WSDA®-1500-LXRS®

Wireless Sensor Data Aggregator

The **WSDA®-1500-LXRS® Wireless Sensor Data Aggregator** is a data acquisition gateway used with LORD MicroStrain® wireless sensor nodes to collect and distribute sensor data. The WSDA®-1500-LXRS® is Ethernet-capable and can be configured to operate with a static IP, a DHCP-enabled LAN, or as a datalogger to local memory. Secure, web- based data access and analysis is available with integration to the SensorCloud™ platform. Sensor data can also be pushed to a J1939 capable CAN bus.

The WSDA®-1500-LXRS® starter kit includes all components required to integrate it into the wireless sensor network. This quick start guide describes the basic interfaces and operation.

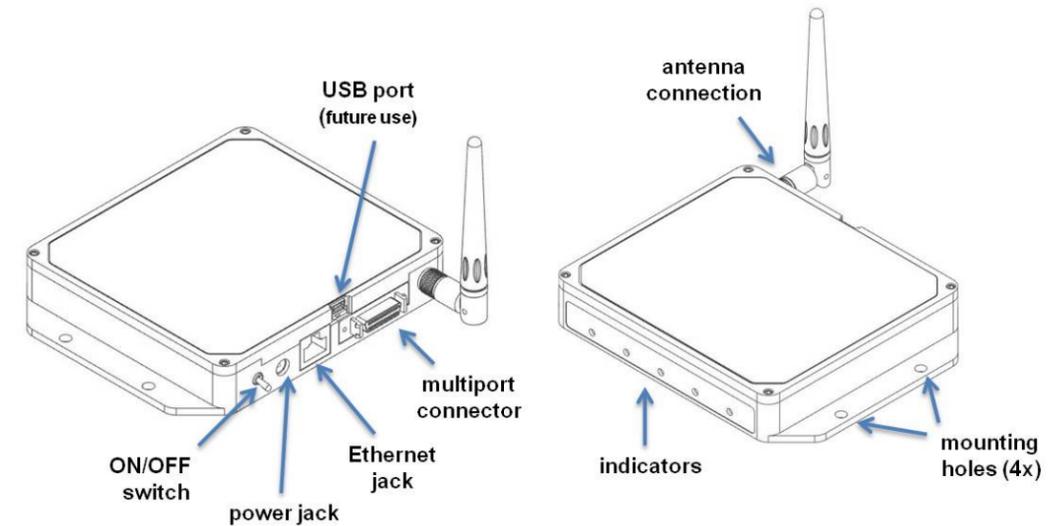| Item	Description	Quantity
A	WSDA®-1500-LXRS® Wireless Sensor Data Aggregator	1
B	Antenna	1
C	Ethernet cable, 10 ft	1
D	Power supply and plug adapter kit	1
--	Node Commander® Software Suite, User Manual, Quick Start Guide, and WSDA® Access Certificate	1

Table 1 - Starter Kit Components

Figure 1 - Ports and Indicators

Indicator	Behavior	Node Status
POWER	OFF	Gateway is off
	ON green	Gateway is on
CLOUD	Flashing blue	Uploading data to SensorCloud™
	ON green	Web upload successful
	ON red	Web upload error
DATA	Flashing green	Receiving wireless data
	Flashing blue	Sync sampling beacon enabled
	Flashing red	WARNING: another gateway beacon is detected on the same frequency
WSDA	ON green	Fully booted & idle
	Flashing blue & green	Sampling and porting data through Node Commander®
ACT	--	(future use)

Table 2 - Basic Indicator Behaviors

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Gateway Operation

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                                    NOTE

The default configuration of Ethernet gateways is for DHCP network connectivity. In order
to change the gateway communication settings, initial connection to a DHCP-enabled
network is required
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The Ethernet gateway has three primary operating sequences:

a. **Gateway configuration** in the internal gateway operating system Control Panel
(accessible through Live Connect™ and any non-deprecated web browser, or directly through
the browser)

b. **Node configuration and data acquisition** through Node Commander®
(accessible through Live Connect™)

c. **Data acquisition, viewing, and analysis** through SensorCloud™
(accessible through a live web connection)

Instructions

1. **Install Software**

The **Node Commander® Software Suite** is included with all data gateways and is also available on
the LORD MicroStrain® website for download. Install the Node Commander® Software Suite on the
host computer. It includes the following programs:

- The **Node Commander®** program is used for configuring nodes and acquiring, viewing, and
saving data.

- The **Live Connect™** program is a TCP/IP-to-serial conversion tool that translates the
communications between Node Commander® and the Ethernet gateway.

- The **WSDA® Data Downloader** program is used to download acquired data from the flash
memory card embedded in the gateway to a host computer.

SensorCloud™ is a web-based data collection, visualization, analysis, and remote management
platform based on cloud computing technology. SensorCloud™ is accessed directly from a web
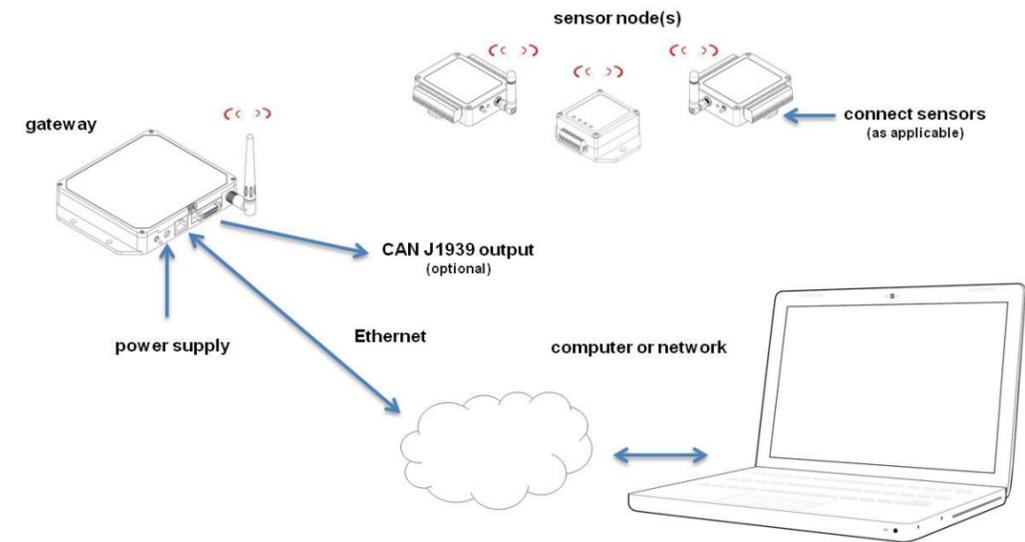connection and requires no installation.

2. **Make System Connections**

Figure 2 - System Connections

3. **Connect to the Gateway**

The WSDA®-1500-LXRS® configuration Control Panel can be accessed using Live Connect™ or
directly through a web browser.

To connect directly to the gateway Control Panel through a web browser, type the device IP address
into the browser address bar and press enter (*Figure 3 - Gateway Control Panel Access (Browser)*).
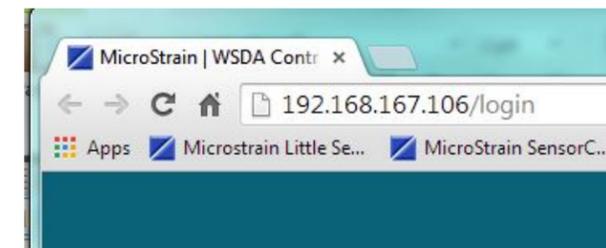

Figure 3 - Gateway Control Panel Access (Browser)

To connect to the gateway Control Panel through Live Connect™ an initial connection to a DHCP enabled network is required.

1. Connect the host computer and gateway to the DHCP network, and apply power to the gateway. Verify the gateway status indicator shows that it is on and has completed the boot up process.

2. Open Live Connect™. The gateway will be detected automatically but, depending on the network, it may take two to three minutes. Once detected, the gateway will appear on the list of discovered devices and can be identified by its name or serial number (with a WSDA® prefix) in the Device Name column (*Figure 4 - Live Connect™ Interface*).
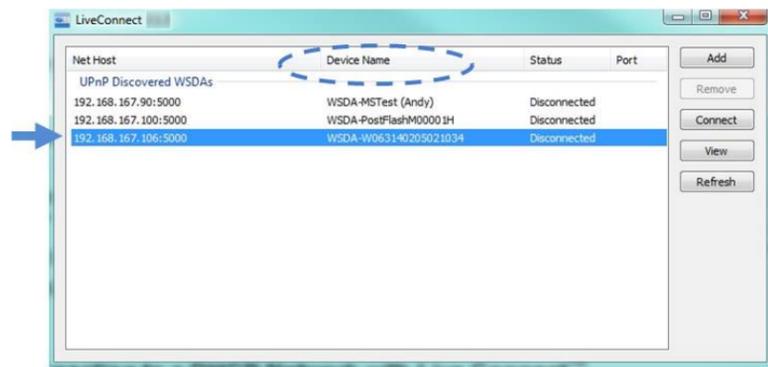

Figure 4 - Live Connect™ Interface

3. To access Control Panel through Live Connect™, highlight the device, and select the View button (*Figure 5 - Gateway Control Panel Access (Live Connect™)*).
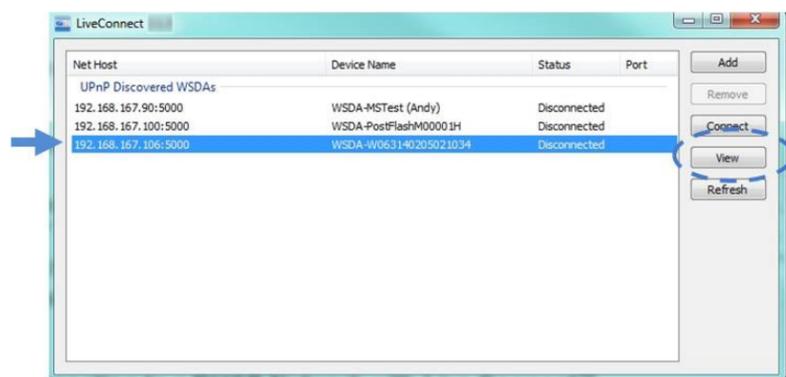

Figure 5 - Gateway Control Panel Access (Live Connect™)

4. **Configure the Gateway**

Log in to the gateway Control Panel with the default credentials:
   a. Login: wsda
   b. Password: wsda

There is a navigation panel on the left that contains three menu categories; General, Data, and Tools (*Figure 6 - Control Panel Menus*).
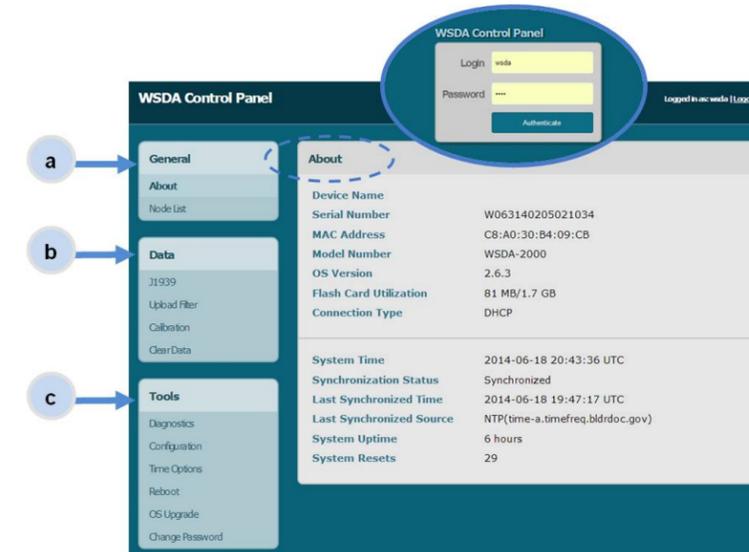

Figure 6 - Control Panel Menus

a. **General** - this category includes menu selections for information about the gateway's identity and time settings (About) and the sensor nodes it currently has data for in memory (Node List).

b. **Data** - this category includes menu selections that allow users to set which node and channel data is uploaded to SensorCloud™ (Upload Filter), set which data is pushed out the CAN J1939 port (J1939), apply calibration coefficients to data downloaded from the gateway internal memory (Calibration), and clear data from the device internal memory (Clear Data).

c. **Tools** - this category includes menu selections for troubleshooting the gateway (Diagnostics); configuring communication settings, enabling and disabling operating sequences, changing the node synchronization beacon state, and changing the gateway radio frequency (Configuration); configuring system time (Time Options); rebooting the gateway (Reboot); updating the operating system (OS Upgrade); and changing the Control Panel log-in (Change Password).

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5. Connect to Node Commander®

Sensor node configuration is done in Node Commander®. The following steps provide an overview of how to access the sensor node configuration menus in Node Commander®.

1. To enable access to Node Commander® highlight the device in Live Connect™, and select the Connect button (*Figure 7 - Connecting the Gateway to Node Commander®*).
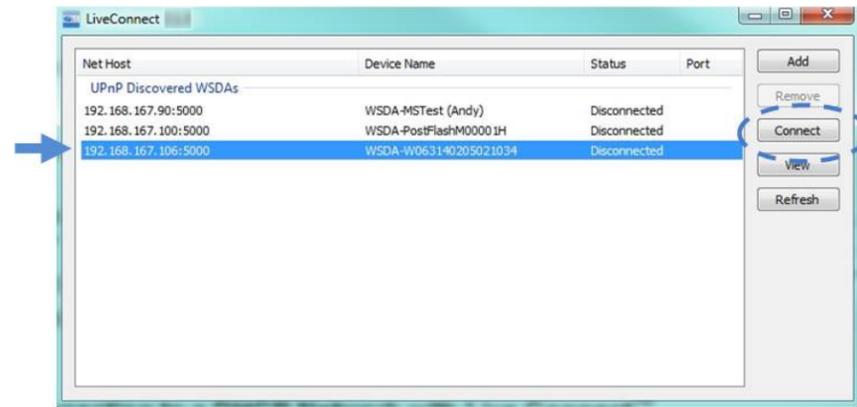

Figure 7 - Connecting the Gateway to Node Commander®

2. Once connected, a virtual serial port is assigned to the gateway and will appear in the Port column (*Figure 8 - Virtual Serial Port*).
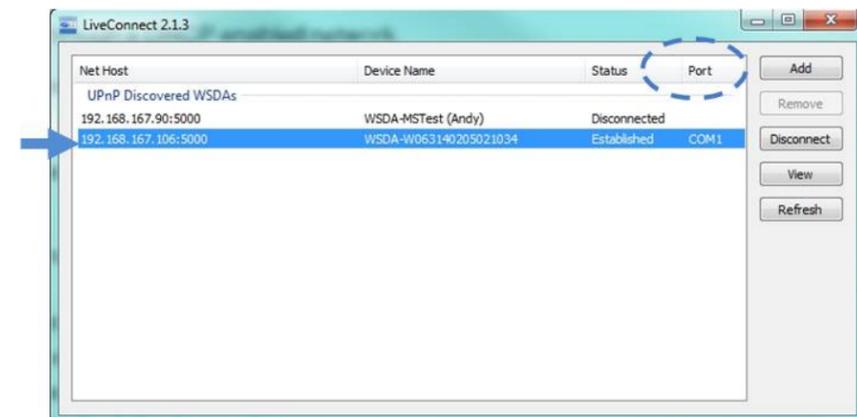

Figure 8 - Virtual Serial Port

3. Open Node Commander®.

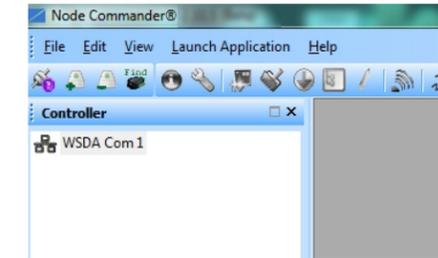4. The gateway will appear automatically in the Controller window with a communication port assignment.

Figure 9 - Ethernet Gateway Communication

6. Connect to Nodes

Two ways node connection can be made are with the automatic node discovery feature, and by manually entering the node address and searching for it on the current gateway communication frequency. The node address is indicated on the functional test or calibration document included with the node when it is purchased.

1. To add a node by address, right-click on the gateway name in the Controller window, and select Add Single Node.

2. Enter the node address, and select OK. If the node is not found a message will appear and provide the option to scan for the node on other frequencies. Once communication has been established, additional node information can be viewed by selecting the "+" symbol next to the node name.
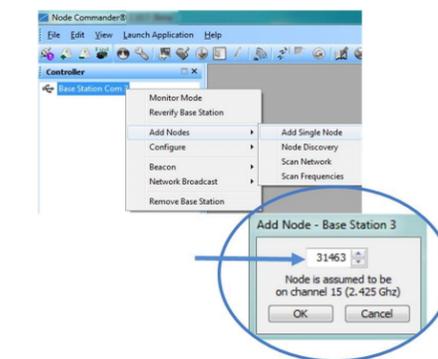

Figure 10 - Adding a Node by Address

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To connect to all nodes with the node discovery feature, the nodes must be powered OFF to start.

1. Right-click on the gateway name in the Controller window and select Add Node > Node Discovery.

2. Turn the node ON with the ON/OFF switch. During power-up, the node will transmit a message with its operating frequency within a few seconds.

3. When the device status indicator on the node ends the rapid flash sequence and begins pulsing at one-second intervals, it has completed the normal boot-up sequence and is running in idle mode. At this point the node should be listed in the Controller window, and scanning can be stopped by selecting the Stop button in the Node Discovery window. Additional node information can be viewed by selecting the "+" symbol next to the node name. If the information list appears, communication has been established.
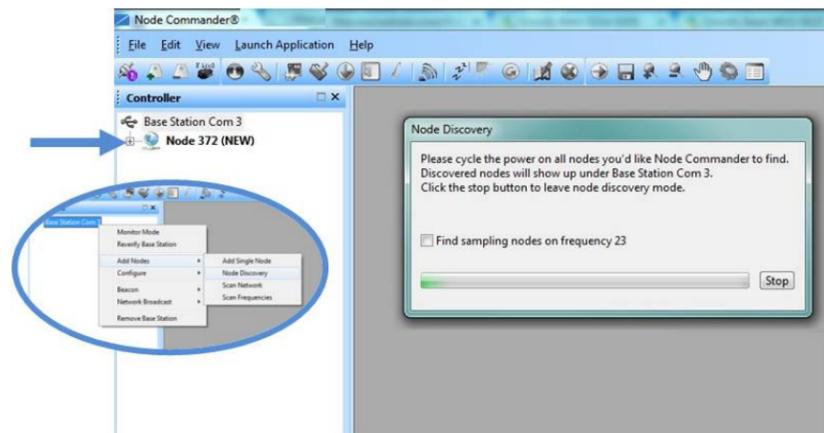

Figure 11 - Node Discovery

NOTE

Automatic node discovery may not work in some boot-up modes (depending on the revision of the node). When the node is set for normal boot mode and powered on, the device status indicator on the node will flash rapidly and then pulse in one-second intervals thereafter. If any other indicator behavior is observed during boot-up, the node is configured for a different mode, and automatic node discovery may not work. To force normal boot-up mode, toggle the node ON/OFF switch rapidly two times, and then leave it in the ON position for normal power up.

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7. **Configure Sensor Channels**

Node channels are configured for the sensor connected to it. The sensor settings are stored in the node memory for that channel. Only the channels and configuration options that are available on the type of node being used will appear in the configuration menus.

1. To enter the configuration menu, right-click on the node name, and select Configure > Configure Node. The Channels tab displays channel options available for the current node.

   a. **Channel Enabled:** indicates the channel number. The check box is used to enable the channel and select it for sampling. The icon next to the check box describes the channel type, which is intrinsic to the node being used. In the following example (*Figure 12 - Node Channels Menu*): a1) analog differential channel icon, a2) analog single ended channel icon, and a3) temperature channel icon.

   b. **Current channel configuration:** The Data Output, Units, Input Range, and Label fields describe how the channel is currently configured.

   c. **Configure:** Select the channel's Configure button to change the channel parameters such as measurement units, gain and offset settings, and calibration values. The channel must be enabled first by selecting its adjacent check box.
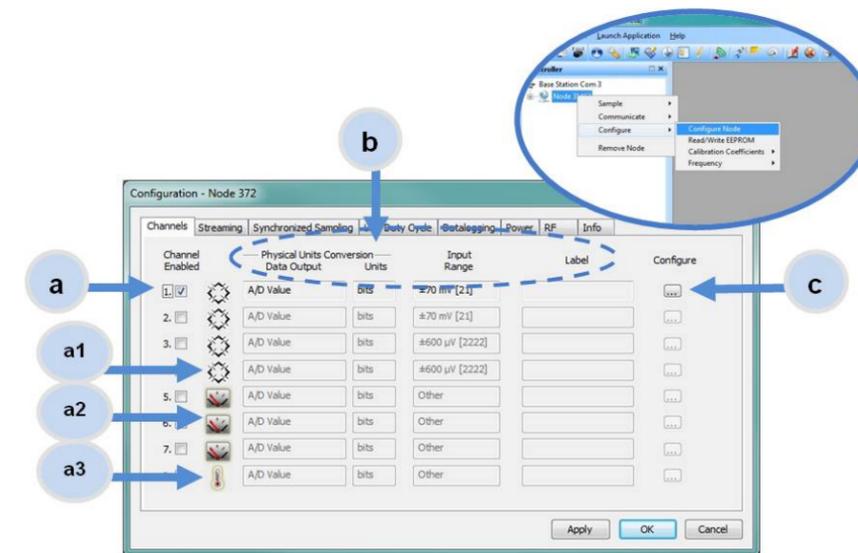

Figure 12 - Node Channels Menu

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8. Configure Sampling Settings

Depending on the type of node and gateway being used, up to four sampling modes are available: Synchronized Sampling, Low Duty Cycle, Streaming, and Datalogging. Some modes have user-configurable settings for sample rate, sample duration, event based sampling, beaconing, and data logging schemes. Other settings are automatic, depending on the number of active channels and other variables.

NOTE

Streaming mode (which is continuously polling and transmitting) uses a lot of system bandwidth and can significantly reduce node battery life. Streaming is recommended primarily for diagnostics and can only be performed in Node Commander®. Streaming is not supported in SensorCloud™.

In general, when determining which sample mode and rate is most suitable for the application, consider the following:

- Increasing the sample rate reduces the available bandwidth and therefore also reduces the number of nodes that can be reporting simultaneously.

- Increasing the sample rate increases the power requirement of the node and therefore reduces battery life.

Sampling settings are accessed through the Configure Node menu. There is a tab for each sampling mode.
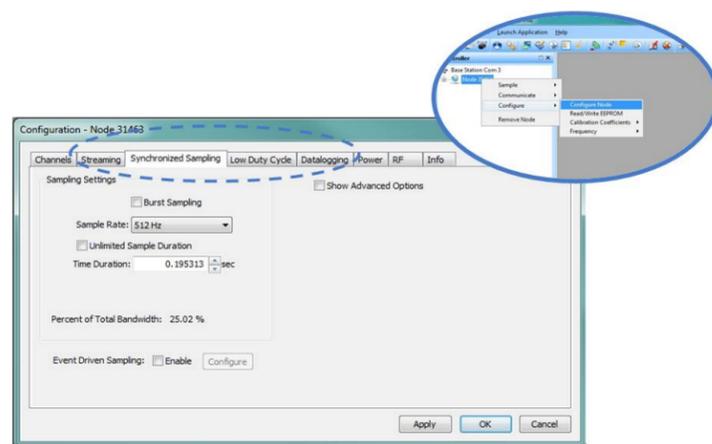

Figure 13 - Sample Settings Menu

9. Start Data Acquisition

NOTE

Once sampling has started it will continue as configured without the need to leave Node Commander® open. However, if the node is powered off and is not configured to sample on boot up, data acquisition will end and must be restarted in Node Commander®.

When data acquisition is started, each of the four sampling modes has different menu options and views. Some have a settings menu before data acquisition begins and may include a data list view and/or a graph view.

The following is an example of Synchronized Sampling (*Figure 14 - Node Sampling Settings*). For information on other sampling menus refer to the node user manual or the LORD MicroStrain® website Support page (http://www.microstrain.com/support).

1. Right-click on the node (or nodes) name and then Sample > Synchronized Sampling.

2. In the Synchronized Sampling window select the destination folder for the data in the Save Location field.

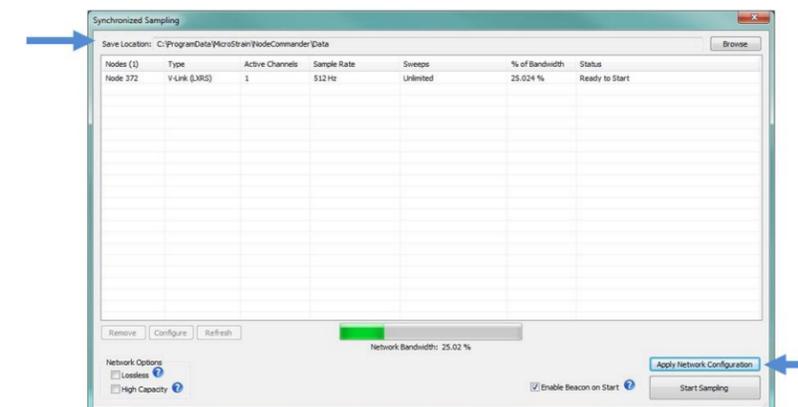3. Select Apply Network Configuration, and then select Start Sampling.

Figure 14 - Node Sampling Settings

4. Close the Synchronized Sampling window by clicking the window X in the upper right. The Sampled Data window is behind it. The default view is the Data Grid view. Use the "+" symbol next to the node heading to view the data statistics. Sampled data will appear in this window.

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NOTE

When synchronized sampling is set for slower sample rates it may take several seconds after sampling is initiated for the first sample to appear in Node Commander®.
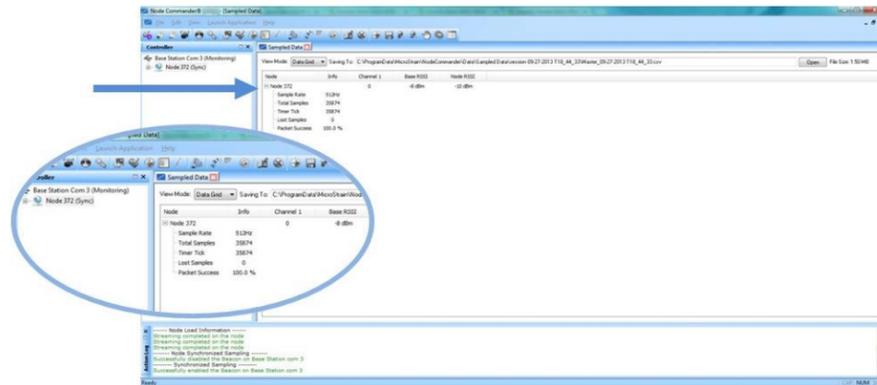
Figure 15 - Sampling Data Grid View

5. Select Graph from the View Mode field, and then click on the node name to view a graphical representation of the data.

6. To end sampling, close the Sampled Data window by clicking the X on the window tab, and select Exit > Stop Nodes.
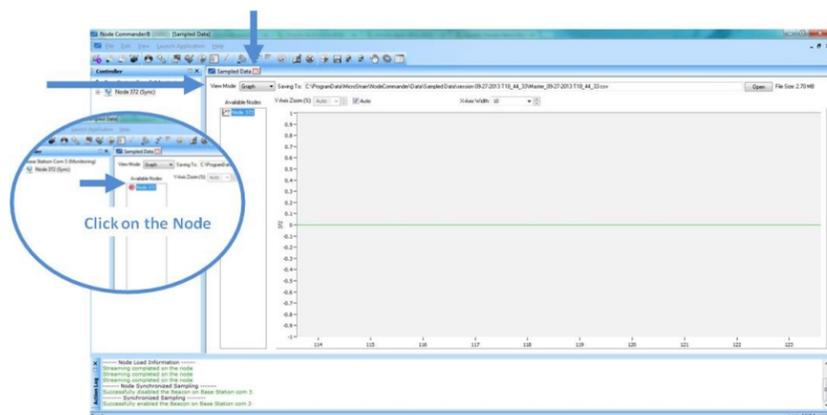
Figure 16 - Sampling Data Graph View

10. Connect to SensorCloud™

If the gateway is enabled for SensorCloud™ access and the sensor node sampling has been activated, data will automatically upload to the web. Basic SensorCloud™ services are available to all users free of charge.

There are two ways to log in to SensorCloud™ and begin viewing data:

a. Log into the SensorCloud™ website with the device-specific log-in information (WSDA® Access certificate) provided when the device is purchased, which will allow SensorCloud™ access that is restricted to that device.

b. Register as a SensorCloud™ user on the SensorCloud™ website, which will allow access to multiple initialized devices under one profile.

For either option, go to the SensorCloud™ website log-in page and enter the log-in credentials. Register as a new user if needed.

http://sensorcloud.com/log-in/

Figure 17 - SensorCloud™ Log-in or Register

The SensorCloud™ interface has six main views:

Device management, SensorCloud™ **Account** management, data **Uploader**, **Data** viewer, SensorCloud™ **Settings**, and data analysis with **MathEngine®**. When logging in as a registered user, the Device view is the default view. Navigate to other views by clicking the view name at the top of the page (*Figure 18 - SensorCloud™ Device Menu*).
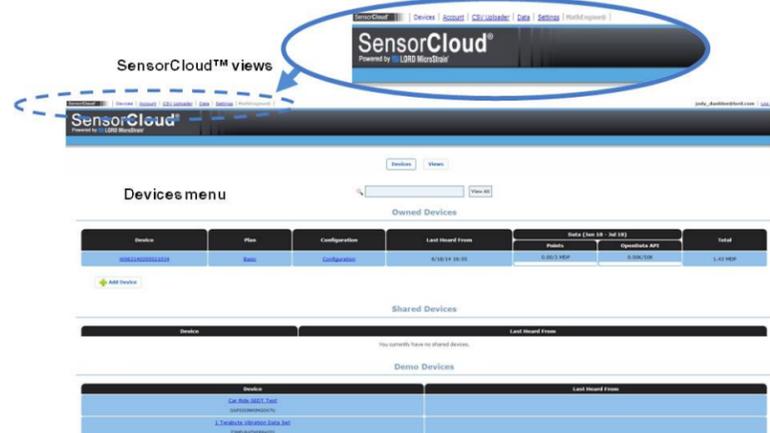
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Figure 18 - SensorCloud™ Device Menu

a. **Device** - The device list shows every gateway and API device associated with the SensorCloud™ account, including owned, shared, and demo devices. This view provides links to each devices SensorCloud™ subscription plan, device configuration options, and a summary of last communications and data transactions.

b. **Account** - The account view is for logistic management of the SensorCloud™ account, such as changing the log-in password, user email, and billing information.

c. **CSV Uploader** - The data upload feature enables data from any source or sensor to be uploaded to the gateway memory for display in SensorCloud™. The data should be in the LORD MicroStrain® CSV format.

d. **Data** - The data view is the data visualization page and displays data collected from sensor nodes or uploaded from files. Sensor data selections are listed by the node channel or user-defined label, and can be enabled for display in the graph window. The interactive graph has navigational features such as panning, zooming, and an overview graph for single click access to data points or ranges.

There are also data use and management features such as viewing the meta-data and downloading, embedding and tagging data graphs (*Figure 19 - SensorCloud™ Data View*).

Figure 19 - SensorCloud™ Data View

e. **Settings** - The settings view provides options for adding meta-data, configuring the data displays for each channel, creating alerts based on data thresholds, and setting the data timezone and more.

f. **MathEngine®** - is used to analyze sensor data. Functions include the ability to filter out frequencies, smooth out noisy data, perform math operations such as Fast Fourier Transforms (FFTs), and much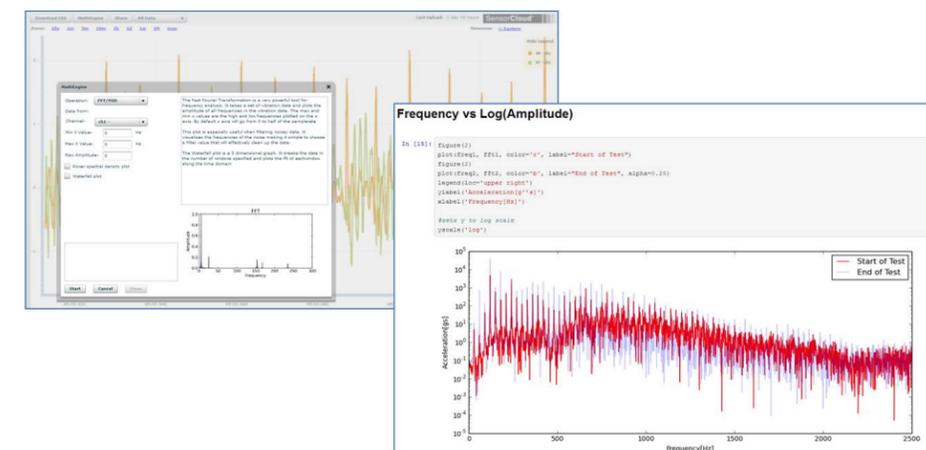 more. MathEngine® interfaces with the SensorCloud™ graphing view for faster processing (*Figure 20 - MathEngine® View*).

Refer to the MathEngine® website for more information (http://sensorcloud.com/mathengine)

Figure 20 - MathEngine® View