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## NI 9795

### C Series WSN Gateway



- Elegantly add wireless I/O to your NI CompactRIO system
- Insert into any available slot in your CompactRIO chassis (one gateway per chassis currently supported)
- Data from distributed WSN measurement nodes is available from the host or within your CompactRIO real-time application
- 2.4 GHz, IEEE 802.15.4 radio to communicate with up to 36 distributed WSN nodes per chassis
- Up to 200 m outdoor range with line of sight

### 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.

Using the NI 9795 C Series WSN gateway, you can elegantly combine the benefits of distributed WSN monitoring with high-performance CompactRIO measurement and control systems. With this flexibility, you can create complete wired and wireless measurement and control solutions that meet your unique application needs.

The NI 9795 plugs into any available slot in your CompactRIO chassis and manages the wireless network of distributed WSN measurement nodes. Through the RIO Scan Interface, WSN I/O data is made available in your deployed LabVIEW Real-Time application, where you can integrate WSN I/O with the rest of your measurement and control system. Conversely, you can also access WSN I/O data directly from a host machine connected to the CompactRIO system. Because the data is passed through the scan interface, you can use the NI 9795 only in CompactRIO chassis that work with the scan interface. Additionally, only one NI 9795 is supported per CompactRIO chassis at this time.

With graphical NI LabVIEW 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 LabVIEW Real-Time Module, you can deploy embedded applications to run on CompactRIO to perform local processing, data hosting, and communication with other devices through serial or Ethernet. With the 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 digital I/O lines, and even store data to flash memory.

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## Application and Technology

### System and Network Architectures

NI wireless sensor networks (WSNs) are ideally suited for long-term remote monitoring applications focusing on subjects such as the environment, water quality, structural health, energy consumption, transportation, and machine conditioning. 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 system is built on a low-power, reliable IEEE 802.15.4 network. The WSN 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.



*Figure 1. Choose from three different gateways that deliver unique connectivity options.*

Up to 36 measurement nodes can communicate with a single gateway, and each gateway can operate on any of 14 wireless communication channels to increase network size and ensure coexistence with other wireless devices. This allows a full WSN system to scale to over 2,000 analog channels (14 gateways multiplied by 36 nodes per gateway multiplied by 4 analog channels per node).

### 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 define device aliases.

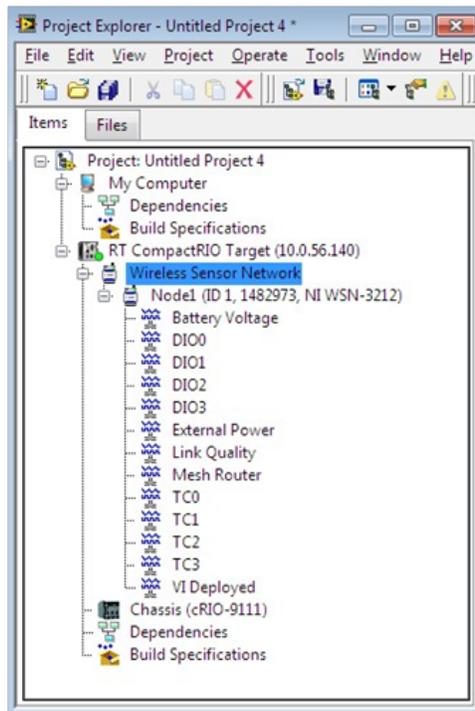


Figure 2. NI 9795 WSN System in the LabVIEW Project

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

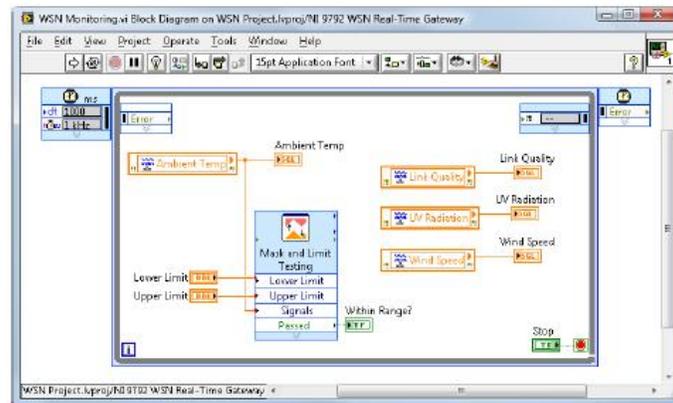


Figure 3. Extracting NI WSN Measurement Data Using LabVIEW

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.

### CompactRIO Programming (LabVIEW Real-Time)

The LabVIEW Real-Time Module helps you use LabVIEW graphical programming to create applications that run on embedded hardware targets such as CompactRIO. 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 email and FTP protocols
- Watchdog functions to automatically restart some hardware targets if your program stops running

### Node Programming (LabVIEW WSN)

NI recommends the programmable versions of both nodes and gateways. 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 lengthen 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.

## WSN 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 and gateways.

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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