LORD **USER MANUAL**

WSDA®-200-USB

Wireless USB Base Station

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Table of Contents

1. Gateway Overview

The WSDA-200-USB is a data acquisition gateway designed to configure, co-ordinate, and collect sensor data from LORD Sensing wireless sensor nodes. The gateway supports all data acquisition sessions between wireless nodes and host computers including: continuous sampling, burst sampling, and datalogging. The gateway also facilitates precision sampling synchronization between sensor nodes by transmitting a continuous, system-wide timing reference known as the beacon.

The WSDA-200-USB utilizes aUSB interface to transfer data from the wireless nodes to a host computer for viewing, analysis, and storage.

Figure 1 - WSDA-200-USB

1.1 Gateway Components

The WSDA-200-USB can be purchased with an internal antenna (A) or an external antenna (B).

Item	Description	Product Number
A	WSDA-200-USB Base Station	6307-2040
B	WSDA-200-USB, Connectivity Cable, External Antenna	6307-2140
--	SensorConnect download here: http://www.microstrain.com/software	--

Table 1 - Components

1.2 Gateway Interface

There is one device status indicator on the top of the WSDA-200-USB. The following table describes indicator behavior.

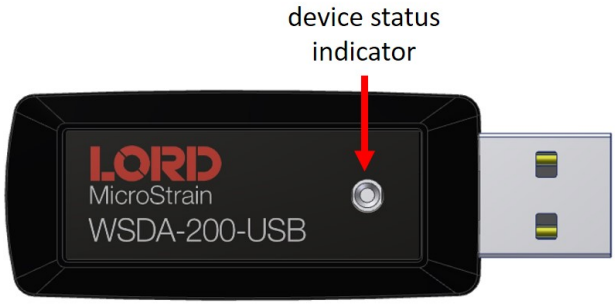

Figure 2 - Status Indicator

	Behavior	Node Status
Device Status Indicator	OFF	Gateway is off
	ON green	Gateway is powered & idle
	Flashing blue	Sync sampling beacon enabled or incoming data from other sampling modes
	Pulsing green	Stop node
	Flashing red	WARNING: another gateway beacon is detected on the same frequency

Figure 3 - Basic Indicator Behaviors

2. System Operation

The gateway is the interface between LORD Sensing sensor nodes and the data acquisition computer. The gateway co-ordinates the configuration and sampling of the nodes and can handle many nodes simultaneously. Communication between the nodes and gateway is wireless and uses the LORD Sensing LXRS and LXRS+ data communications protocols.

LORD Sensing's SensorConnect software program is available for data acquisition from the wireless sensor network. This is a PC-based software used for configuring gateways and nodes, selecting sampling modes and parameters, initializing data acquisition, and viewing and saving data.

2.1 Software Installation

Install the **SensorConnect** software on the host computer before connecting any hardware. Access the free software download on the LORD Sensing website at:

SensorConnect™

http://www.microstrain.com/software

NOTE

The SensorConnect software includes hardware drivers required for use with USB gateways. Once installed, the software will automatically detect and configure any USB gateways that are plugged into the host computer.

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2.2 System Connections

To acquire sensor data the following components are needed: user-supplied external , a LORD Sensing wireless sensor node, a LORD Sensing data gateway, and a host computer with access to the data acquisition software.

The sensor, node, gateway, and software selection are application-dependent, but the basic interfaces are the same.

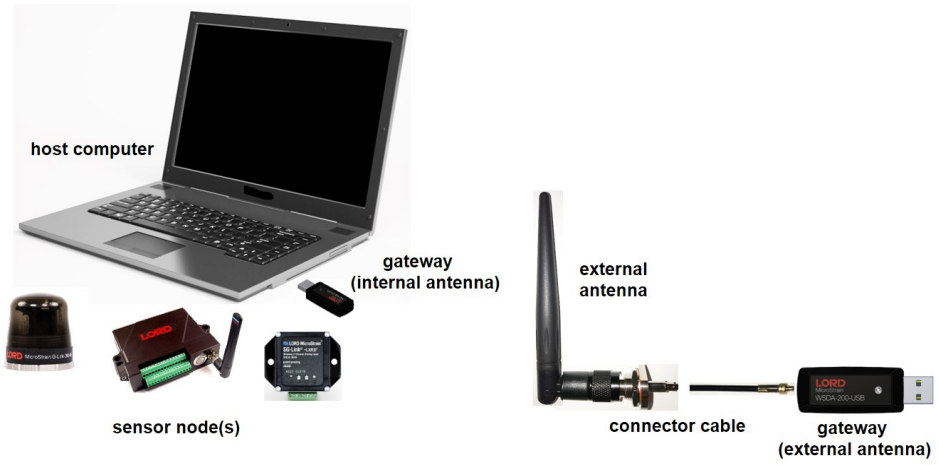


Figure 4 - System Connections

2.3 Gateway USB Communication

Drivers for the USB gateways are included the SensorConnect software installation. With the software installed, the USB gateway will be detected automatically whenever the gateway is plugged in.

1. Power is applied to the gateway through the USB connection. Verify the gateway status indicator is illuminated, showing the gateway is connected and powered on.

2. Open the SensorConnect software.

3. The gateway should appear in the Controller window automatically with a communication port assignment. If the gateway is not automatically discovered, verify the port is active on the host computer, and then remove and re-insert the USB connector.

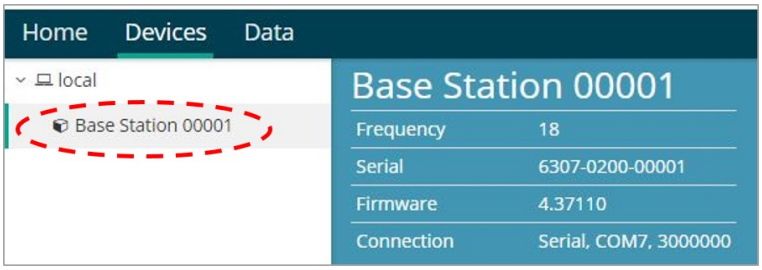


Figure 5 - USB Gateway Communication

2.4 Connect to Nodes

Several methods can be used in SensorConnect to establish communication with the nodes: the automatic node discovery feature, manually entering the node address, and scanning transmission frequency and node address ranges.

2.4.1 Add A Node Via Node Discovery

For all LORD Sensing 200 Series nodes, a node discovery is triggered by turning on the node. A discovery packet is sent from the node to all channels and will appear in SensorConnect. The node address and frequency are indicated in the documentation included with the node when it is purchased.

NOTE

Automatic discovery in nodes not included in the LORD Sensing 200 Series will only occur if the node is set to idle mode. To force boot-up into idle mode, cycle the node power rapidly two times, and then leave it on. The status indicator on the node will pulse once per second to indicate it is in idle mode (*see Troubleshooting Guide on page 27*).

If the base and node are on the same operating frequency, the node will populate below the Base Station listing when powering on the WSDA-200-USB.

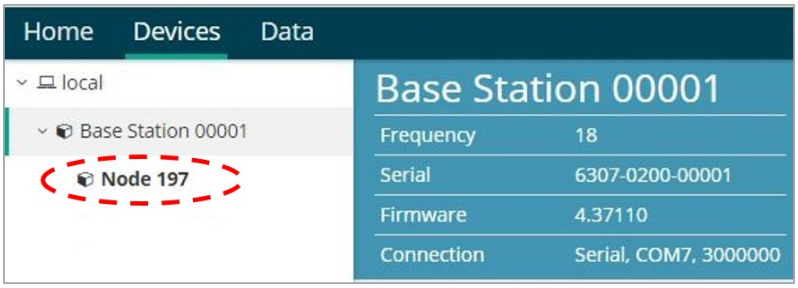


Figure 6 - Node Discovered On Same Frequency

If a red circle with a number appears next to the Base Station, the node is operating on a separate radio channel (*see Move Node To Base Station Frequency on page 14*).

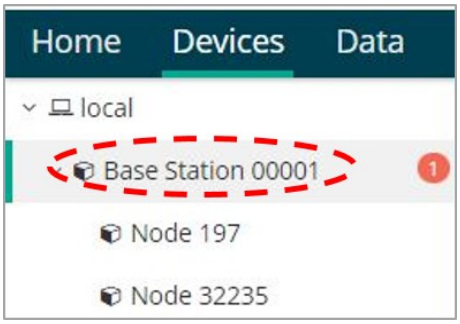


Figure 7 - Node On Other Frequency

2.4.2 Add A Node Manually

Adding a node manually requires entering the node address and its current frequency setting.

From the Base Station, select the Manual Add Node tile, enter the Node Address, last known Frequency (factory default is 15), and select Add Node.

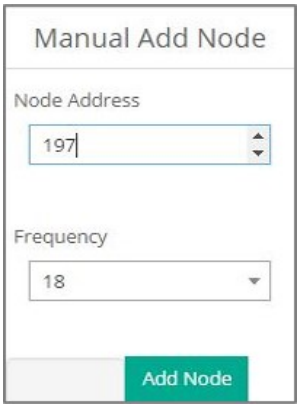


Figure 8 - Add Node By Address

If the node was successfully added, two confirmation messages will appear and it will be listed under the Base Station.

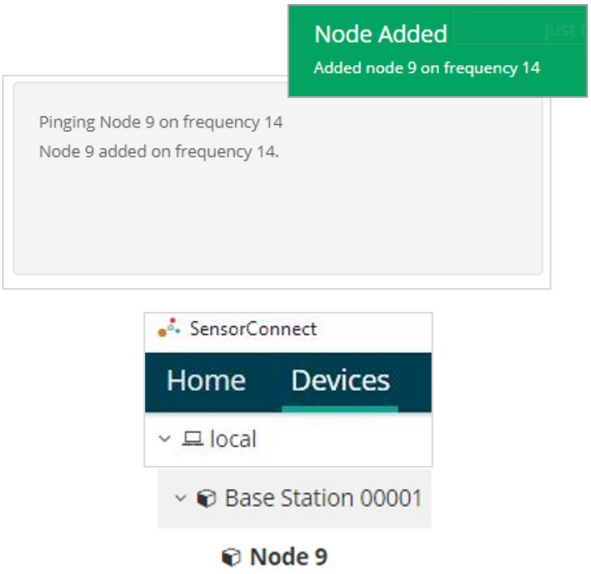


Figure 9 - Add Node Confirmation

If the node failed to be added, a failure message will appear. This means the node did not respond to the base station which could indicate the node is not in idle mode or it may be on another frequency. If "Add Node Anyway" is selected, it will associate that node with the channel entered but it is likely there will be a communication error. If the node was not in idle, move the base station to the frequency of the node and issue a "Set to Idle" command.

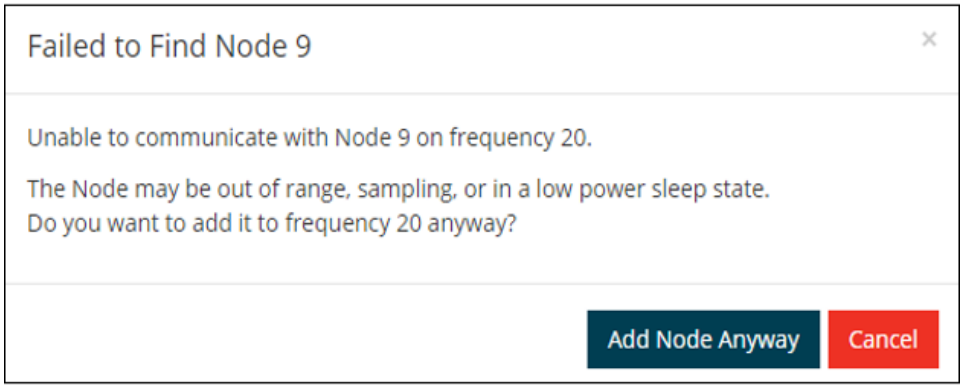


Figure 10 - Failure to Add Node

2.4.3 Move Node To Base Station Frequency

If a red circle with a number appears next to Base Station, the node is operating on a separate radio channel. Select the Base Station and then select the Nodes on Other Frequencies tile.

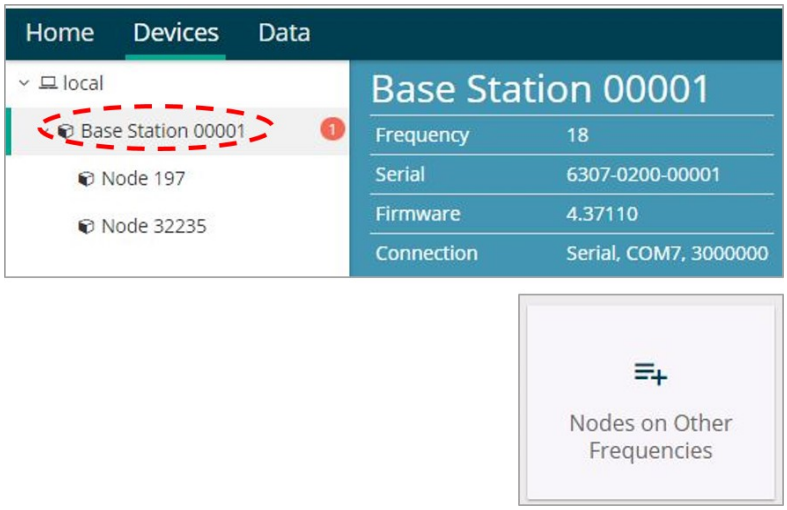


Figure 11 - Nodes On Other Frequencies

Highlight the new node being added and select Move Node to Frequency (#).

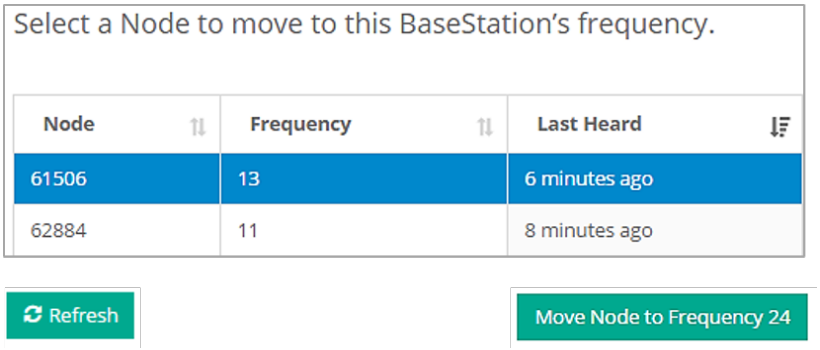


Figure 12 - Move Node

2.5 Configure Node

Node settings are stored to non-volatile memory and may be configured using SensorConnect. The configuration menus show the channels and configuration options available for the type of node being used.

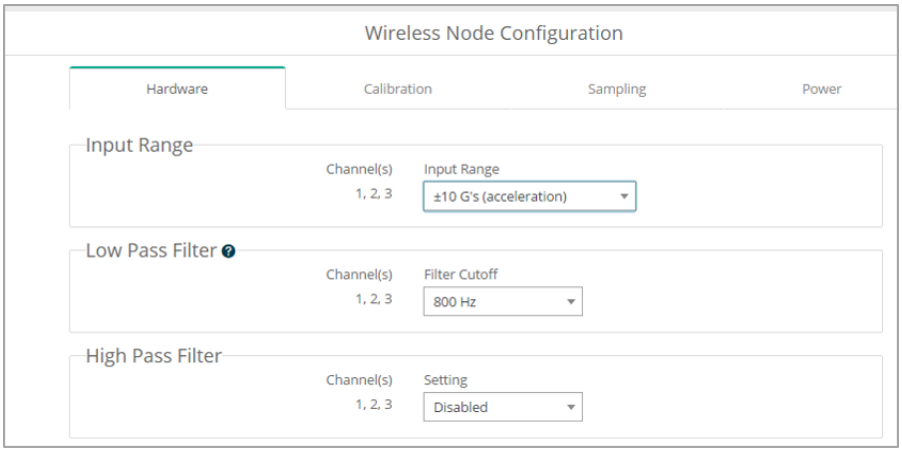


Figure 13 - Node Configuration

2.6 Sampling Configuration

To start a sampling session, nodes can be selected individually by selecting the Node name > Sampling, or as a group by selecting the Base Station > Sampling. As a group, they will all be set to the same sampling mode. When the Base Station is selected, all the nodes will appear in a list with a check mark to the left, all of the nodes checked off will be included in the sampling. Uncheck the nodes to be excluded from the sampling.

The Network Settings menu includes Synchronized and Lossless sampling options, while the Node settings menu offers multiple configuration options to customize the data sampling for a single node, or a group of nodes.

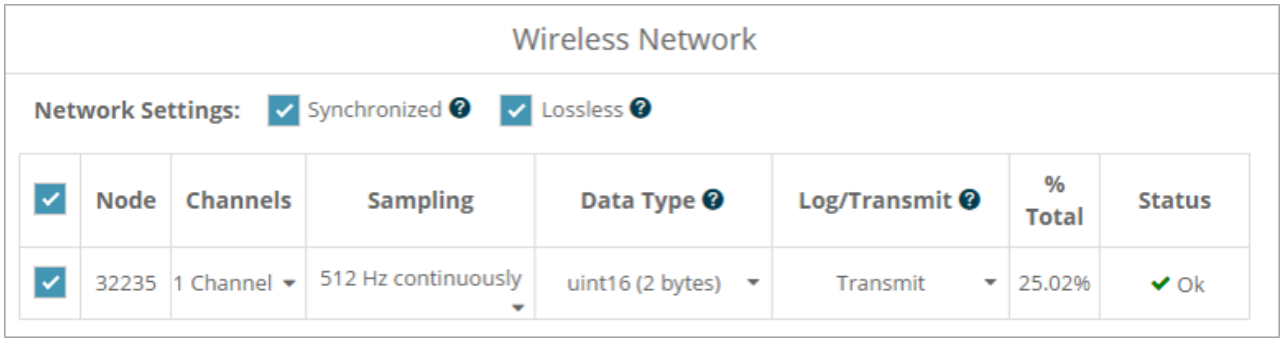


Figure 14 - Network and Node Configuration Menu

a. **Synchronized -** By selecting Synchronized, all nodes in the network will periodically synchronize their time clocks to a beacon that is broadcasted by the **WSDA gateway**. Each beacon contains a UTC timestamp, allowing nodes to timestamp their collected data within an accuracy of +/- 50 us.

   Each node will also buffer data and transmit this data in time-slots allocated prior to sampling. Using time-slots assures the transmissions will not “collide”, or corrupt each other. It also provides a means for efficiently scaling the size of the network to allow as much data throughput as possible.

   If Synchronized is deselected, the node will not require a beacon time source and will transmit a data transmission for each measurement sweep. The user should deselect Synchronized if, either low latency, or the lowest possible power at slow sample rates, is required.

b. **Lossless -** The user can achieve near lossless data collection in most environments through the use of data buffering, radio acknowledgments, and retransmissions. Each node buffers collected data and timestamps to an internal 2 Mbit FIFO buffer. For each transmission, data is pulled from this buffer. Upon receiving the data packet, an acknowledgment is sent from the **WSDA gateway** providing the beacon. The node will retransmit data until this acknowledgment is received. Inherent overhead in the transmission scheduling protocol assures the node time to recover from periods of poor radio communication.

   This feature allows lossless performance in environments where the node achieves as low as 50% packet error rate. It also allows for operation in situations where the gateway and node move in and out of range of each other.

   The Lossless feature is only available when Synchronized is enabled. Disable Lossless if the application requires consistent latency or can tolerate lost data.

c. **Node:** Indicates the node address beside a box with a check mark. This box is checked by default to include the node in the sampling. Uncheck the box to exclude the node from the sampling.

d. **Channels:** Provides a drop-down menu to select the desired sensor channels for the node.

e. **Sampling:** Displays a drop-down menu to select the sample rate. "Continuously" samples indefinitely, "For" specifies a fixed sampling time-frame, and "Bursting" allows short sampling durations performed at periodic intervals.

f. **Data Type:** Select the resolution of the data reported by the node. Selecting lower resolution data will require fewer transmissions and lower power. Selecting "Float" will request the node send data in the configured calibration unit type.

g. **Log/Transmit:** Select "Log Only" to have the node store all collected data to flash memory for later download. Select "Transmit Only" to have the node transmit all data while it is collected. Or select "Log and Transmit" to have the node perform both operations.

h. **% Total:** Indicates the percentage of total over-the-air bandwidth reserved for each node.

i. **Status:** Displays network errors.

j. **Apply and Start Network:** Applies all of the settings, starts the entire network, and starts the Base Station's beacon. A drop-down menu displays options to Apply and Arm all of the nodes without starting the beacon, or Apply Only to save the settings to memory and not start the network.

3. Gateway Settings

3.1 Transmit Power

The transmit power level may require adjustment if power consumption is a concern or in regions where there are transmit power restrictions. Lowering the power output reduces power consumption, but it also reduces the wireless communication range between the gateways and nodes.

NOTE

Actual range is highly dependent on how the nodes and gateways are installed and the conditions in the surrounding environment (*see Range Test on page 26*).

Setting	Power Output	Maximum Range
Extended	20 dBm (100 mW)	LXRS 2 km LXRS+ --
Standard	10dBm (10mW)	2 km --
Low	0dBm (1mW)	2 km --

Table 2 - Transmit Power Settings

From the Base Station, select Configure > Transmit Power for a drop down menu of five power options ranging from 0 dBm to 20 dBm.

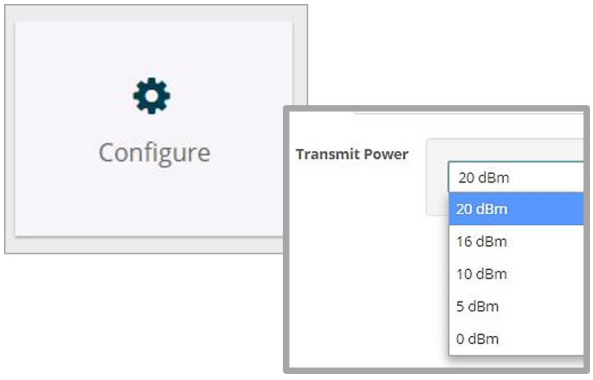


Figure 15 - Transmit Power Setting

3.2 Change Frequency

There are 14 available frequency channels between 2.405 and 2.470 GHz. Wireless nodes and the gateway must be on the same frequency channel to communicate.

To move node(s) to a different frequency, select Base Station and then the Change Frequency tile.

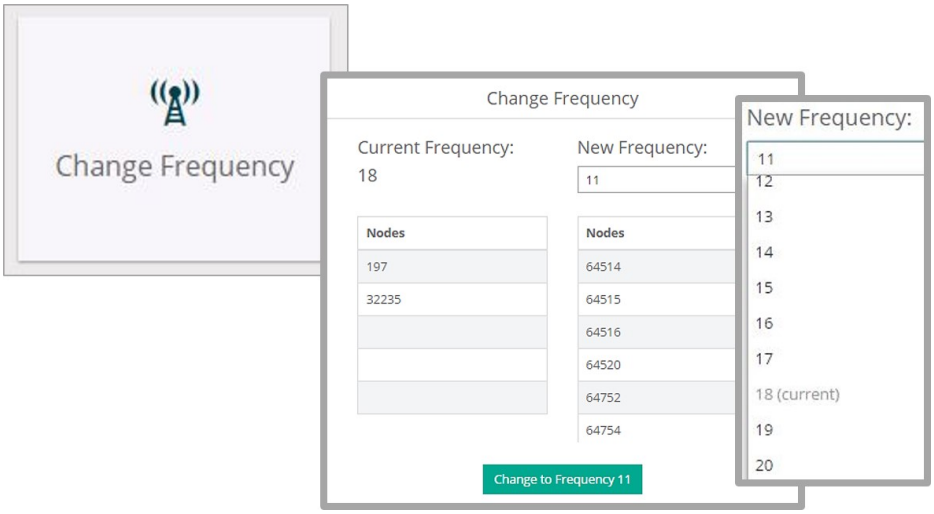


Figure 16 - Gateway Frequency

3.3 Using the Beacon

In synchronized sampling, the beacon feature is used to coordinate sampling and transmission timing between multiple nodes. The primary purpose is to avoid data collision, guarantee timing between samples from different nodes, and to time-stamp the data. The beacon cannot be used in any another sampling mode.

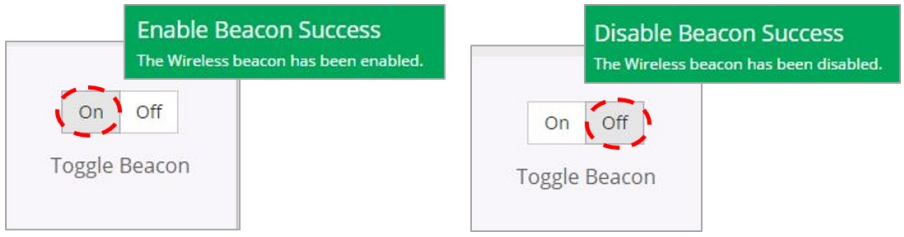
When the beacon is enabled, the gateway broadcasts a data message once every second containing a Coordinated Universal Time (UTC) time stamp, and it is used to update each node's real time clock (RTC). This continuous synchronization beacon, coupled with the accuracy of the gateway and node clocks (+/-3 ppm drift), provides a node-to-node synchronization within ±50 microseconds. The gateway receives the UTC from the host computer, so the host must be connected to a UTC time server to achieve that accuracy. There is some lag inherent in the Microsoft Windows distribution of the UTC. This dictates the overall accuracy of the time-stamp, but the synchronization times between the gateway and nodes will be consistent because of the accuracy of the embedded RTC clocks.

When the beacon is active, the gateway device status indicator will pulse blue once per second. When the nodes connected to the gateway are in synchronized sampling mode, the network can be put to sleep by turning off the beacon and then resuming transmitting once the beacon is enabled. Any node

that is actively sampling in synchronized sampling mode on the same frequency as the gateway will synchronize to it automatically if the beacon is activated.

To avoid interference with other devices it is recommended that the beacon be disabled when not in use. Do not operate multiple gateways on the same frequency.

To enable and disable the beacon, select On or Off from the Toggle Beacon tile. A green pop up window will appear confirming the successful action.



3.4 Set Nodes to Idle

To stop all (or selected) nodes on a network, select the Set Nodes to Idle tile and indicate with a check mark which nodes are to be set to idle mode. If the Broadcast option is enabled, a signal to all nodes (including unsolicited nodes) will be sent out to request they return to idle.

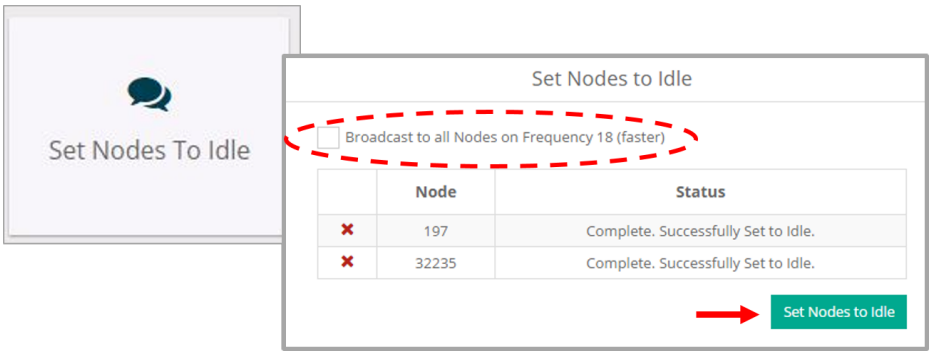


Figure 17 - Set to Idle

4. Viewing Data

4.1 SensorConnect

4.1.1 Using Dashboards and Widgets

Collected data is viewed on the Data page through the creation of dashboards and widgets. Think of dashboards as individual pages and widgets as an illustration on the page. Create multiple data widgets on each dashboard to display sampled data as a time-series graph, text chart, or a simple gauge that only displays the most current reading. This format provides an easy way to organize many sensors and networks, and it allows the information to be displayed in the most appropriate layout.

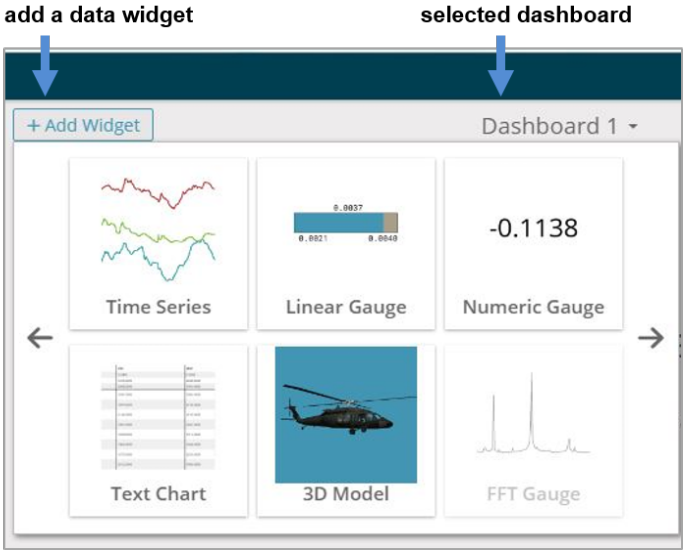


Figure 18 - Viewing Data

4.1.2 Navigating Graphs

Use the mouse along with the shift and control keys inside the graph window to adjust the data view.

Control	Action
Mouse wheel	Zoom in/out on *x*-axis
Shift + mouse wheel	Zoom in/out on *y*-axis
Mouse double-click	Zoom to extends
Shift + mouse left-click and drag left/right	Zoom window left/right
Shift + mouse left-click and drag up/down	Zoom window up/down
Ctrl + mouse left-click and drag	Zoom box

Table 3 - Graph View Controls

4.1.3 Widgets Options

The widget configuration menu is different for each type of widget but typically includes sensor or channel selections and widget settings such as titles and legends.

After adding a widget, left click to select and configure it in the Channels and Settings left sidebar menu. Under Channels, the channel(s) for the widget can be enabled and disabled.

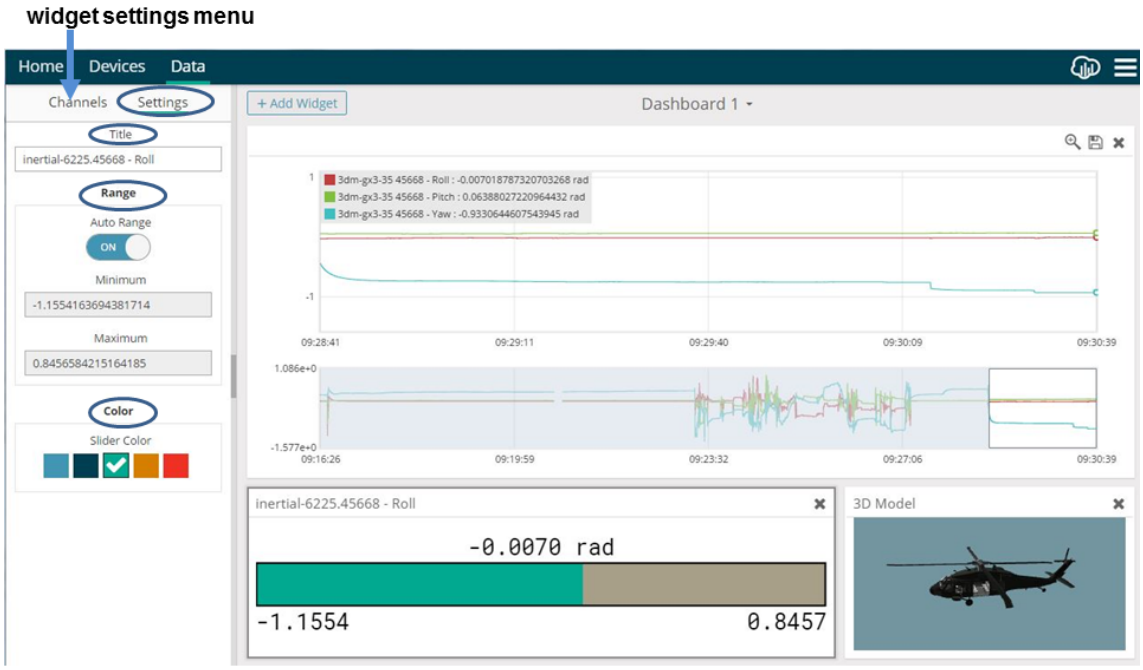


Figure 19 - Widget Settings Menu

4.1.4 Time Series Widget Menu

The Time Series Widget menu has two features to help optimize sensor data collection for export to a .csv file. *Snap to Latest* captures the most recent data and *Zoom* isolates specific events from a larger data sample (*see Exporting Data Files on page 23*.)

Figure 20 - Time Series Widget Menu

4.1.5 Exporting Data Files

To export data to a .csv file, select the Export Data button on the Time Series widget > Export > name the document > save to the preferred location on the host computer.

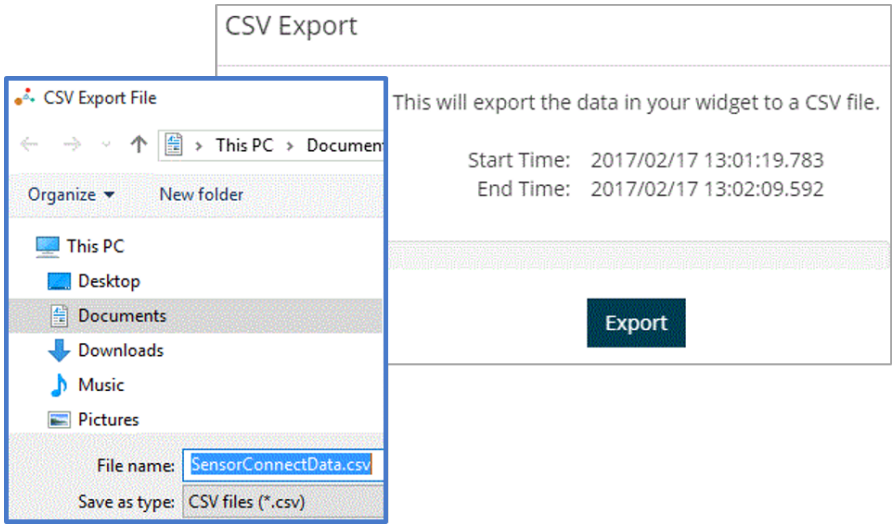


Figure 21 - Exporting Data

5. Installation

5.1 Installation Recommendations

The WSDA-200-USB is rated for indoor use only, unless housed in a ruggedized outdoor enclosure (purchased separately). It is designed for desktop use, although it can be mounted in any orientation as required by the application. It is recommended that it is mounted in a way that optimizes the wireless communications, typically with the antenna pointing upward. For more information *see Optimizing the Radio Link on page 25*.

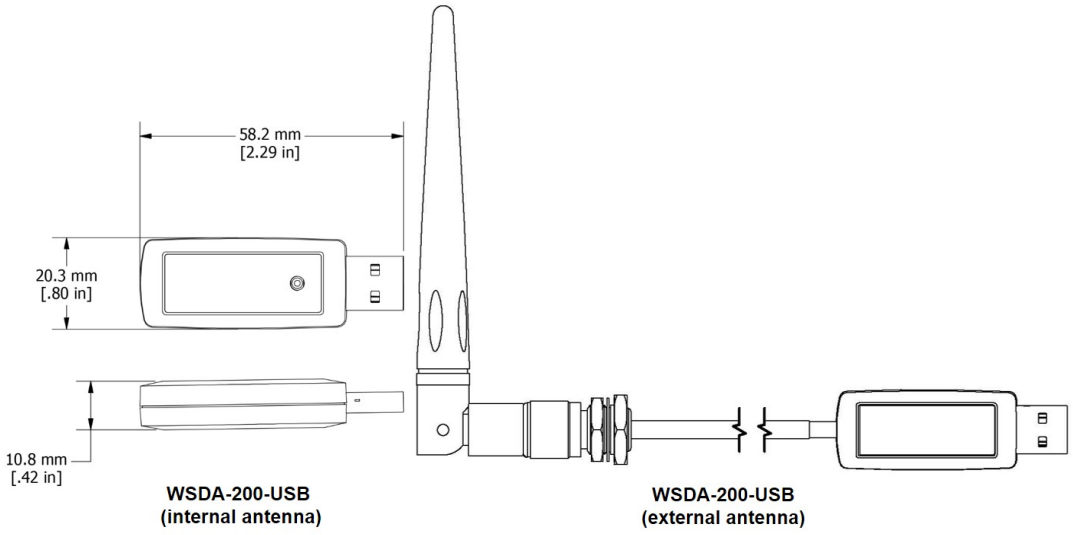


Figure 22 - Gateway Installation

5.2 Optimizing the Radio Link

NOTE

In the event of communication difficulties, it may be necessary to disable WIFI on the host computer, or use a USB extender when collecting data.

The best method for ensuring optimal radio communication is to conduct an RF survey of the installation site. This is easily accomplished in SensorConnect by using the range test feature to quantify the radio signal strength (RSSI) in various scenarios. *See Range Test on page 26* for instructions on using SensorConnect for measuring RSSI. The following are general guidelines for maximizing communication range:

- **Line of Sight (LOS)** between the node and gateway. Try to avoid obstructions such as buildings, terrain, vegetation, or other physical barriers.
- **Increase the Mounting Height** of the node to allow a clearer LOS path to the gateway. Height above the ground is also important because reflections off of the ground can interfere at the receiver. Generally, the higher above the ground the better.
- **Minimize Radio Frequency Interference (RFI)** from other wireless devices, especially those operating in the same frequency range. This includes other nodes and 2.4 GHz WIFI routers. If other wireless devices are required nearby, mount them at different heights to minimize interference. Additionally, a different radio frequency may be selected using SensorConnect software.
- **Minimize Electromagnetic Interference (EMI)** such as that which is generated by power transmission equipment, microwaves, power supplies, and other electromagnetic sources.
- **Metal Objects** in close proximity to either antenna, particularly ferrous metals such as steel and iron, can be problematic for wireless communications. The larger the object, the greater the influence.

5.2.1 Range Test

After establishing communication between node and gateway, use the range test feature in SensorConnect to monitor the signal strength and to optimally position the nodes, gateway, and antennae for installation. Maximum achievable range is determined by the gateway and node power settings (found in the device Configure menu) and is highly dependent on the physical environment surrounding the devices.

1. Select the node name > Range Test

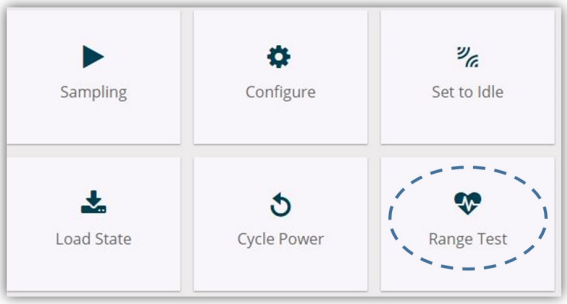


Figure 23 - Range Test Menu

2. RSSI is a measure of signal strength between the node and the base station. A higher RSSI value (closer to zero), will result in better node to base station communication. Reliable communication can be achieved with a signal strength greater than -75 dBm, in the absence of radio frequency interference. Position the node and gateway antennas where the best RSSI value is observed.

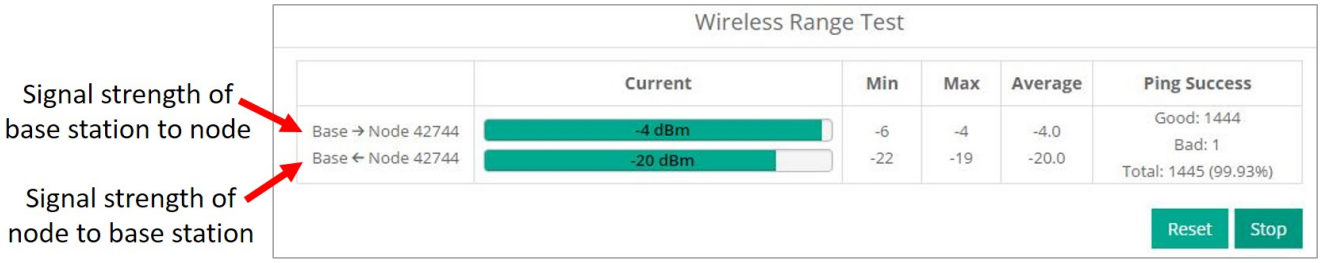
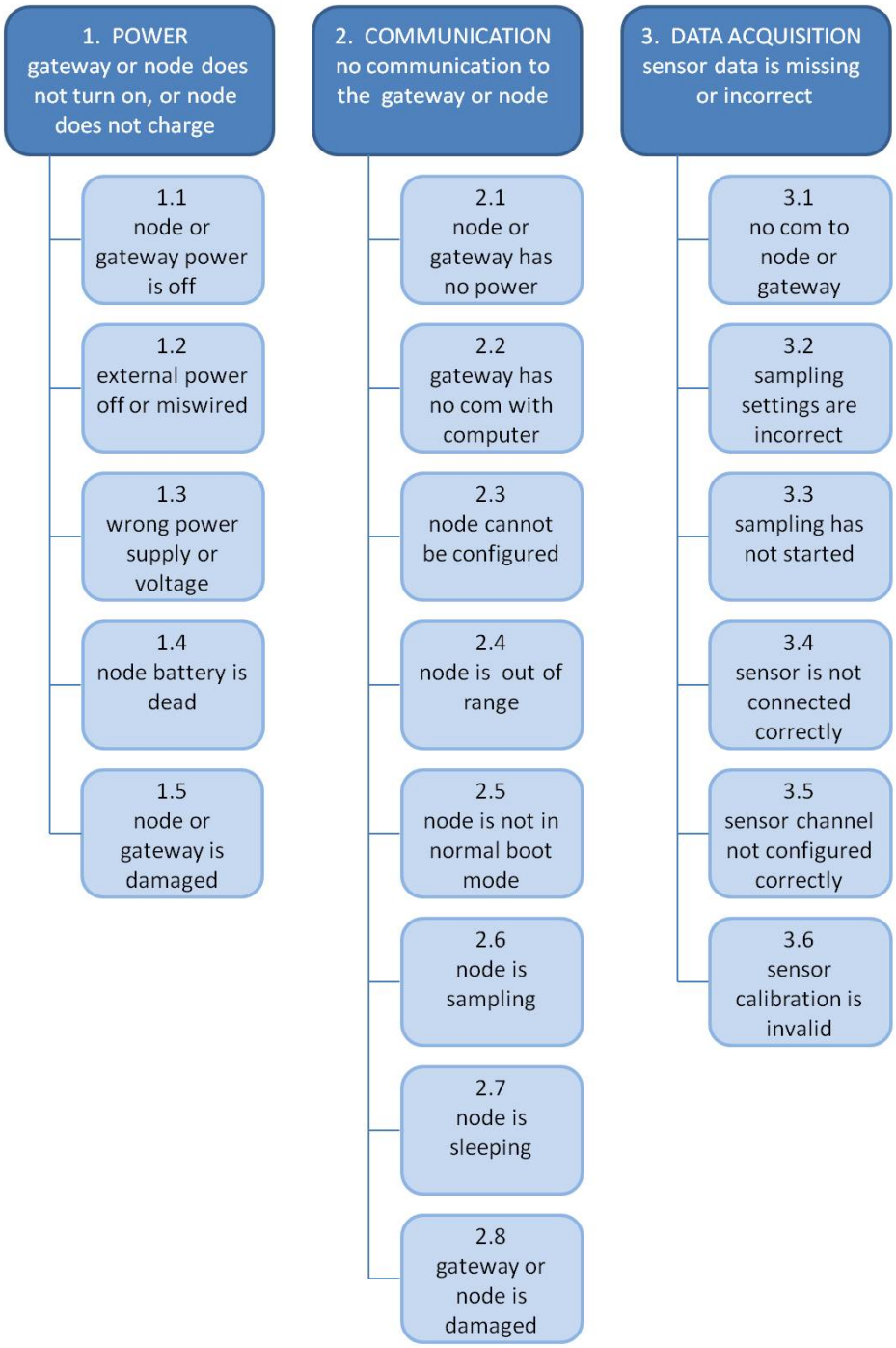


Figure 24 - Range Test Statistics

6. Troubleshooting

6.1 Troubleshooting Guide



	Possible cause and recommended solution
1. POWER gateway or node does not turn on	**1.1 node or gateway power is off** The status indicator LED on the device may be off. Turn the device on, and the status indicator LED should illuminate.
	1.2 external power is off or miswired Verify the device power source is connected correctly and powered on.
	1.3 wrong power supply or voltage Using a power supply other than the one specified for the device (or an external supply that is outside of the device operating range) could result in permanent damage to the device or cause it to not work properly.
	1.4 node battery is dead If the node will not power on, the node battery may need to be replaced.
	1.5 node or gateway is damaged If all power settings and connections have been verified, and the node is still unresponsive, contact LORD Sensing Technical Support (*See Technical Support on page 33*).
2. COMMUNICATION no communication to the gateway or node	**2.1 node or gateway has no power** Verify the node and gateway have power applied and that applicable power switches are on. Power is indicated on both devices by a status indicator LED.
	2.2 gateway has no communication with the computer Verify gateway communication in the software. Check, remove, and reconnect communications and power cables as applicable. • For USB gateways, verify that the drivers are installed on the computer (included with SensorConnect) and that the software has had sufficient time to detect it.
	2.3 node cannot be configured Observe the node status indicator LED to determine the device's state: boot, idle, sample, or sleep. If the node is sampling or sleeping, it cannot be configured. In , execute the command to put the node in idle state, allowing configuration to occur. If the user inactivity timeout is set very low, the configuration menu will have to be entered quickly, before the timeout occurs, putting the node back in a sample or sleep state.
	2.4 node is out of range Perform a bench test with the node in close proximity to the gateway to verify they are operational. For range test and installation recommendations The system has been tested to

	Possible cause and recommended solution
	operate with the node and gateway up to 2 km apart with clear line of sight.
	2.5 node is not in normal boot mode If the node status indicator shows the node booting in a mode other than the normal boot mode, it can be bypassed by cycling the node power rapidly three times, then leaving it on for normal power up. In normal boot mode the communication can be established with automatic node discovery (or manually) once the boot process is complete and the node is in idle state. Start-up mode can then be changed in the software.
	2.6 node is sampling Observe the node status indicator LED to determine the device's state: boot, idle, active, or sleep. If the node is sampling, it cannot be configured. In SensorConnect, execute the Stop Node command to put the node in idle state, allowing configuration to occur.
	2.7 node is sleeping Observe the node status indicator LED to determine what state it is: boot, idle, active, or sleep. If the node is sleeping, it cannot be configured. In SensorConnect, execute the Stop Node command to put the node in idle state, allowing configuration to occur.
	2.8 gateway or node is damaged Verify all connections, power, and settings. If available, try installing alternate nodes and gateways one at a time to see if the faulty device can be identified. If no conclusion can be determined or to send a device in for repair, contact LORD Sensing Technical Support (*See Technical Support on page 33*).
3. DATA ACQUISITION **sensor data is missing or incorrect**	**3.1 no communication to node or gateway** Verify connections and power to the node and gateway. Verify they are powered on and communicating with the software. Enter a configuration menu to verify that the node can be accessed.
	3.2 sampling settings are incorrect If the sampling mode, rate, or duration are not performing as expected, enter the node configuration menu, and verify the sampling settings.
	3.3 sampling has not started If sampling is occurring, the sampling mode will be displayed next to the node name in SensorConnect. The node device status indicator will also be flashing the sampling mode code. If the node is not sampling, activate it in the software or with a sample on start up boot sequence.

	Possible cause and recommended solution
	3.4 sensor is not connected correctly Verify sensors connections and wiring. For non-standard connections contact LORD Sensing Technical Support (*See Technical Support on page 33*).
	3.5 sensor channel not configured correctly Verify that the sensor is configured on the correct channel and has been enabled for data acquisition.
	3.6 sensor calibration is invalid External sensors come with a factory calibration value that is entered during configuration.

6.2 Communications Ports in Windows®

Serial gateways (including USB gateways) have either a standard serial or virtual communications port in Windows®. Windows®Device Manage can be used to determine what communication port the gateway is connected to.

1. Click on the Windows® Start icon, and select Control Panel.

2. Navigate to the System menu, and select Device Manger. The menus may appear different depending on the version of Windows and the View settings.

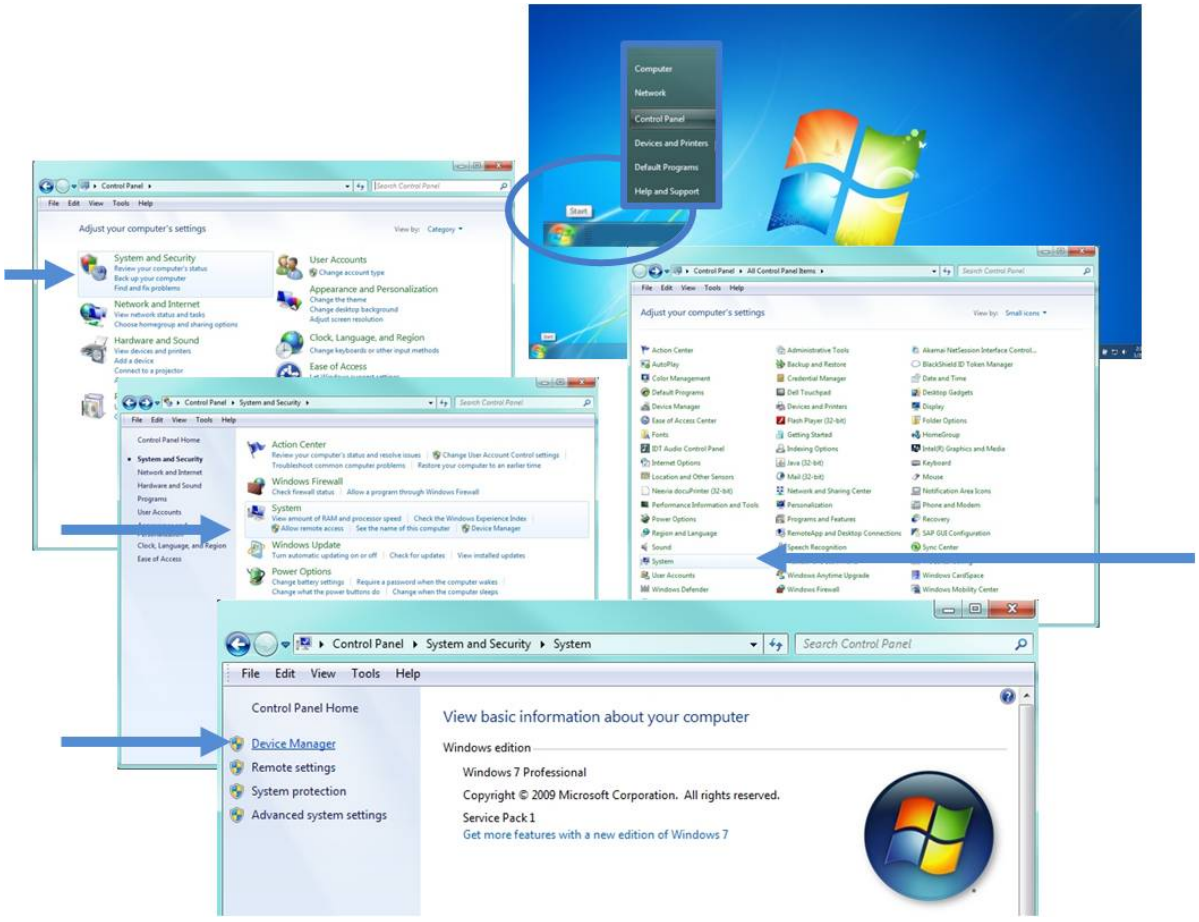


Figure 25 - Windows® System Menu

3. In Device Manager, expand the view for Ports (COM and LPT). Active COM ports will appear on this list with the COM port number. The WSDA- 200- USB [[[Undefined variable Variables.ProductName3]]] will be displayed as LORD Sensing Virtual COM Port (COM 7). If no port is listed, the port is not recognized by the computer, and no gateway communication can be established.

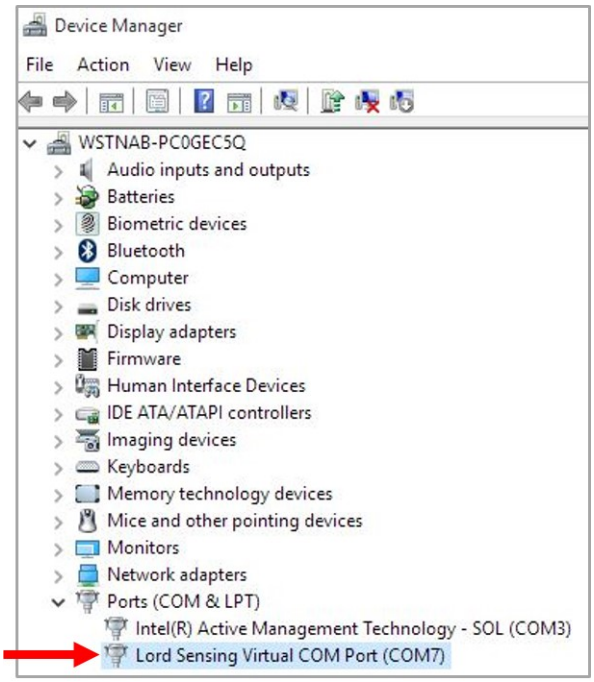


Figure 26 - Windows® Device Manger Menu

6.3 Technical Support

There are many resources for product support found on the LORD Sensing website, including technical notes, FAQs, and product manuals.

http://www.microstrain.com/support/documentation

For further assistance our technical support engineers are available to help with technical and applications questions.

Technical Support

sensing_support@LORD.com

Phone: 802-862-6629
Fax: 802-863-4093

SKYPE: microstrain.wireless.support

Live Chat is available from the website during business hours:
9:00 AM to 5:00 PM (Eastern Time US & Canada)

7. Parts and Configurations

7.1 Standard Models

For the most current standard, custom, and OEM product options, refer to the LORD Sensing website or contact the LORD Sensing Sales Department.

Model Number	Description	LORD Sensing Part Number
WSDA-200-USB	Wireless USB Base Station	6307-2040
WSDA-200-USB, External Antenna	Wireless USB Base Station with external antenna	6307-2140

7.2 Wireless System Equipment

Model	Description	LORD Sensing Part Number
--	SensorConnect Software	8220-0023

Table 4 - Wireless System Equipment

7.3 Product Ordering

Products can be ordered directly from the LORD Sensing website by navigating to the product page and using the Buy feature.

http://www.microstrain.com/wireless

For further assistance, our sales team is available to help with product selection, ordering options, and questions.

Sales Support

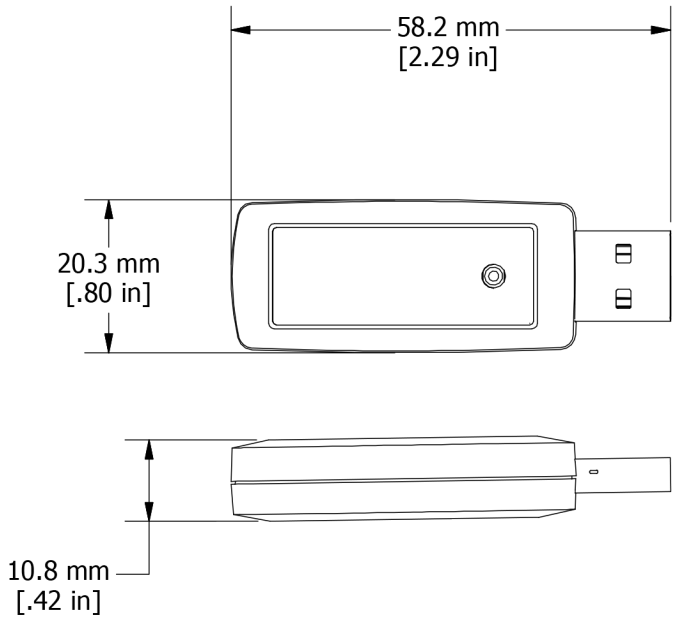
sensing_sales@LORD.com

Phone: 802-862-6629
Fax: 802-863-4093

9:00 AM to 5:00 PM (Eastern Time US & Canada)

8. Specifications

8.1 Physical Specification



Dimensions:	58.2 mm x 20.3 mm x 10.8 mm
Weight:	17 grams
Enclosure Environmental Rating:	General purpose indoor

8.2 Operating Specifications

Parameter	Specifications
General	
Connectivity	USB 2.0 virtual serial communication @ 3 mbps
Sampling	
Supported node sampling modes	Synchronized, low duty cycle, continuous, periodic burst, event-triggered, and datalogging
Synchronization beacon interval	1 Hz beacon provides ± 50 µsec node-to-node synchronization
Synchronization beacon stability	± 3 ppm
Network capacity	Up to 2000 nodes per RF channel (and per gateway) depending on the number of active channels and sampling settings. Refer to the system bandwidth calculator: http://www.microstrain.com/configure-your-system
Operating Parameters	
Wireless communication range	<table><tr><th></th><th>Typical*</th><th>Ideal**</th></tr><tr><td>LXRS</td><td>1 km</td><td>2 km</td></tr><tr><td>LXRS+</td><td>400 m</td><td>1 km</td></tr></table>
Radio frequency (RF) transceiver carrier	License-free 2.405 to 2.480 GHz with 16 channels
RF communication protocol	IEEE 802.15.4 and Proprietary
RF transmit power	User-adjustable from 0 dBm to 20 dBm. Power output restricted regionally to operate within legal requirements
Power source	USB port: 5.0 V dc
Power consumption	50 mA; Eight active node channels operating at 256 Hz low duty cycle: 65.6 mA
Operating temperature	-40 °C to +85 °C
Physical Specifications	
Dimensions	58.2 mm x 20.3 mm x 10.8 mm
Weight	17 grams
Integration	
Connectors	Internal antenna: USB Type A male External antenna: Reverse Polarity TNC Type (RP-TNC)
Compatible nodes	LORD Sensing LXRS and LXRS+ nodes
Firmware	Firmware upgradeable through software interface
Software	SensorConnect 7.0 or newer, Windows 7, 8 & 10 compatible
Software development	Open-source MicroStrain Communications Library (MSCL) with sample code available in C++, Python, and .NET formats, Labview (OS and computing platform independent) http://www.microstrain.com/software/mscl
Regulatory compliance	FCC (U.S.), IC (Canada), CE (European Union)

*Actual range varies with conditions
**Measured with antennas elevated, no obstructions, no RF interferers.

8.3 Radio Specifications

The WSDA-200-USB employs a 2.4GHz IEEE 802.15.4-compliant radio transceiver for wireless communication. The radio is a direct-sequence spread spectrum radio and can be configured to operate on 16 separate frequencies ranging from 2.405 GHz to 2.480 GHz. Following the 802.15.4 standard, these frequencies are aliased as channels 11 through 26. For all newly manufactured nodes, the default setting is 2.425 GHz (channel 15).

Contains LORD Sensing 200 Series Radio Module

FCC ID: XJQMSLINK0006

IC ID: 8505A-MSLINK0006

Or

FCC ID: XJQMSLINK0007

IC ID: 8505A-MSLINK0007

This device complies with Part 15 of the United States FCC Rules, and Industry Canada's license-exempt RSSs. Operation is subject to the following two conditions: 1) This device may not cause interference, and 2) This device must accept any interference, including interference that may cause undesired operation of the device. Changes or modifications, including antenna changes not expressly approved by LORD Corporation could void the user's authority to operate the equipment.

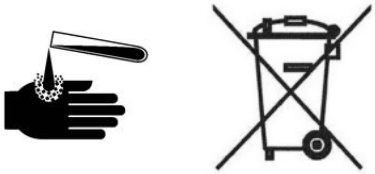
Cet appareil est conforme à la Partie 15 des Règles de la FCC des États-Unis et aux RSSS exempts de licence d'Industrie Canada. Le fonctionnement est soumis aux deux conditions suivantes: 1) Cet appareil ne doit pas causer d'interférences et 2) Cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l'appareil. Les changements ou modifications, y compris les changements d'antenne non expressément approuvés par LORD Corporation, pourraient annuler l'autorisation de l'utilisateur d'utiliser l'équipement.

9. Safety Information

This section provides a summary of general safety precautions that must be understood and applied during operation and maintenance of components in the LORD Sensing Wireless Sensor Network.

9.1 Disposal and Recycling

⚠WARNING **⚠CAUTION** ***NOTICE***



The WSDA®-200-USB contains printed circuit boards and electronic components. These items are known to contain toxic chemicals and heavy metals that are harmful to humans health and the environment. Disposal is subject to federal and local laws. Do not discard the device in the trash. Follow proper electronic and battery waste disposal protocol, as dictated by federal and local authorities. Some states have programs for extracting reusable parts for recycling.

10. References

10.1 Related Documents

Many references are available on the LORD Sensing website including product user manuals, technical notes, and quick start guides. These documents are continuously updated, and new applications are added. They may provide more accurate information than printed or file copies.

Document	Where to find it
Online Wireless Network Calculator	http://sensorcloud.com/?onlyCalc=true
SensorConnect Overview & Download	http://www.microstrain.com/software/sensorconnect
Product Datasheets	http://www.microstrain.com/wireless/sensors
Product Manuals and Technical Notes	http://www.microstrain.com/support/documentation
Product Application Notes	http://www.microstrain.com/applications
NIST Calibration Procedures	http://www.nist.gov/calibrations/
ASTM Testing Procedures	http://www.astm.org/Standard/standards-and-publications.html

Table 5 - Related Documents

11. Glossary

These terms are in common use throughout the manual:

A/D Value: the digital representation of the analog voltages in an analog-to-digital (A/D) conversion. The accuracy of the conversion is dependent on the resolution of the system electronics; higher resolution produces a more accurate conversion. Also referred to as "bits".

Base Station: The base station is the transceiver that attaches to the host computer and provides communication between the software and the node(s). It is also referred to as a gateway.

Burst Sampling: a mode of operation in which the node is sampled for a fixed window of time (burst) and then repeats that window at set intervals. The burst duration and time between bursts is configurable. Also referred to as periodic burst sampling.

Calibration: to standardize a measurement by determining the deviation standard and applying a correction (or calibration) factor

Configuration: a general term applied to the node indicating how it is set up for data acquisition. It includes settings such as sampling mode/rate, number of active channels, channel measurement settings, offsets, hardware gain, and calibration values.

Continuous Sampling: a mode of operation in which the node is sampled continuously until stopped or sampled continuously for a fixed amount of time

Coordinated Universal Time (UTC): the primary time standard for world clocks and time. It is similar to Greenwich Mean Time (GMT).

Cycle Power: a command transmitted to the node to reboot it either through a hardware or software switch

Data Acquisition: the process of collecting data from sensors and other devices

Data Logging: the process of saving acquired data to the system memory, either locally on the node or remotely on the host computer

DHCP (network): Dynamic Host Configuration Protocol is the standardized networking protocol used on Internet Protocol (IP) networks, which automatically configures devices that are attached to it by assigning and configuring the device IP address.

EMI: Electromagnetic Interference is an inductive or radiated disturbance that can create signal degradation on electrical signals, including loss of data.

ESD: Electrostatic Discharge is the sudden flow of electricity that can occur between two charged objects of different potential that come in contact or in close proximity of each other. Static electricity is a common source of ESD.

Event-Based Sampling: a mode of operation in which the node sampling is started when a sensor measurement value (threshold) is achieved

Firmware: the code that is programmed onto a microcontroller or similar device in an embedded system. It includes device operation commands, conditions, memory allocation, and many other tasks.

Gateway: The gateway is a transceiver that attaches to the host computer and provides communication between the software and the node(s). It is also known as a base station.

Host (computer): The host computer is the computer that orchestrates command and control of the attached devices or networks.

LED: Light Emitting Diode is an indicator light that is used in electronic equipment.

LOS (Line of Sight): is used in radio communications to describe the ideal condition between transmitting and receiving antennas in a radio network. As stated it means the antennae are in view of each other with no obstructions.

LXRS: Lossless Extended Range Synchronized is the proprietary LORD Sensing data communications protocol used in the wireless sensor network.

Node: The node is the wireless transceiver to which the sensor (s) is connected, providing communication with the gateway. The G-Link® -LXRS®, V-Link® -LXRS®, and SG-Link® -LXRS® are examples of nodes manufactured by LORD MicroStrain®.

Node Tester Board: The node tester board is a device designed by LORD MicroStrain® that can be plugged into nodes to test their functionality.

Offset: When describing a mathematically-linear relationship, the offset is the value where the line that represents the relationship in a graph crosses the *y*-axis. The equation of a straight line is: $y = mx+b$, where x is the x-axis coordinate, y is the y-axis coordinate, m is the slope and b is the offset.

Oversampling: In signal processing, oversampling is a technique used to achieve increased signal resolution and better noise immunity by recording readings at a higher frequency than the output of the device being measured. In analog-to-digital conversion, the higher the oversampling rate, the better the recreated analog signal.

Packet: unit of sampled data

Periodic Burst Sampling: a mode of operation in which the node is sampled for a fixed window of time (burst) and then repeats that window at set intervals. The burst duration and time between bursts is configurable. Also referred to as burst sampling.

Ping: a byte transmitted by the gateway to the node. The node responds by echoing the byte, indicating communication exists between the node and gateway.

Range Test: a continuous string of pings used to validate communication between the gateway and the node over distance and obstruction

Real Time Clock (RTC): a computer clock that keeps track of the current time

RFI: Radio Frequency Interference is a disturbance in an electrical circuit due to electromagnetic induction or radiation.

RSSI: Received Signal Strength Indication is a measurement of the transmission power in a radio signal. It is measured in decibels with reference to 1 milliWatt (dBm).

RS232: a serial data communications protocol

Sensor: a device that physically or chemically reacts to environmental forces and conditions, producing a predictable electrical signal

Sleep: a command transmitted to the node to put it into sleep configuration

Sampling: the process of taking measurements from a sensor or device

Sampling Mode: the type of sampling that is being utilized, such as event-triggered, continuous, or periodic. The nodes have several sampling modes that employ these types of sampling.

Sampling Rate: the frequency of sampling

Slope: When describing a mathematically linear relationship, the slope is the steepness of the line that represents that relationship on a graph. The equation of a straight line is: $y = mx+b$, where x is the x-axis coordinate, y is the y-axis coordinate, m is the slope, and b is the offset.

Streaming: Streaming is a sampling mode in which all active channels (and the sensors attached to them) are measured, and the acquired data is transmitted to the gateway and software. The data is not written to non-volatile memory during streaming. Streaming can either be finite (have a user defined start and end time) or continuous (continued until the power is cycled on the node).

Synchronized Sampling: a sampling mode that automatically coordinates all incoming node data to a particular gateway. This mode is designed to ensure data arrival and sequence.

Transmission rate: the number of data packets per transmission window, measured in seconds. Depending on the sampling mode and settings it will be between 1 and 64 packets/second.

Transmission window: the time allowed for one data transmission at the automatically determined transmission rate

USB: Universal Serial Bus is a serial data communications protocol

WSN: Wireless Sensor Network describes a distribution of sensors and data acquisition equipment that autonomously monitors environmental characteristics, such as temperature, pressure, and strain.