

# WSDA<sup>®</sup>-Base-104 USB Base Station



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MicroStrain<sup>®</sup>, WSDA<sup>®</sup>, Node Commander<sup>®</sup>, V-Link<sup>®</sup>, SG-Link<sup>®</sup>, G-Link<sup>®</sup>, TC-Link<sup>®</sup>, mXRS<sup>™</sup>, SensorCloud<sup>™</sup>, DVRT-Link<sup>™</sup> and EH-Link<sup>®</sup> are trademarks of MicroStrain, Inc.

**Node Commander<sup>®</sup> software**

This product is designed for use with MicroStrain's Node Commander<sup>®</sup> software version 2.4.0 and higher.

## About this manual

The following annotations have been used to emphasize information, provide software instruction, and so forth.

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The user should pay particular attention to this symbol. It means there is a chance that physical harm could happen to the equipment if the instruction is not observed.



**WARNING:** The WSDA<sup>®</sup>-Base-104 should not be disassembled by the user. Damage not covered by warranty may result.

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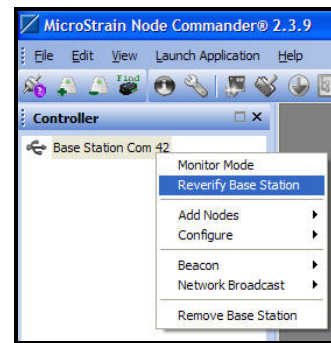
This symbol indicates that a step-by-step instruction is given to use Node Commander<sup>®</sup> software to operate the equipment.



### ***Node Commander<sup>®</sup>***

*Establish communication with the Base Station*

1. Launch Node Commander software.
2. The base station will appear as Base Station Com X in the Controller frame, e.g., Com 42 indicating the base station has been assigned com port 42.
3. Right-click the Base Station and click Reverify Base Station if it is grayed-out.



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## Overview

The WSDA<sup>®</sup>-Base-104 USB Base Station operates as an integral part of MicroStrain's mXRS<sup>™</sup> Wireless Sensor Networks. It provides seamless communication between a host PC, single board computer or microcontroller, and single or multiple remote wireless nodes, including:

- [V-Link<sup>®</sup>-mXRS<sup>™</sup>](#) Wireless Voltage Node
- [SG-Link<sup>®</sup>-mXRS<sup>™</sup>](#) Wireless Strain Node
- [G-Link<sup>®</sup>-mXRS<sup>™</sup>](#) Wireless Accelerometer Node
- [DVRT-Link<sup>™</sup>-mXRS<sup>™</sup>](#) Wireless Displacement Node
- [TC-Link<sup>®</sup>-6CH-mXRS<sup>™</sup>](#) Wireless Thermocouple Node
- [TC-Link<sup>®</sup>-1CH-mXRS<sup>™</sup>](#) Wireless Thermocouple Node
- [EH-Link<sup>®</sup>](#) Wireless Energy Harvesting Node
- [SG-Link<sup>®</sup>-OEM-S](#) Wireless Strain Node
- [TC-Link<sup>®</sup> OEM](#) Wireless Thermocouple Node
- MicroStrain's legacy 2.4 GHz wireless nodes including V-Link<sup>®</sup>, SG-Link<sup>®</sup>, SG-Link<sup>®</sup> OEM, G-Link<sup>®</sup>, TC-Link<sup>®</sup>-6CH, TC-Link<sup>®</sup>-1CH, TC-Link<sup>®</sup> OEM and DVRT-Link<sup>™</sup>.

Coupled with MicroStrain's Node Commander<sup>®</sup> software, the WSDA<sup>®</sup>-Base-104 supports configuration of the wireless nodes including discovery, initialization, radio frequency, sample rate, reading/writing to node EEPROM, calibrating nodes' sensors, managing the nodes' batteries including sleep, wake and cycle power, and upgrading the nodes' firmware.



The WSDA<sup>®</sup>-Base-104 supports all data acquisition sessions between wireless nodes and host computers including **Synchronized Sampling (both Continuous and Burst modes), Armed Datalogging, Datalogging, Streaming and Legacy Low Duty Cycle.**

Each MicroStrain mXRS<sup>™</sup> wireless node has an embedded precision timekeeper. The WSDA<sup>®</sup>-Base-104 provides a continuous, system-wide synchronization signal, or 'beaconing', that maintains a precision timing reference for all node timekeepers. Time-stamp synchronization of all sensors in the network is maintained within +/- 32 microseconds as a result.

## Software

### Software Installation

The WSDA<sup>®</sup>-Base-104 is configured and operated using MicroStrain's Node Commander<sup>®</sup> software. Place the Node Commander<sup>®</sup> CD into your CD-ROM drive and follow the on-screen instructions to install the software. The software is written for the Microsoft Windows operating system; the software will also work in Windows emulators on the MAC OS.

### Communicating with Node Commander<sup>®</sup>

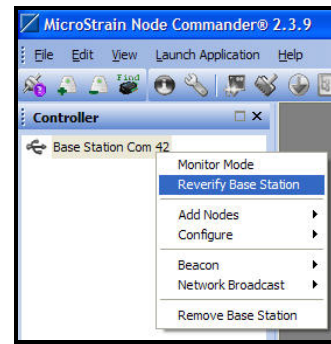
Node Commander<sup>®</sup>, MicroStrain's Wireless Sensor Networks software, is designed to operate the mXRS<sup>™</sup> wireless nodes and base stations including the WSDA<sup>®</sup>-Base-104. The software provides for configuration of the individual wireless nodes, configuration of the base station, operation of Synchronized Sampling (both Continuous and Burst modes), Armed Datalogging, Datalogging, Streaming and Legacy Low Duty Cycle data acquisition sessions, real time display of data, and writing data to file. The software also provides intuitive 'wizards' that allow the user to set-up any sensor attached to the wireless nodes including strain gauges, displacement sensors, load cells, torque transducers, pressure sensors, accelerometers, geophones, temperature sensors, etc. The software can discover any wireless nodes within range, set the nodes and base stations to operate on separate frequencies, acquire data from multiple nodes and multiple base stations all at the same time, manage the nodes' batteries including sleep, wake and cycle power, and upgrade the nodes' firmware.



#### **Node Commander<sup>®</sup>**

*Establish communication with the Base Station*

1. Launch Node Commander software.
2. The base station will appear as Base Station Com X in the Controller frame, e.g., Com 42 indicating the base station has been assigned com port 42.
3. If it is grayed-out, right-click the Base Station and click Reverify Base Station.



## Communicating with Wireless Nodes

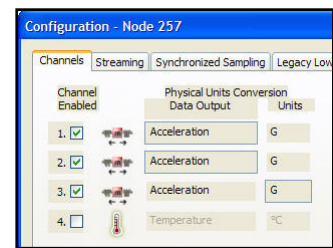
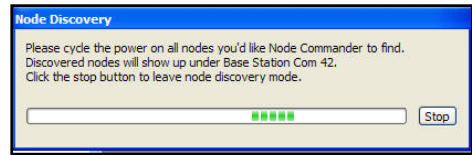
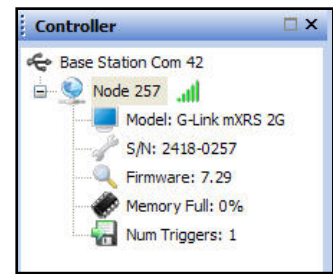
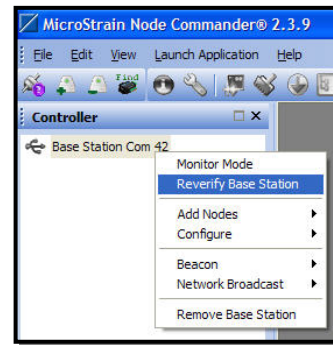
The WSDA<sup>®</sup>-Base-104 is the communication link between Node Commander<sup>®</sup> and the wireless nodes. Node Commander<sup>®</sup> sends configuration commands and requests for sensor data through the base station to the nodes. The nodes send their acknowledgements and data back through the base station to Node Commander<sup>®</sup>. The base station is essentially transparent to the back and forth traffic. A session involves 1) configuring the node, 2) sampling the node's sensors, 3) displaying the data, and 4) writing the data to file. Let's walk through a typical **Legacy Low Duty Cycle** session using a MicroStrain [G-Link<sup>®</sup> Wireless Accelerometer Node](#) as our example.



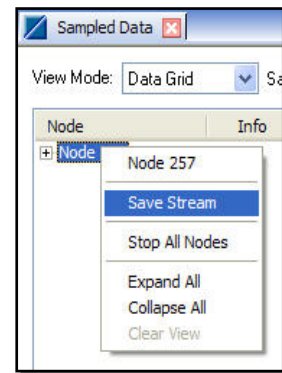
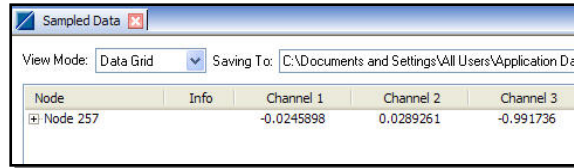
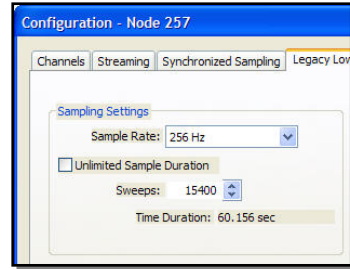
### Node Commander<sup>®</sup>

*Configuring and running a Low Duty Cycle session*

1. Launch Node Commander software.
2. The base station will appear as Base Station Com X in the Controller frame, e.g. Com 42, indicating the base station has been assigned com port 42.
3. Right-click the Base Station and click Reverify Base Station if it is grayed-out.
4. Right-click the Base Station.
5. Click Add Nodes.
6. Click Node Discovery and the Node Discovery window will appear.
7. Turn the G-Link wireless node on.
8. The Node and its unique address, e.g. Node 257 (NEW), will be discovered automatically and appear in the tree under the Base Station.
9. Click the Stop button and the Node Discovery window will disappear.
10. Right-click the Node.
11. Click Load Node Information and the model, serial number, firmware version, datalogging memory and datalogging triggers information will appear.
12. Right-click the Node.
13. Click Configure.
14. Click Configure Node and the Configuration window will appear.
15. Click the Channel Enabled checkboxes to enable channels 1, 2 and 3 (X, Y and Z axis accelerometers on the G-Link).
16. Click Apply.
17. Click the Legacy Low Duty Cycle tab.
18. Select a Sample Rate of 256 Hz.
19. Uncheck the Unlimited Sample Duration checkbox.



20. Set a Sweeps value of 15400, a finite sampling session of ~60 seconds.
21. Click Apply.
22. Click OK and the Configuration window will disappear.
23. Right-click the Node.
24. Click Sample.
25. Click Legacy Low Duty Cycle and the Sampled Data window will appear.
26. Node 257 and its 3 channels of data will be displayed.
27. Channel 1 is the X axis accelerometer, channel 2 is the Y axis accelerometer and channel 3 is the Z axis accelerometer, all displaying in Gs.
28. The sampling will continue for ~60 seconds and stop.
29. Right-click Node 257.
30. Click Save Stream and the Save As dialog box will appear.
31. Name your data file, select your data folder and click Save.
32. The data will be saved in a standard CSV (comma separated value) file which is readily importable into most analysis software.



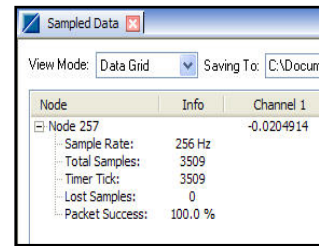
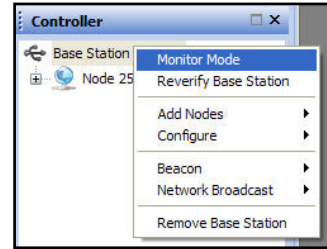
## Monitor Mode

Monitor Mode is a Node Commander<sup>®</sup> function that instructs the base station to monitor for either Synchronized Sampling activity or Legacy Low Duty Cycle activity by any wireless nodes on the same radio channel (frequency) as the base station. The nodes may have already been discovered by the base station or may not. An example of this function's use would be to capture the data arriving from wireless nodes that have been set to begin Legacy Low Duty Cycle on start-up, i.e., when power is applied.



### Node Commander<sup>®</sup> Start Monitor Mode

1. Right-click the Base Station Com X, e.g., Com 42.
2. Click Monitor Mode.
3. The Sampled Data window will appear.
4. Any nodes found will be displayed along with their channel data.
5. Right-click the Base Station Com X to Exit Monitoring.



## Network Broadcast

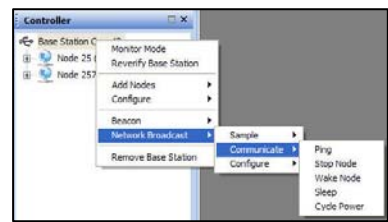
Network Broadcast is a Node Commander<sup>®</sup> function that allows the user to send the same command to multiple wireless nodes at the same time. Examples of this function's use would be to command all the nodes to go to Sleep, or command all the nodes to Trigger Datalogging Session. The Network Broadcast command uses the node broadcast address 65535 and will be responded to by only those nodes that are on the same radio channel (frequency) as the base station. The list below shows the Network Broadcast commands that are available:

- Sample
  - Synchronized Sampling Start
  - Legacy Low Duty Cycle Start
  - Armed Datalogging
  - Trigger Datalogging Session
  - Erase
- Communicate
  - Ping
  - Stop Node
  - Wake Node
  - Sleep
  - Cycle Power
- Configure
  - Read/Write EEPROM



### *Node Commander<sup>®</sup>* *Start Monitor Mode*

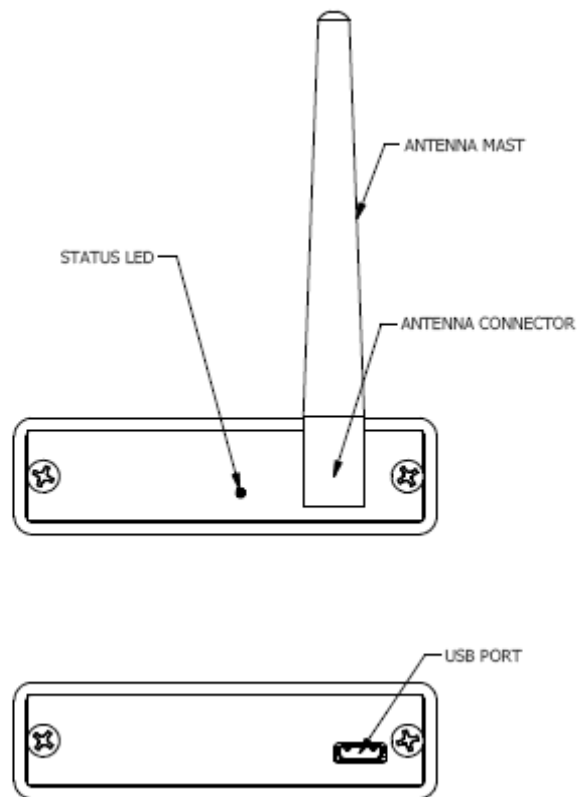
1. Right-click the Base Station Com X, e.g., Com 42.
2. Click Network Broadcast.
3. Monitor Mode.
4. Click either Sample, Communicate or Configure to send the appropriate command.



## Hardware

### **WSDA<sup>®</sup>-Base-104 Installation**

1. Install the antenna on the WSDA<sup>®</sup>-Base-104 antenna connector. Tighten hand tight; do not over tighten.
2. Insert the Micro-B connector of the USB cable into the USB connector on the back panel of the WSDA<sup>®</sup>-Base-104.
3. Insert the Type A connector of the USB cable into any USB connector on your host computer.
4. The **green** LED on the front panel of the WSDA<sup>®</sup>-Base-104 will illuminate continuously, indicating the device is powered (through the USB connection from the host computer).



*Figure 1. Base Station Nomenclature*

## **Communication Interface**

### **USB Interface**

The WSDA<sup>®</sup>-Base-104 and the host computer communicate via a USB connection. The USB interface, from a physical standpoint, resides in a communication cable connecting a Micro-B USB connector to the base station and a Type A USB connector to the host. The USB communication on the base station is provided via a Silicon Laboratories CP210x USB to UART Bridge chip. The CP210x is a single-chip USB to UART bridge that converts data traffic between USB and UART formats. The chip includes a complete USB 2.0 full-speed function controller, bridge control logic and a UART interface with transmit/receive buffers and modem handshake signals. Specifications for the chip may be found at: <https://www.silabs.com/products/interface/usbtouart/Pages/usb-to-uart-bridge.aspx>

This physical architecture is supported by a Silicon Laboratories CP210x USB to UART Bridge Virtual COM Port (VCP) driver installed on the host. This driver is required for device operation as a Virtual COM Port to facilitate host communication. The driver is normally installed during installation of MicroStrain's Node Commander<sup>®</sup> software. The driver may also be downloaded from Silicon Labs at: <https://www.silabs.com/products/mcu/Pages/USBtoUARTBridgeVCPDrivers.aspx>

With the installation of this driver, the software developer will find that communication between base station and host will be, for all intents and purposes, typical serial communication. The various coding languages will interact as if a standard serial port existed. The WSDA<sup>®</sup>-Base-104 communicates with its host computer at 921,600 baud (921.6 Kbaud) by default. All operations on the base station and the wireless nodes communicating with it are supported at this baud rate.

### **Device Manager**

The Device Manager in Microsoft Windows can be used to determine the presence of the communications driver and the state of the host-to-base station connection. Here's how:

- Click Start on your Windows desktop.
- Click Control Panel.
- Click System and the System Properties window will appear.
- Click the Hardware tab.
- Click the Device Manager button and the Device Manager window will appear.
- Locate the Ports (COM&LPT) item in the tree.
- Click the '+' sign to the left of Ports to open the tree.
- Locate a line item that reads *Silicon Labs CP210x USB to UART Bridge (ComX)*.
- This will indicate that the driver is installed and the base station and host are ready to communicate.
- If the line item is not found, the driver has not been installed, the base station is not connected, or some other problem exists.

## Analog-to-Digital

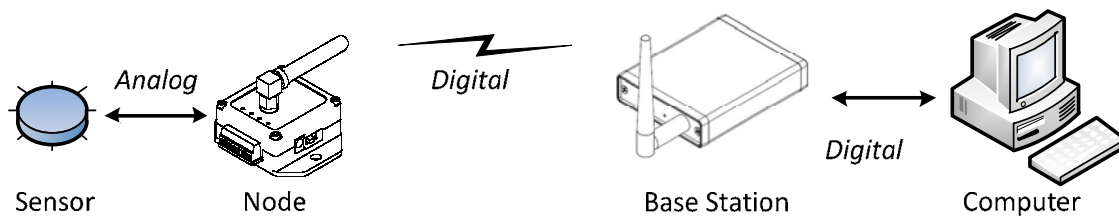
MicroStrain's wireless nodes support 0-3 volt analog sensors. As examples:

- The G-Link<sup>®</sup> has 3 on-board accelerometers and a temperature sensor.
- The V-Link<sup>®</sup> has 4 differential input channels to accommodate strain gauges and other wheatstone bridge sensors, 3 single ended channels to accommodate a range of 0-3 volt analog sensors, and an on-board temperature sensor.
- The SG-Link<sup>®</sup> has 1 differential input channel to accommodate strain gauges and other wheatstone bridge sensors, 1 single ended channels to accommodate a range of 0-3 volt analog sensors, and an on-board temperature sensor.
- The TC-Link<sup>®</sup>-6CH has 6 thermocouple channels, 1 CJC channel and 1 relative humidity sensor.

As each of these sensors is sampled during any given sampling session, .i.e., datalogging, streaming, legacy low duty cycle, etc., its 0-3 volt output is digitized by a 12-bit analog-to-digital (A2D) converter on the node. This results in a digital representation of the voltage as a range of 0 to 4095 'bits'. As examples we see:

- 0 volts = 0 bits
- 1.5 volts = 2048 bits
- 3 volts = 4095 bits

These digital values are transmitted to the WSDA<sup>®</sup>-Base-104, are passed on to Node Commander<sup>®</sup> software and scaled into actual engineering units. Please refer to the *Scaling Engineering Units* section of this guide for further discussion on this subject.



*Figure 2. Analog-to-Digital*

## Scaling Engineering Units

As introduced in the *Analog-to-Digital* section of this guide, the sensor data arriving from the nodes into the base station is a 0-4095 value, representing the 0-3 volts sensor output. This digital representation of volts is passed on to Node Commander<sup>®</sup> and is scaled into actual engineering units. Accelerometer data is scaled into Gs, strain gauge data is scaled into microstrain, temperature sensor data is scaled into °C, and so forth. Node Commander<sup>®</sup> accomplishes this by reading the calibration coefficients that are stored in non-volatile memory on-board the wireless nodes. It applies these calibration coefficients to the bits values on-the-fly and reports the actual engineering units in its graphing functions, displays and data files. Let's take a look at this process using Node Commander<sup>®</sup> and a G-Link<sup>®</sup>-mXRS<sup>™</sup>.



### **Node Commander<sup>®</sup>**

*Confirm each sensor channel's calibration coefficients*

1. Right-click Node X, e.g., Node 257.
2. Click Configure.
3. Click Configure Node and the Configuration window opens.
4. Click the Configure button (with the ... dieresis) for Channel 1 and the Channel 1 Configuration window opens.
5. Observe in the Conversion Coefficients frame that the accelerometer on channel 1 of the G-Link is being scaled into 'G' Units.
6. Observe in the Bits to G frame that channel 1 carries a Slope of 0.00409836 and Offset of -8.22131. Node Commander has read these values from the G-Link's memory. These calibrations coefficients are applied by Node Commander using the Conversion formula  $Output = Slope * Bits + Offset$  to produce actual engineering units.

For example, if we had an output of 2048 bits on channel 1 of our G-Link, channel 1 being our X axis accelerometer, we would calculate:

$$0.172g = 0.00409836 \text{ g/bit} * 2048 \text{ bits} + -8.22131 \text{ g}$$

**Status LED**

The WSDA<sup>®</sup>-Base-104 has a Status LED on the front panel that indicates the current activity state of the base station. **Table 1** describes the various the LED state and its meaning.

LED State	Activity
Solid <b>Green</b> LED	The base station is powered and idle.
Blinking <b>Blue</b> LED every 1 second	The base station is beaconing.
Blinking <b>Red</b> LED	The base station has received a beacon from another base station.

*Table 1. LED Activity*

## Beaconing

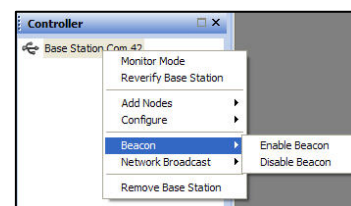
The WSDA<sup>®</sup>-Base-104 provides system-wide clock synchronization to the wireless nodes it is operating in **Synchronized Sampling (both Continuous and Burst modes)**. We refer to this function as the base station ‘beacon’, or ‘beaconing’. The base station broadcasts a special data packet containing the base station’s current UTC time ([Coordinated Universal Time](#)) to all nodes every second (1 Hz). The time stamp is pulled from the base station’s real time clock (RTC) and updates each node’s real time clock. The continuous synchronization beacon coupled with the accuracy of the base station and nodes’ real time clocks (+/-3 ppm drift) provides a node to node synchronization of +/-32 microseconds.

- The base station transmits the beacon only on its current radio channel (frequency). This requires any wireless node to be on the same radio channel in order to receive the beacon. Nodes on other radio channels will not receive the beacon.
- The base station uses the node broadcast address 65535 when it transmits the beacon. All wireless nodes respond to this special broadcast address.
- Node Commander<sup>®</sup> polls the Windows OS for the host time and updates the base station RTC each time it sends the **Synchronized Sampling** command. Assuming the host computer is being updated via a UTC time server (Internet, etc.), and given the nature of the Windows OS, the base station RTC time will be accurate vis-à-vis UTC within +/-1 second.
- The wireless nodes only utilize the beacon when they are actually performing **Synchronized Sampling**. They do not utilize it at any other time. Therefore it is recommended that you keep the beacon disabled when not performing **Synchronized Sampling**. This will conserve battery, minimize radio interference, etc.
- The beaconing function is not available for **Armed Datalogging, Datalogging, Streaming** and **Legacy Low Duty Cycle** data collection modes.
- The current UTC time contained in the beacon has a resolution of 1 second. The time does not contain a sub-second value.
- Beaconing is indicated by the base station Status LED as a blue blip every one second.
- Beaconing is enabled in Node Commander<sup>®</sup> by clicking Enable Beacon. It is also automatically enabled when you click Start Sampling in the Synchronized Sampling window.
- Beaconing is disabled in Node Commander<sup>®</sup> by clicking Disable Beacon or clicking Stop Node. It is also automatically disabled when you click Synchronized Sampling and Synchronized Sampling window opens.



### **Node Commander<sup>®</sup>** *Enable and Disable the Beacon*

1. Right-click the Base Station Com X, e.g. Com 42.
2. Click Beacon.
3. Click Enable Beacon or click Disable Beacon.



## **Power**

### **USB**

The WSDA<sup>®</sup>-Base-104 receives its power through the USB connection with the host computer. The USB specifications provide *for a 5 volt supply on a single wire from which USB connected USB devices may draw power with no more than 5.25 volts and no less than 4.75 volts (5 volts +/-5%) between the positive and negative bus power lines.* The host computer must adhere to these specifications.

### **Power consumption**

**Table 2** shows the current draw of the WSDA<sup>®</sup>-Base-104 in different operating modes.

<b>Configurations/operations</b>	<b>Current draw</b>
Idle	45.7 mA
Broadcast Stop	91.6 mA
8 active node channels operating at 256 Hz Synchronized Sampling	62.6 mA

*Table 2. Power Consumption*

### **Upgrade Base Station Firmware**

From time to time, MicroStrain makes improvements to the firmware on-board the WSDA<sup>®</sup>-Base-104. MicroStrain Support Engineers will provide you with a bootloader program, the new firmware version and instructions to upgrade your base station without having to return it to the factory.

## Radio Operation

### ***Frequencies and Channels***

The WSDA<sup>®</sup>-Base-104 employs a 2.4 GHz IEEE 802.15.4 compliant radio transceiver for wireless communication with MicroStrain wireless nodes. The radio is a direct-sequence spread spectrum radio and can be configured to operate on any of 16 separate frequencies ranging from 2.405 GHz to 2.480 GHz. Following the 802.15.4 standard, the MicroStrain Wireless Sensor Networks family of base stations and nodes alias these frequencies as channel 11 through channel 26 and the WSDA<sup>®</sup>-Base-104 default setting is 2.475 GHz (channel 25), as shown in **Table 3**.

Frequency	Channel Designation	Frequency	Channel Designation
2.405 GHz	11	2.445 GHz	19
2.410 GHz	12	2.450 GHz	20
2.415 GHz	13	2.455 GHz	21
2.420 GHz	14	2.460 GHz	22
2.425 GHz	15	2.465 GHz	23
2.430 GHz	16	2.470 GHz	24
2.435 GHz	17	2.475 GHz	25 (default)
2.440 GHz	18	2.480 GHz	26

**Table 3.** *Radio Frequencies and Channel Designation*



#### ***Node Commander<sup>®</sup>***

##### *Change Base Station Radio Frequency*

1. *Right-click Base Station Com X.*
2. *Click Configure.*
3. *Click Frequency.*
4. *Click Channel, e.g. 24 (2.470 GHz).*

### ***Antenna Positioning***

The base station enclosure can be mounted in any position, and, in general, the antenna mast itself should always be rotated to the vertical (pointed up to the sky). However, there are environments where communications will improve if the antenna mast is pointed in other directions. The Node Range Test function in Node Commander<sup>®</sup> will aid you in determining the best pointing position.



#### ***Node Commander<sup>®</sup>***

##### *Range Test the Node*

1. *Right-click Node X.*
2. *Click Communicate.*
3. *Click Range Test and the Short Packet Range Test window will appear.*
4. *Move the antenna position and observe the Good Pings and Signal Strength.*

## Communication Range vs. Transmit Power

MicroStrain's mXRS™ wireless nodes and the WSDA®-Base-104 have a user-settable radio transmit power level function. This function has a two-fold purpose. On the one hand, the function provides a method to conserve power consumption on either the internal rechargeable batteries in the wireless nodes OR any external batteries (either rechargeable or non-rechargeable) that may be deployed to power the nodes or the base station. On the other hand, the function allows the user to stay within radio transmission power restrictions in certain countries or other conditions. Users will normally want to select the power level that insures robust communication between base station and node, is within any restrictions, AND at the same time, conserves battery life.

The mXRS™ wireless nodes and the WSDA®-Base-104 can be set to operate at the following transmit power levels. We recommended that you match levels of the nodes with the base station.

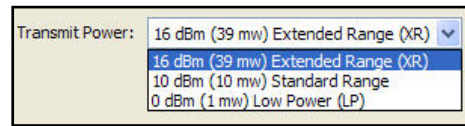
- 16 dBm (39 mW) Extended Power yielding range up to 2 kilometers
- 10 dBm (10 mW) Standard Power yielding range up to 1 kilometer
- 0 dBm (1 mW) Low Power yielding range up to 70 meters



### **Node Commander®**

*Set Transmit Power Level on Node*

1. Right-click Node X.
2. Click Configure.
3. Click Configure Node and the Configuration window appears.
4. Click the RF tab.
5. Click the Transmit Power Level drop-down.
6. Click the desired power level.
7. Click Apply.



Please ask your MicroStrain Support Engineer for further help characterizing the range versus transmit power requirements for your particular application.

## Radio Interference

The WSDA®-Base-104 and the wireless nodes it is serving may experience radio performance problems in the 2.4 GHz band as a result of the many other devices that share this license free zone. If you suspect that other devices in the immediate area might be interfering with the communication between base station and nodes, try selecting a different channel for the base station and nodes. As indicated above in the *Frequencies and Channels* section, the base station and nodes can be set to operate on any of 16 different frequencies within the band.

## Radio Certification

### FCC (United States) Certification

The WSDA<sup>®</sup>-Base-104 complies with Part 15 of the FCC rules and regulations. Compliance with the labeling requirements, FCC notices and antenna usage guidelines is required. In order to operate under MicroStrain's FCC Certification, OEMs/integrators must comply with the following regulations:

### Labeling Requirements

The WSDA<sup>®</sup>-Base-104 is labeled with its FCC ID number XJQMSLINK0001. If this FCC ID is not visible when the module is installed inside another device, the outside of the device into which the module is installed must also display the following label referring to the enclosed module:

---

**Contains FCC ID: XJQMSLINK0001**

**This device complies with Part 15 of the FCC Rules.**

**Operation is subject to the following two conditions:**

- (1) this device may not cause harmful interference and**
  - (2) this device must accept any interference received, including interference that may cause undesired operation.**
- 

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures: 1) re-orient or relocate the receiving antenna, 2) increase the separation between the equipment and receiver, 3) connect equipment and receiver to outlets on different circuits, and/or 4) consult the dealer or an experienced radio/TV technician for help.

### FCC-approved Antennas

This device has been designed and tested to operate with the antennas listed below:

- Antenna Factor (ANT-2.4-CW-RCS-SMA)

### **Important Notes**

- The WSDA<sup>®</sup>-Base-104 has been certified by the FCC for use with other products without any further certification (as per FCC section 2.1091). Modifications not expressly approved by MicroStrain could void the user's authority to operate the equipment.
- If the WSDA<sup>®</sup>-Base-104 is integrated with an unintentional radiator, the OEM/integrator is responsible for testing compliance of the unintentional radiator (FCC section 15.107 & 15.109) before declaring compliance of their final product to Part 15 of the FCC Rules.
- If using the WSDA<sup>®</sup>-Base-104 in portable applications (module antenna is less than 20cm from the human body during device operation), the integrator or end user is responsible for passing additional SAR (Specific Absorption Rate) testing based on FCC rules 2.1091 and FCC Guidelines for Human Exposure to Radio Frequency Electromagnetic Fields, OET Bulletin and Supplement C. The testing results will be submitted to the FCC for approval prior to selling the integrated unit. The required SAR testing measures emissions from the module and how they affect the person.

### **IC (Industry Canada) Certification**

The WSDA<sup>®</sup>-Base-104 is labeled with its IC ID number. If this IC ID is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display the following label referring to the enclosed module.

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**Contains Model: WSDA<sup>®</sup>-Base-104, IC: 8505A-MSLINK0001**

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Integrator is responsible for its product to comply with IC ICES-003 & FCC Part 15, Sub. B - Unintentional Radiators. ICES-003 is the same as FCC Part 15 Sub. B and Industry Canada accepts FCC test report or CISPR 22 test report for compliance with ICES-003.

### **Transmitter Antennas**

This device has been designed to operate with the antennas listed below:

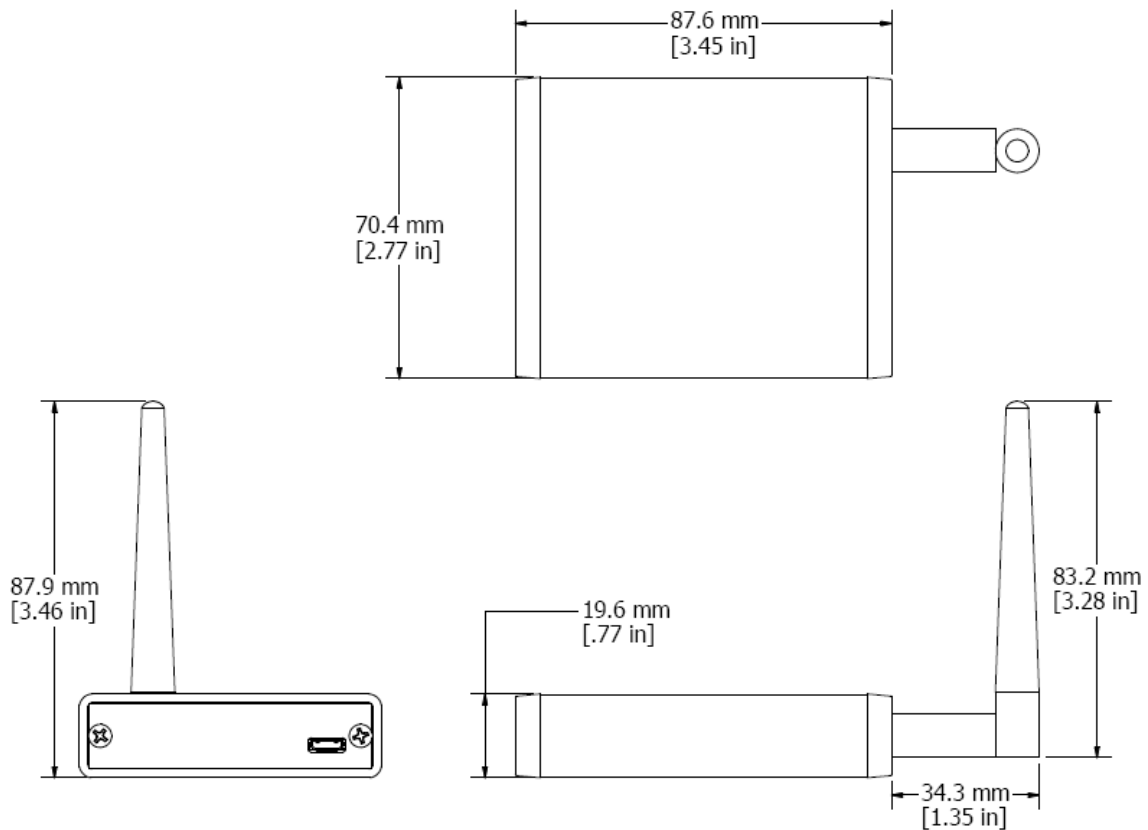
- Antenna Factor (ANT-2.4-CW-RCS-SMA)

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.

This device complies with Industry Canada license-exempt RSS standard(s). 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.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

## Dimensional Drawing



*Figure 3. WSDA<sup>®</sup>-Base-104 Dimensions*

## Enclosure

The WSDA<sup>®</sup>-Base-104 enclosure is made of black-anodized aluminum with 4 rubber foot pads for desktop mounting.

The WSDA<sup>®</sup>-Base-104 is designed to be operated within a temperature range of -30° C to +70° C.



**WARNING:** The WSDA<sup>®</sup>-Base-104 should not be disassembled by the user. Damage not covered by warranty may result.