                             |
|--|-----------------------------|
| Operating temperature (IEC 60068-2-1, IEC 60068-2-2) | - 40 to 70 °C               |
| Storage temperature (IEC 60068-2-1, 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                                     | 2, indoor use only          |

### Shock and Vibration

To meet these specifications, you must panel mount the system and use the NI 9940 backshell kit to protect the connections.

|   |  |
|---|--|
| Random (IEC 60068-2-64)                         | 5 g <sub>rms</sub> , 10 to 500 Hz  |
| Operating vibration, sinusoidal (IEC 60068-2-6) | 5 g, 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 |

### 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 (IEC 61326): 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

The NI WSN-3230/3231 also meets the requirements of the following EMC standards for intentional radiators:

- EN 300 328
- EN 301 489-1 and EN 301 489-17
- FCC 47 CFR Part 15C
- IC RSS-210



**Note** In the United States (per FCC 47 CFR), Class A equipment is intended for use in commercial, light-industrial, and heavy-industrial locations. In Europe, Canada, Australia and New Zealand (per CISPR 11) Class A equipment is intended for use only in heavy-industrial locations.



**Note** Group 1 equipment (per CISPR 11) is any industrial, scientific, or medical equipment that does not intentionally generate radio frequency energy for the treatment of material or inspection/analysis purposes.



**Note** For the standards applied to assess the EMC of this product, refer to 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 module number or product line, and click the appropriate link in the Certification column.

## Environmental Management

National Instruments 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 their life cycle, all products *must* be sent to a WEEE recycling center. For more information about WEEE recycling centers and National Instruments WEEE initiatives, visit [ni.com/environment/weee.htm](http://ni.com/environment/weee.htm).

### 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).)

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