G-Link®-LXRS®

Wireless Accelerometer Node

The G-Link®-LXRS® wireless sensor node features two integrated high-speed ± 2 *g* or ± 10 *g* micro-electro-mechanical (MEMS) accelerometers and an internal temperature sensor. The combined readings from the accelerometers produce a triaxial acceleration output. The node has 12-bit resolution with a measurement bandwidth of 0 to 500 Hz. The node can log data to internal memory and transmit real-time, synchronized data at a wide range of sample rates and intervals.

The G-Link -LXRS does not come with any accessories, however a power supply for charging the internal battery is available. To acquire sensor data, the G-Link -LXRS is used with a LORD MicroStrain® data gateway such as the WSDA®-Base or WSDA® -1500 - LXRS®. This quick start guide describes the basic interfaces and operation using a WSDA-Base-104 USB gateway. For other system configurations, refer to the node and gateway user manuals.

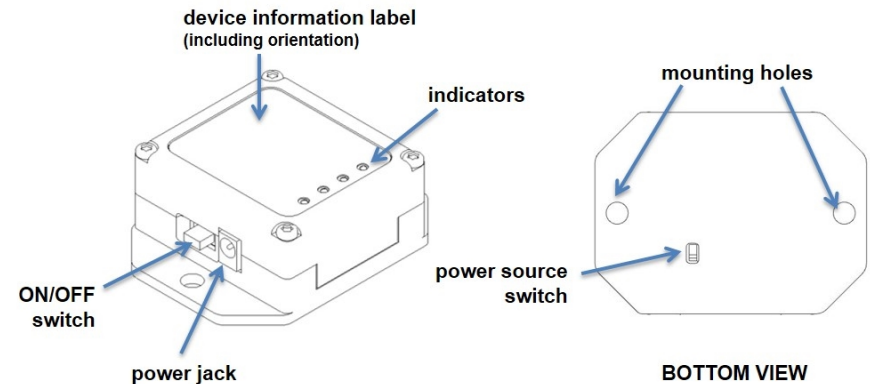| Item	Description	Quantity
A	G-Link®-LXRS® Wireless Accelerometer Node	1
--	Charging power supply with plug adapter kit (optional)	1
--	User Manual, Quick Start Guide and Calibration Certificate	1

Table 1 - Node Components List

Figure 1 - Interface and Indicators

Indicator	Symbol	Behavior	Node Status
Battery charge source indicator		OFF	No power source detected
		ON green	Charging source detected
Battery charging indicator		OFF	Node not charging
		ON bright red	Node battery charging
Completed charge indicator		OFF	Node charge status unknown
		ON green	Battery fully charged
Device status indicator		OFF	Node OFF
		Rapid flashing	Node booting up
		1 second pulse	Node idle

Table 2 - Indicator Behaviors

LORD MicroStrain®
SENSING SYSTEMS

1. Node Operational Modes

Sensor nodes have three operational modes: *active*, *sleep*, and *idle*. When the node is sampling it is in active mode. To stop sampling, the node is put into idle mode. Idle mode is used for configuring node settings (such as frequency and sampling rates) and is the only way to stop sampling or go between active and sleep modes. Sleep mode is an ultra low power mode. The node will automatically go into sleep mode after a user-settable period of inactivity. The node will not go into sleep mode while sampling.
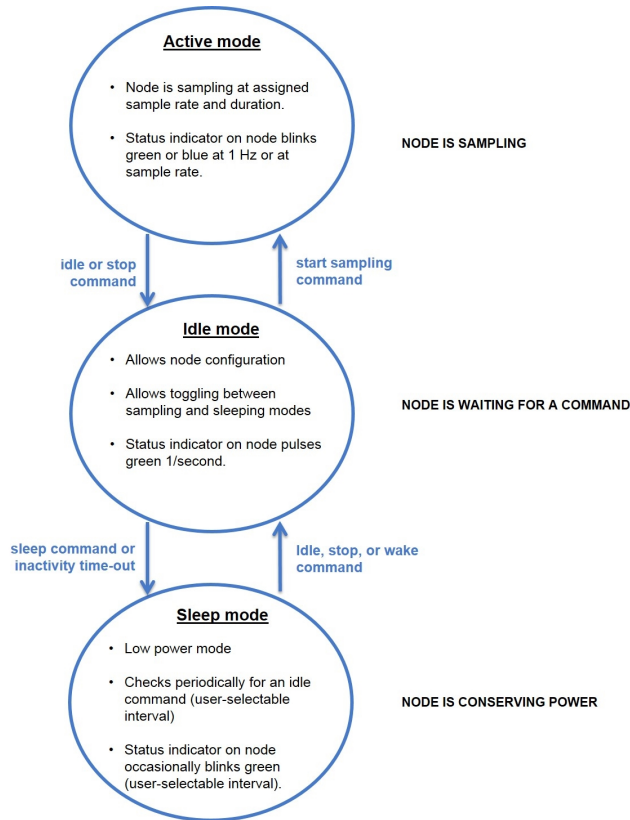
Active mode

- Node is sampling at assigned sample rate and duration.
- Status indicator on node blinks green or blue at 1 Hz or at sample rate.

NODE IS SAMPLING

idle or stop command

start sampling command

Idle mode

- Allows node configuration
- Allows toggling between sampling and sleeping modes
- Status indicator on node pulses green 1/second.

NODE IS WAITING FOR A COMMAND

sleep command or inactivity time-out

Idle, stop, or wake command

Sleep mode

- Low power mode
- Checks periodically for an idle command (user-selectable interval)
- Status indicator on node occasionally blinks green (user-selectable interval).

NODE IS CONSERVING POWER

Figure 2 - Node Operational Modes

QUICK START INSTRUCTIONS

2. Install Software

Install the **Node Commander® Software Suite** on the host computer before connecting any hardware. The Node Commander software is used for node configuration and data collection. The SensorCloud™ web platform is also available for data visualization and analysis, and it is accessed by logging onto the SensorCloud website (see Connect to SensorCloud™ on page 9).

The Node Commander Software Suite is included with all data gateways and is also available on the LORD MicroStrain® website for download:

http://www.microstrain.com/wireless/software

3. Make System Connections

To acquire sensor data, the G-Link -LXRS is used with a LORD MicroStrain data gateway such as the WSDA®-Base or WSDA® -1500 - LXRS®. G-Link®-LXRS® sensor nodes come with the following components and options.
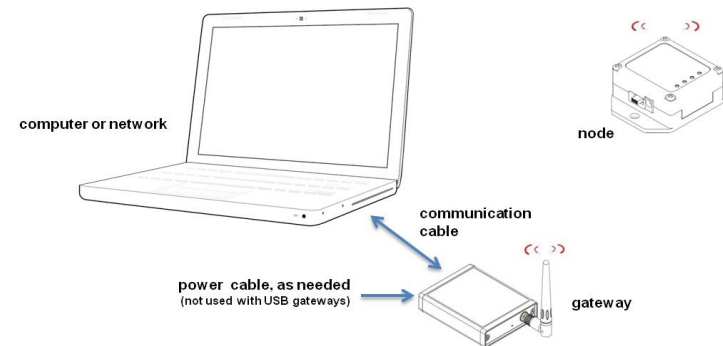
computer or network

node

communication cable

power cable, as needed
(not used with USB gateways)

gateway

Figure 3 - System Connections

LORD MicroStrain®
SENSING SYSTEMS

4. Establish Gateway Communication

The WSDA-Base USB gateway is used as an example in this quick start guide. For information on how to use other gateways, refer to the gateway or Node Commander® user manual.

Drivers for the USB gateways are included the Node Commander® software installation. With the software is 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 on.

2. Open the Node Commander software.

3. The gateway should appear in the Controller window automatically with a communication port assignment. If it is not automatically discovered, verify the port is active on the host computer, and then remove and re-insert the USB connector.
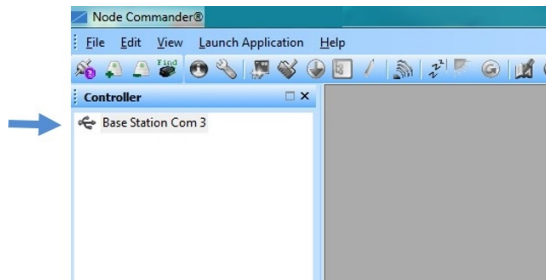
Figure 4 - USB Gateway Communication

5. Connect to Nodes

Two ways to connect the node are with the automatic node discovery feature and by manually entering the node address and searching for it on the current gateway communication frequency.

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

2. The node address and frequency are indicated in the documentation included with the node. 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. Alternately, the Node Discovery feature can be used.
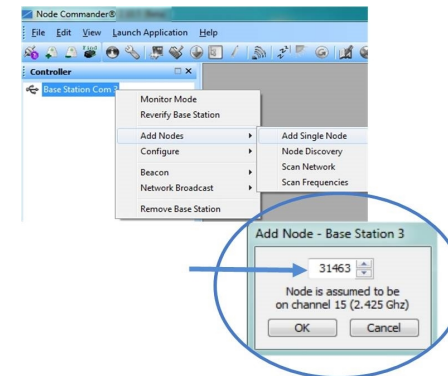

Figure 5 - Adding a Node by Address

NOTE

Nodes can be configured to boot-up in different operational modes. Automatic discovery in Node Commander® will only occur if the node is set to idle mode. To force boot-up into idle mode, toggle the node power switch rapidly two times, and then leave it in the ON position. The status indicator on the node will pulse once per second to indicate it is in idle mode.

LORD MicroStrain®
SENSING SYSTEMS

The Node Discovery feature allows connection between the gateway and node to occur even if they are on different frequencies. To connect to nodes using node discovery, begin by making sure the node is powered off.

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

2. Using the power switch, turn on the node. Within a few seconds, the node will transmit a message with its operating frequency.

3. When the device status indicator on the node ends the rapid flash sequence and begins pulsing at one-second intervals, the node 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; scanning can be stopped by selecting the Stop button in the Node Discovery window.
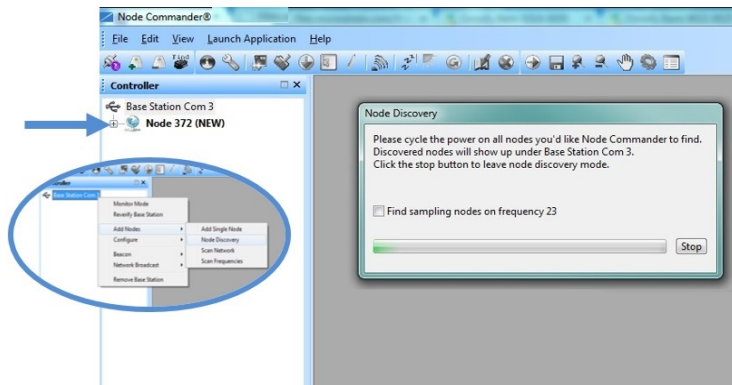
Figure 6 - Using Node Discovery

6. Configure Sensor Channels

The sensor settings are stored in the node memory, and each sensor is assigned a corresponding channel number. The configuration menus will only show the channels and configuration options that are available for the type of node being used.

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 node.

    a. **Channel Enabled:** indicates the sensor 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 inherent to the node being used.

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

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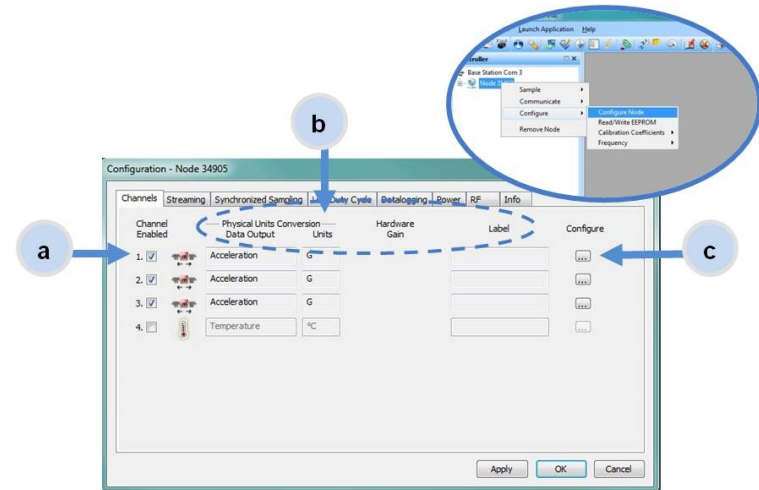

Figure 7 - Node Channels Menu

2. To enter the channel configuration menu, select the Configure button. The channel configuration menu options change depending on the sensor type selected.

LORD MicroStrain®
SENSING SYSTEMS

a. **Channel Label:** names the channel

b. **Channel diagram:** shows channel electronics and data flow

c. **Conversion Coefficients:** defines the type and units of the measurement being made

d. **Sensor Slope:** is the sensor sensitivity value used to convert the sensor voltage reading to engineering units. For the G-Link -LXRS this value is provided via the factory calibration.

e. **Conversion Formula and Effective Range:** is the formula used to convert sensor readings to engineering units. It also shows the resulting sensor measurement range.
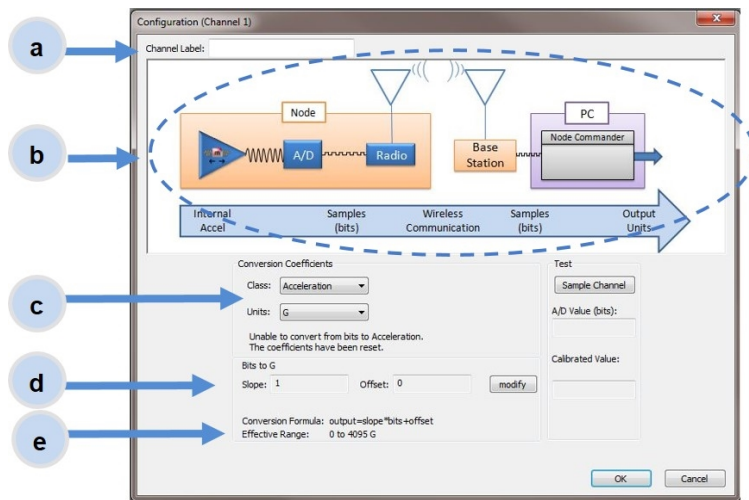
Figure 8 - Channel Setup

7. Configure Sampling Settings

Sampling settings are accessed through the Configure Node menu. The G-Link®-LXRS® has four primary sampling modes: Synchronized Sampling, Low Duty Cycle Sampling, Streaming, and Datalogging. Some modes have user-configurable settings for sample rate, sample duration, and datalogging. Other settings are automatic, depending on number of active channels and

other variables. For more information on sampling modes, refer to the Node Commander user manual.
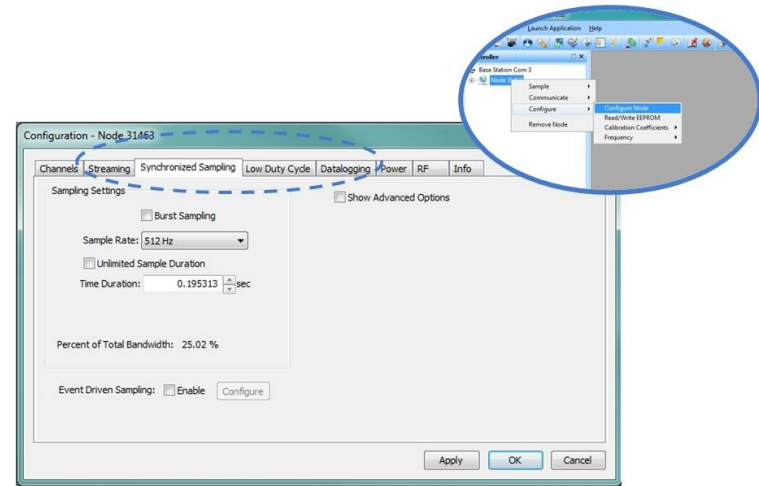

Figure 9 - Sample Settings Menu

In general, when determining what sample mode and rate is most suitable for the application, refer to the following guidelines;

- Use a sample rate at least twice the value of the target measurement frequency. This is the minimum sample rate required to produce an accurate digital representation of the measured signal. The higher the sample rate, the more accurate the digital representation.

- Using the minimum required sample rate will increase battery life and minimize the allocated network bandwidth.

- Using periodic burst sampling in place of continuous sampling will increase battery life, and the longer the sample interval, the more power and network bandwidth will be saved.

For synchronized sampling, use the online calculator to evaluate network bandwidth at different sampling settings :

http://www.microstrain.com/configure-your-system

LORD MicroStrain®
SENSING SYSTEMS

8. Start Data Acquisition

When data acquisition is started, each of the sampling modes has different menu options and views. The following is an example using Synchronized Sampling. For more information about other sampling modes, refer to the Node Commander® user manual.

To start a sampling session, nodes can be selected individually or as a group. When selected as a group, they will all be set to the same sampling mode. Right-click on the nodes and select Sample > Synchronized Sampling.
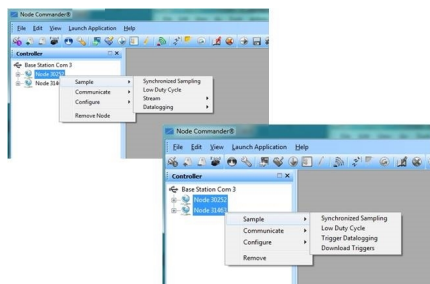

Figure 10 - Starting a Sampling Session

When a synchronized sampling session is started, the sampling menu appears and includes settings to enable optional sampling features, configure nodes, and to specify where the data will be saved. The built-in bandwidth calculator displays the total bandwidth used by the nodes selected for synchronized sampling (Figure 11 - Synchronized Sampling Menu).

a. **Save Location:** indicates where the data file will be saved on the host computer. Use the Browse button to select a preferred location.

b. **Node configuration:** includes the node serial number, sampling settings, bandwidth calculation, and current status. Highlight any node or group of nodes, and the Remove, Configure, and Refresh buttons become active.

c. **Lossless:** enables the lossless data protocol. The protocol enables buffering and retransmission of data in order to provide

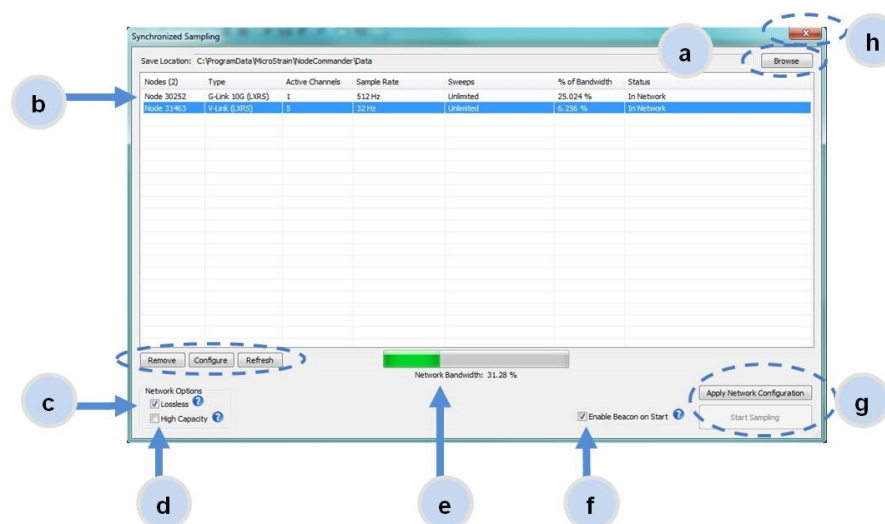100% data collection success. Using this feature may increase data display latency.

Figure 11 - Synchronized Sampling Menu

d. **High Capacity:** optimizes bandwidth and power use for nodes with slower sample rates by reducing the transmit rates. May increase data latency.

e. **Network Bandwidth:** is the total calculated bandwidth used by all the nodes. The bandwidth changes as nodes are added, removed. and settings changed.

f. **Enable Beacon on Start:** When synchronized sampling is started the nodes wait for the first beacon transmission to initiate sampling. When this option is selected (default), the gateway beacon is enabled and will begin transmitting at a fixed interval when sampling is started. Refer to the Node Commander® User Manual for more information.

g. **Apply settings and start sampling:** Before acquisition can begin, use the Apply Network Settings to save the session settings to the

LORD MicroStrain®
SENSING SYSTEMS

node. When completed, select Start Sampling to begin.

h. **Close sampling window** (with the red "X") to exit sampling or, once the sampling has been started, to view the data window behind it.

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®.

Synchronized sampling features two data views: Grid view and Graph view. Once sampling has started, the data grid view is the default view (Figure 12 - Synchronized Sampling Data View). The data display will begin automatically but may take several seconds to appear if sampling is set to slower sample rates.
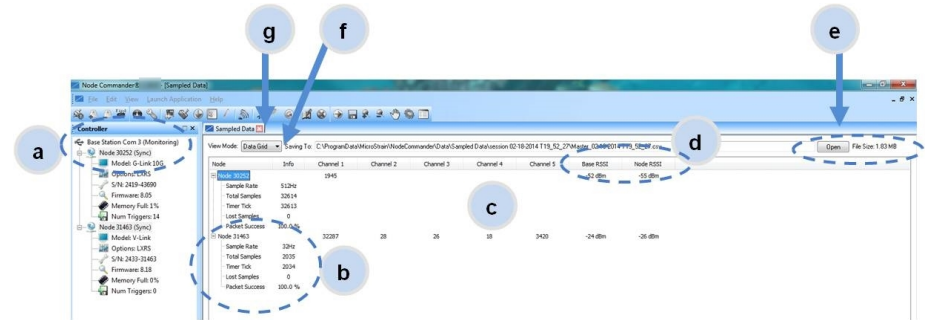

Figure 12 - Synchronized Sampling Data View

a. **Device status:** Node sampling mode and gateway status are displayed in parentheses next to the device name.

b. **Node information:** includes node serial number and sampling statistics. Right-click on the node name for more menu options such as Stop Nodes.

c. **Data:** is a display of the sampled data with each channel in its own column.

d. **Radio strength:** indicates the strength of the communication between the gateway and node.

e. **Data file:** the location and size of the data file, as data is added. View the data in .CSV format with the Open File button.

f. **View menu:** Select between Data Grid and Graph views.

g. **End sampling:** The red "X" is used to exit the sampling window and/or end sampling.

LORD MicroStrain®
SENSING SYSTEMS

Use the view menu to select the Graph view of the data (see Synchronized Sampling Graph View on page 8). Click on the node name to view the graph for that node. Click again to hide it.
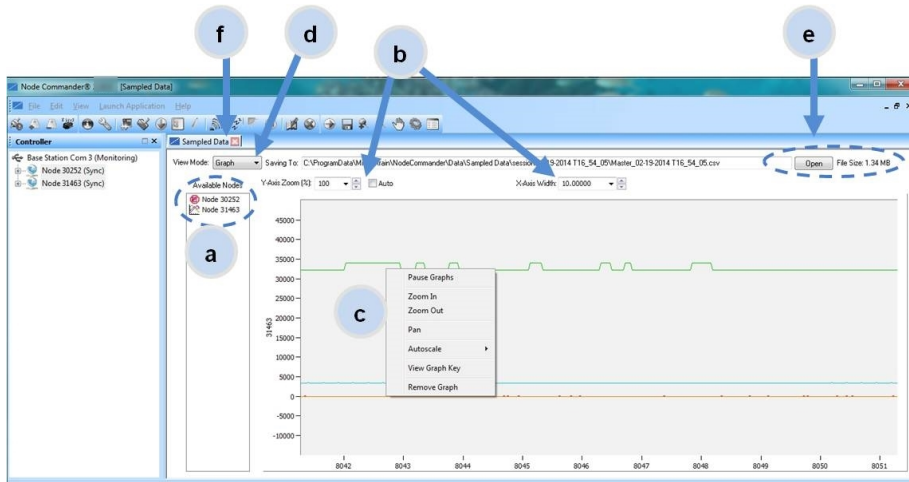

Figure 13 - Synchronized Sampling Graph View

a. **Available Nodes:** Click on the node to display the graph for that node. Click again to hide it. Right-click on the node name for more menu options such as Stop Nodes and Save Stream.

b. **Axis range:** Select the *x*-axis width and *y*-axis zoom percentage, or use the Auto check box for automatic scaling.

c. **Graph:** The node graph shows the sampled data. Each active channel is displayed in a different color. The *x*-axis is time in seconds and the y-axis is the A/D value (bits). Right-click on the graph for additional menu options such as View Graph Key, Pan, Zoom, Pause, and Remove Graph.

d. **View menu:** Select between Data Grid and Graph views.

e. **Data file:** The location and size of the data file as data is added. View the data in .CSV format with the Open File button.

f. **End sampling:** The red "X" is used to exit the sampling window and/or end sampling.

9. Access Data Files

Data acquired in Node Commander is stored in .CSV format and can be opened with Microsoft Excel, Quattro Pro, Open Office, or another CSV editors/spreadsheet program. Data in this format is easily uploaded to SensorCloud™ using the CSV Uploader. The data files can be found on the host computer in the default directory or the location specified at the beginning of the sampling session (as applicable). The files are organized in separate folders by mode and then further categorized by date, session, and/or node serial number.

The default directory is:
C:\ProgramData\Microstrain\NodeCommander\Data

Synchronized sampling and low duty cycle files are found in the Sampled Data folder, and **streaming data** is stored in the Streaming folder. **Datalogging files** need to be downloaded from the node to be available for viewing. They are accessed through datalogging menus as well as the File menu, and are saved in the Downloaded Triggers folder.
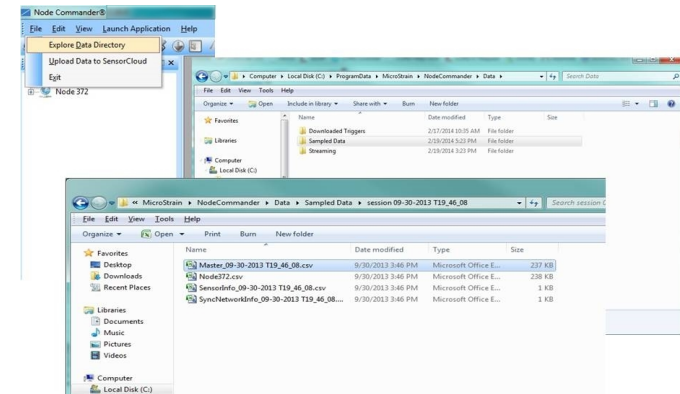

Figure 14 - Exploring Data

LORD MicroStrain®
SENSING SYSTEMS

10. Connect to SensorCloud™

For global data aggregation, visualization, and analysis, data is uploaded to the SensorCloud web platform. Basic SensorCloud services are available to all users free of charge. Ethernet gateways, such as the WSDA® -1500 - LXRS® can be enabled to upload data automatically to SensorCloud once the node sampling has been activated. Refer to the gateway user manual for more information. can be enabled to upload data automatically to SensorCloud once the node sampling has been activated. Refer to the gateway user manual for more information.

To connect to SensorCloud go to the SensorCloud website log-in page, and enter the log-in credentials. Register as a new user if needed.
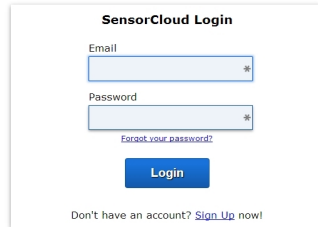
http://sensorcloud.com/log-in/

Figure 15 - SensorCloud™ Log-in or Register

The SensorCloud interface has **six main views**. When logging in as a registered user, the Device view is the default. Navigate to other views by clicking the view name at the top of the page (Figure 16 - SensorCloud™ Menu Views). The Data and Settings views are only available once a device is selected from the device list.
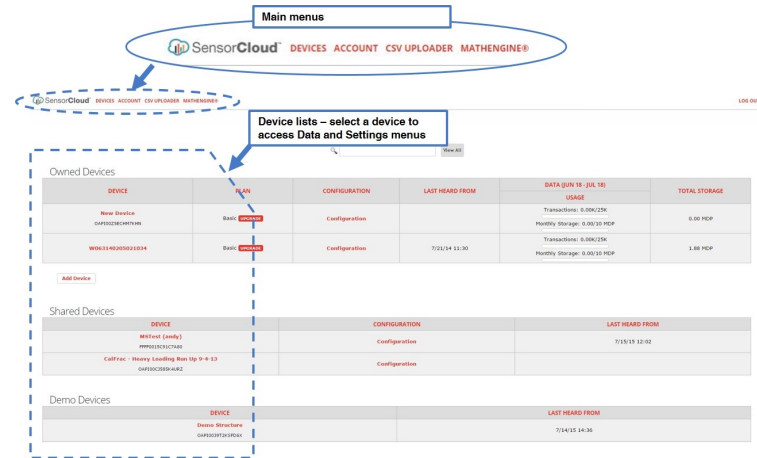

Figure 16 - SensorCloud™ Menu Views

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

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

CSV Uploader - The data upload feature enables data from any source (such as non-Ethernet LORD MicroStrain gateways, or third-party sensor) to be uploaded to the SensorCloud platform. The data must be in the LORD MicroStrain CSV format.

LORD MicroStrain®
SENSING SYSTEMS

Data - This view is only available after a device is selected. It displays data that is collected from sensor nodes or uploaded from files. Data selections are listed by node channel or a user-defined label, and can be enabled for display in the graph window. The interactive graph enables navigational features such as panning, zooming, and accessing data points and ranges with a single click. There are also features for use and management such as viewing the meta-data and downloading, embedding, and tagging data graphs.

Figure 17 - SensorCloud™ Data View

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

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 more. MathEngine® interfaces with the SensorCloud graphing view for faster processing. Users can write their own algorithms for custom applications. Refer to the MathEngine® website for more information.
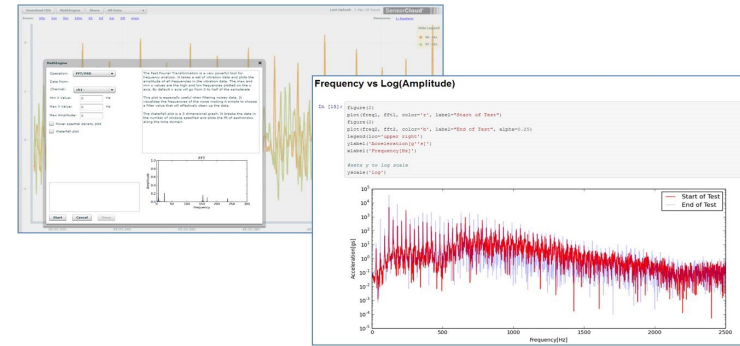
http://sensorcloud.com/mathengine

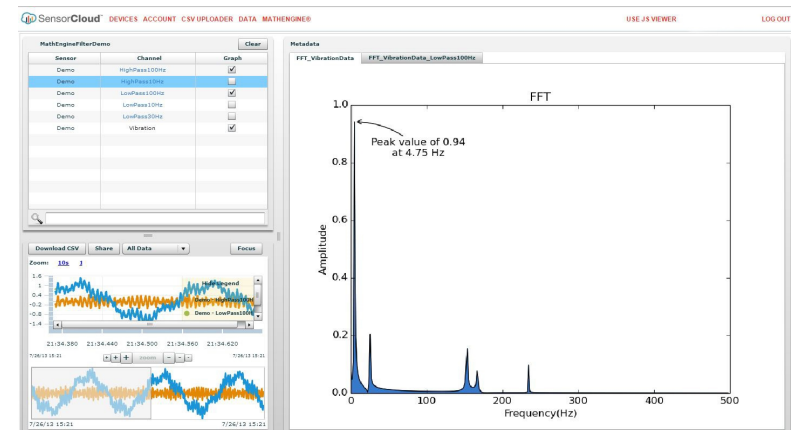**Figure 18 - MathEngine® View**

Figure 19 - FFT Graph in SensorCloud™

For more information about SensorCloud features and navigation, refer to the SensorCloud website or contact LORD MicroStrain Technical Support.

http://sensorcloud.com