

# Installation and Maintenance

Bently Nevada\* Asset Condition Monitoring

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## Essential Insight.mesh\* Wireless System



imagination at work

Part Number 185302-01  
Rev. D (04/12)

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## Additional Information

### **Notice:**

This manual does not contain all the information required to operate and maintain the product. Refer to the following manuals for other required information.

200150, 200155, and 200157 Accelerometer Installation Guide (Part Number 164985-01)

200125 Trendmaster\* 2000 Thermocouple (Part Number 149558-01)

ISA100 Gateway Manufacturer Manual (as applicable)

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## Contents

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<b>1. Introduction .....</b>	<b>7</b>
<b>2. Components.....</b>	<b>9</b>
2.1    Wireless Sensor Interface Module Devices (wSIM Devices).....	9
2.2    Repeater.....	13
2.3    Manager Gateway.....	16
2.3.1    ISA100 Gateway .....	16
2.3.2    BN Protocol Manager Gateway.....	17
2.4    Power Modules.....	20
2.4.1    Battery Power Modules.....	20
2.4.2    External Power Module for Safe Areas .....	22
2.5    Energy Harvesters .....	23
2.5.1    Vibration Energy Harvesters.....	23
2.6    Transducers.....	24
2.7    Cables and Connectors.....	25
2.8    Mounting Hardware .....	26
<b>3. Planning Network Installation.....</b>	<b>29</b>
3.1    Designing the Layout .....	33
<b>4. Commissioning/Provisioning .....</b>	<b>35</b>
4.1    Commissioning BN Protocol Devices.....	35
4.1.1    Attach Power Modules to wSIM Devices and Repeaters.....	35
4.1.2    Setup the Manager Gateway .....	36
4.1.3    Configure the Network ID .....	38
4.1.4    Configure the Join Key .....	39
4.1.5    Commission wSIM Devices and Repeaters.....	40
4.1.6    Verify Operation.....	43
4.2    Provisioning ISA100 Devices.....	43

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<b>5. Installing Hardware.....</b>	<b>45</b>
5.1    Installing the Manager Gateway .....	45
5.1.1    Rack-Mount Manager Gateway .....	46
5.1.2    ISA100 Manager Gateway.....	47
5.2    Installing a wSIM Device or Repeater.....	48
5.2.1    Choosing a Mounting Location.....	48
5.2.2    Mount a wSIM Device or Repeater .....	50
5.2.3    Mount a node to a Hex Mounting Base .....	54
5.2.4    Connecting Transducers to wSIM Devices .....	55
5.2.5    Transducer Field Termination.....	56
5.3    Installing a Vibration Energy Harvester .....	57
5.3.1    Finding the Right Location .....	57
5.3.2    Mounting a Vibration Energy Harvester .....	58
5.3.3    Connecting to a wSIM Device or Repeater .....	58
<b>6. Configuring Essential Insight.mesh in System 1 Software.....</b>	<b>61</b>
6.1    Configure the Plant Network .....	61
6.1.1    BN Protocol.....	61
6.1.2    ISA100 Protocol .....	62
6.2    Configure Essential Insight.mesh Network.....	62
6.3    Data collection considerations.....	64
6.3.1    Static Data .....	64
6.3.2    Fast Static Data.....	65
6.3.3    Dynamic Data .....	66
<b>7. Verifying Setup .....</b>	<b>67</b>
<b>8. Data on Demand .....</b>	<b>69</b>
<b>9. Troubleshooting .....</b>	<b>72</b>
9.1    Replacing a Battery Power Module .....	72
9.2    Replacing a Faulty Transducer.....	74
9.3    Replacing a Faulty wSIM Device or Repeater .....	75

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## Essential Insight.mesh Installation and Maintenance Manual

9.4	Changing the Manager Gateway Password .....	77
9.4.1	BN Protocol .....	77
9.4.2	ISA100 Protocol.....	77
9.5	Reset a Manager Gateway to Factory Defaults .....	77
9.5.1	Resetting BN Protocol Manager Gateway .....	77
9.5.2	Resetting ISA100 Manager Gateway.....	78

## 1. Introduction

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The Essential Insight.mesh\* wireless system is a wireless data acquisition system that is fully integrated with the System 1\* software. This manual introduces the components of the Essential Insight.mesh system and assists in the planning and deployment of this wireless system and configuration of the required components in System 1 Configuration software. A typical system requires a Manager Gateway, Wireless Sensor Interface Modules (wSIM\* devices), and Repeaters that create a robust, auto-forming mesh network. Each wSIM device has four channels that can each be individually configured to support vibration and temperature measurements.

The Essential Insight.mesh platform comprises two unique hardware offerings to support two wireless network protocols. Both hardware varieties support identical sensors and System 1 software integration. The ISA100 protocol is an open, industrial standard providing for interoperability with any other ISA100 wireless device. The BN heritage protocol allows communication between Bently Nevada\* Essential Insight.mesh BN devices only.

	<b>Cautions</b>
	<p>When installing components of this system at heights, always use fall protection that meets requirements of local standards, and follow site safety instructions to ensure a safe work environment.</p>
	<p>Do not subject battery modules to storage temperatures greater than 100°C.</p>
	<p>Transportation regulations often restrict the shipment of batteries that have been fully or partially consumed. Consult appropriate regulations prior to disposing batteries or seeking service.</p>
	<p>The External Power Module for Safe Areas (185548-01) is not certified for use in hazardous areas. It is designed for use in safe areas only. All wSIM devices and Repeaters that are used with 185548-01 are only for use in safe areas and are not certified for use in hazardous areas.</p>
	<p>Do not subject wSIM devices or Repeaters to storage temperatures greater than 85°C.</p>
	<p>When wiring the power supply follow safe work practices (LOTO, energy isolation during maintenance or installation).</p>
	<p>Pinch hazard – Magnet mounts have pull strength of up to 200 lbs.</p>
	<p>Any changes or modifications not expressly approved by Bently Nevada, Inc. could void the user's authority to operate the equipment.</p>
	<p>wSIM devices and Repeaters shall be cleaned with a damp cloth only.</p>
	<p>The Essential Insight.mesh system shall not be used in ISA100 networks involving critical control or safety applications</p>

## 2. Components

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The Essential Insight.mesh wireless solution consists of the following components:

- wSIM devices
- Repeaters
- Manager Gateway
- Transducers
- Power Modules
- Energy Harvesters
- Cables and Connectors
- Optional Antenna

### 2.1 Wireless Sensor Interface Module Devices (wSIM Devices)



**P/N 185310-01 (BN), 185410-01 (ISA100)**

A wSIM device conditions and processes the signals received from the transducers. Each wSIM device has four transducer channels that can be individually configured to support vibration and temperature measurements.

Each wSIM device operates both as an input module to capture the data and as a wireless router to route data packets. The maximum rated transmitting range of a node is 200 m or 660 ft.

The wSIM devices are powered by a replaceable power module that is attached to the base of the wSIM device.

RF Certifications:

FCC: XFU-18531002

FCC: XFU-18541001

IC: 8349A-18531001

## NOTE

### FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

The antenna used for this device must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

**NOTE**

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.

# CE0976 Notes

<b>Country</b>	France
<b>Implementation</b>	Limited implementation
<b>Remarks</b>	<p>The outdoor use is limited to 10 mW e.i.r.p. within the band 2454- 2483.5 MHz.</p> <p>Military radiolocation use.</p> <p>Reframing of the 2.4 GHz has been ongoing in recent years to allow current relaxed regulation.</p> <p>Full implementation planned 2012</p>

<b>Country</b>	Italy
<b>Implementation</b>	-
<b>Remarks</b>	<p>For private use, a general authorization is required if WAS/RLAN's are used outside own premises. For public use, a general authorization is required.</p>

<b>Country</b>	Norway
<b>Implementation</b>	Implemented
<b>Remarks</b>	<p>This subsection does not apply for the geographical area within a radius of 20 km from the centre of Ny-Ålesund.</p>

## 2.2 Repeater



**P/N 185350-01 (BN), 185450-01 (ISA100)**

A Repeater is a node added to the mesh network to improve data communication. If wSIM devices are placed more than 200 m (660 ft) apart, one or more Repeaters may be required between two nodes to ensure the integrity of the data communication paths. Repeaters can also be deployed to provide redundant paths, which are required in a mesh network to ensure network reliability.

With exception of the transducer inputs, Repeaters have the same specifications as wSIM devices.

ISA100 networks may implement additional restrictions on network topology when using a mesh configuration with Repeaters. Please refer to the ISA100 gateway manufacturer's specifications.

RF Certifications:

FCC: XFU-18531002  
FCC: XFU-18541001  
IC: 8349A-18531001

## NOTE

### FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

The antenna used for this device must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## NOTE

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.

## CE0976① Notes

<b>Country</b>	France
<b>Implementation</b>	Limited implementation
<b>Remarks</b>	
For indoor use only. Outdoor use expected to be allowed by end of 2012.	

<b>Country</b>	Italy
<b>Implementation</b>	-
<b>Remarks</b>	
For private use only.	

<b>Country</b>	Norway
<b>Implementation</b>	Implemented
Do not install within a radius of 20 km from the center of Ny-Ålesund.	

## 2.3 Manager Gateway

Each network protocol requires a unique manager gateway. A rack-mount gateway supports the BN protocol while a ruggedized, field-installable gateway supports the ISA100 protocol.

The Manager Gateway performs the following functions in the wireless network:

- Coordinates, manages, and optimizes the communication links between wSIM devices and Repeaters in the wireless mesh network.
- Transmits their signals to the System 1 Data Acquisition computer over the Ethernet network.
- Acts as the Access Point to the wireless mesh network.

The Manager Gateway operates as a network gateway that enables communication between the wireless mesh network, which uses Time Synchronized Mesh Protocol (TSMP) and the plant Ethernet network, which uses the TCP/IP protocol.

When a Manager Gateway is mounted in a location that is shielded or that attenuates radio frequency communications, an extended antenna may be required. Optional antenna kits may be ordered for the Rack-Mount Manager Gateway (185510-01), and the ISA100 Gateway ordering options allow extended antennas to be ordered.

### 2.3.1 ISA100 Gateway

ISA100 Manager Gateway: P/N 185515-AA-BB-CC

The ISA100 Manager Gateway accepts +24V DC. The recommended power supply is P/N 02200794

## Section 2 - Components

ISA100 networks support up to 50 devices per gateway. Contact the ISA100 gateway manufacturer for gateway specifications.

### **2.3.2 BN Protocol Manager Gateway**

The BN protocol Rack-Mount Manager Gateway supports up to 100 nodes in a mesh configuration.

RF Certifications:

FCC: XFU-18551001  
IC: 8349A-18551001

Rack-Mount Manager Gateway: P/N 185510-01  
(Designed to fit into industry standard 19" (482.6 mm) wide equipment racks)

The Rack-Mount Manager Gateway accepts power supply inputs from +12 to +30V DC, however, +24V DC is the recommended power supply. P/N 02200794

Power Supply Wiring Harness: P/N 162003  
(A two-wire, 7" (178mm) long wiring harness that can be used to connect the +24V supply to Manager Gateway)

USB to Serial Infrared Converter: P/N 289304

Cat 5 10-Ft Crossover Cable: P/N 284988

## NOTE

### FCC Compliance

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference, including interference that may cause undesired operation of the device.

The Manager Gateways is designed to operate with the antennas listed below that have a maximum gain of 2 dB. Antennas and cables not included in this list or having a gain greater than 2 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.

**Antenna included P/N 283189:** ½ wave, 5", 2dBi antenna

### Optional antenna kits:

**185519-01:** 2.4Ghz, 12", 6dBi, antenna with 75-ft, 50 ohm cable

**185519-02:** 2.4Ghz, antenna with cable for ATEX Zone 1.

**185519-03:** 2.4Ghz, FM-approved antenna with cable for Zone 1.

The antenna used for this device must be installed to provide a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

<b>NOTE</b>
<p>Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.</p> <p>Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication satisfaisante.</p>

	<b>Caution</b>
<p>Any changes or modifications not expressly approved by Bently Nevada, Inc. could void the user's authority to operate the equipment.</p>	

## 2.4 Power Modules

The wireless sensor network used with the Essential Insight.mesh system is optimized and finely tuned for applications that require low power and highly reliable periodic data collection.

The wSIM devices and Repeaters are powered by integrated, replaceable battery power modules as well as external sources.

### 2.4.1 Battery Power Modules

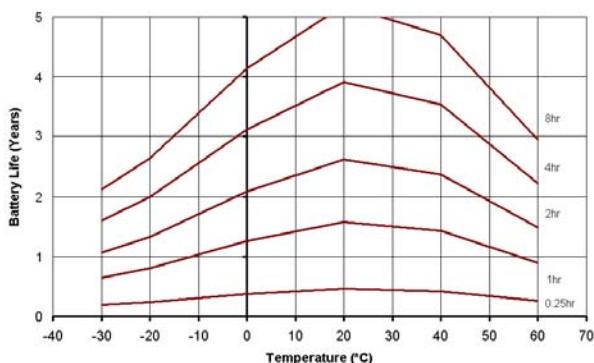


**Zone 0 Battery Power Module, P/N 185547-01**

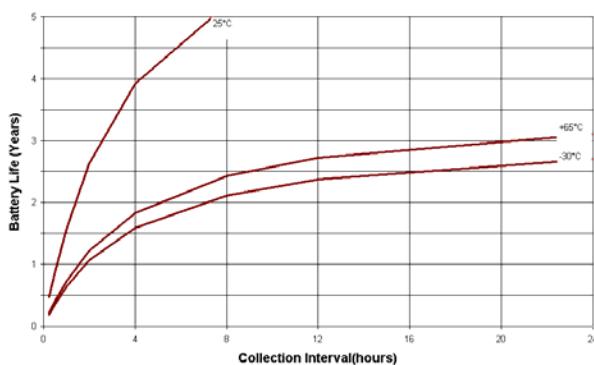
The Essential Insight.mesh platform allows the use of two different power modules. The Zone 0 Battery Power Module (185547-01) consists of Lithium Thionyl Chloride primary C-Cells that have a typical life of 3-5 years depending on the type and frequency of the data collected. The Zone 0 External Power Module (185547-02) provides an input for an external power supply and includes Lithium Thionyl Chloride primary C-Cells for back-up power when a power supply is not available.

Extended data collection intervals will allow a battery life of 5-10 years. Dynamic data collection, integration, high-pass filter corners below 10Hz, high resolution spectrums, and use of the 200155 low frequency accelerometer consumes additional power and reduces battery life. The figures below provide more information.

## Section 2 - Components



Interval Curve (Battery Life vs. Temp)



Temperature Curves for Worst Case Configuration  
(Battery Life vs. Collection Interval)

	<b>Caution</b>
	<b>Do not subject battery modules to storage temperatures greater than 100°C.</b>
	<b>Transportation regulations often restrict the shipment of batteries that have been fully or partially consumed. Consult appropriate regulations prior to disposing batteries or seeking service.</b>

## 2.4.2 External Power Module for Safe Areas



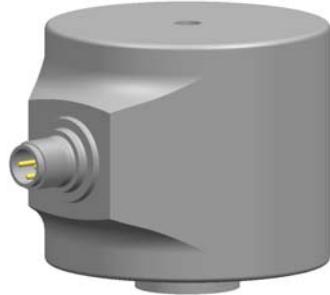
**External Power Module for Safe Areas, 185548-01**

The External Power Module for Safe Areas provides a power input connector that allows wSIM devices and Repeaters to be powered by external sources, potentially eliminating the need for battery changes. The external power module allows the installation of three 1.5V batteries that provide a back-up source of power when the external source is removed or drops below the required level for wSIM device or Repeater operation.

	<b>Caution</b>
<p>The External Power Module for Safe Areas, 185548-01, is not certified for use in hazardous areas. It is designed for use in safe areas only. All wSIM devices and Repeaters that are used with the External Power Module for Safe Areas shall be deployed in safe areas and are not certified for use in hazardous areas.</p>	

## 2.5 Energy Harvesters

### 2.5.1 Vibration Energy Harvesters



**Vibration Energy Harvester**

Vibration Energy Harvesters are designed to supply wSIM devices and Repeaters with power harvested from machine vibration. Harvesters are tuned to 1X and 2X multiples of machine speed to allow the selection of the harvester best suited to the application. Available frequencies and part numbers are shown below.

P/N	Frequency
185545-01	50Hz
185545-02	60Hz
185545-03	100Hz
185545-04	120Hz

The vibration energy harvesters must be used with a cable kit, which includes a 10m cable and field termination connector. P/N 185546-01

## 2.6 Transducers

Accelerometers: P/N 200150, 200155, and 200157

Thermocouple: P/N 200125 K-Type and Standard J, T, and E type

A transducer is a device that measures a physical parameter (vibration or temperature) and provides an analog output signal that is proportional to the measured parameter. The transducers are installed on the machine for which the parameter is to be measured and then connected to a wSIM device.

The Essential Insight.mesh system supports the following measurements:

- Acceleration
- Velocity
- Enveloped Acceleration
- Temperature

The 200157 accelerometer is recommended for acceleration enveloping applications that do not require low frequency response. For low speed machines or other applications requiring frequency response below 10 Hz, the 200155 accelerometer should be used.

### NOTE

Up to four transducers in any combination can be connected to one wSIM device. Thus, a Manager Gateway supports a maximum of 400 channels.

## 2.7 Cables and Connectors

Accelerometer Cable for wSIM Devices:

P/N 185555-AA-BB

AA: Length Option

- 02 2M (6-Ft) Length
- 04 4M (13-Ft) Length
- 06 6M (20-ft) Length
- 10 10M (33-ft) Length
- 15 15M (49-ft) Length
- 25 25M (82-ft) Length

BB: Armor Option

- 00 No Armor
- 01 Stainless Steel Braided Armor

A field-terminated cable option is also available through the use of Trendmaster System accelerometer cables and a field termination connector kit.

Trendmaster System Accelerometer Cable - 15M:

P/N 200152-15

Trendmaster System Accelerometer Cable - 25M:

P/N 200152-25

Connector kit: P/N 162438-01



## 2.8 Mounting Hardware

Magnet Mount Base for wSIM devices and Repeaters:  
P/N 185560

Hex Mounting Base for wSIM devices and Repeaters:  
P/N 185561-01

½-20 x ¾" Flat Head Socket Cap Screw:  
P/N 283575

M12x1.75 x 20mm FHSCS:  
P/N 283611

Mounting Kit for Unistrut® channel: P/N 185580-01 <sup>1</sup>

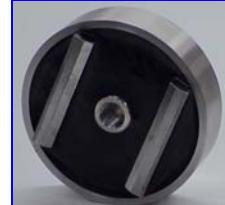
1 ea Angle Bracket: P/N 185562-01

1 ea Spring Nut: P/N 287106

2 ea ½-13 x 1.0" FHSCS: P/N 287107



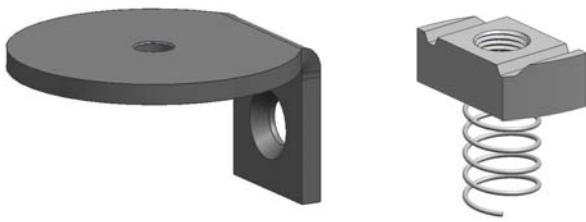
Hex Mounting Base and  
Cap Screw



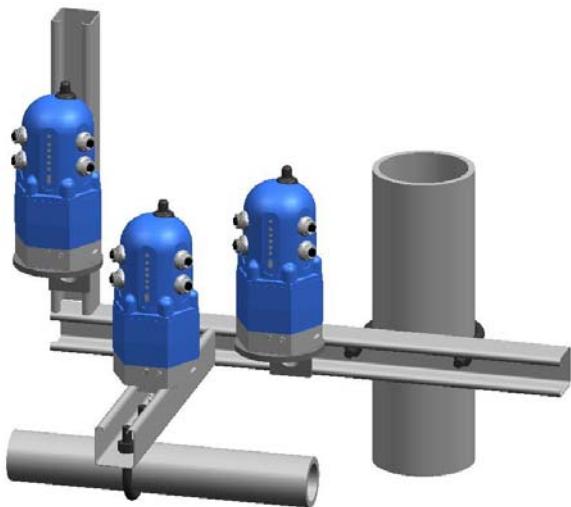
Magnetic Mount

Caution
Pinch hazard – Magnet mounts have pull strength of up to 200 lbs. Wear work gloves when handling.

<sup>1</sup> Unistrut® is a registered trademark of Unistrut International Corporation.



Mounting bracket and retaining nut for Unistrut® Channel



Mounting example using Unistrut® Channel



### 3. Planning Network Installation

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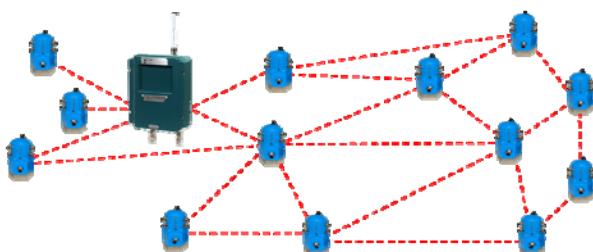
The Essential Insight.mesh network consists of wSIM devices and Repeaters that form a multi-hopping, ad hoc mesh network. It is important to note that the 802.15.4 wireless standard on which the Essential Insight.mesh wireless sensor network is based is optimized and finely tuned for applications that require low power and highly reliable periodic data collection.

The Essential Insight.mesh system is optimized to conserve battery power such that the batteries in the power modules will typically last for up to four years when used with the default configuration. This level of performance is accomplished by selecting a realistic data collection interval, and the ongoing mesh network power optimization executed by the Manager Gateway.

In order to conserve power, the nodes in a mesh network spend most of their time in sleep mode. Nodes power up and are active to execute three functions:

- Sending a message to a neighbor.
- Listening for a node to communicate.
- Executing data collection.

The following diagram best describes the wireless network:



Wireless signals are carried by electromagnetic waves in the Radio Frequency (RF) bands. The frequency range used by the Essential Insight.mesh 802.15.4 wireless mesh network is 2.4 GHz-2.4835 GHz. The typical node to node communication range is 200 m (660 ft) in outdoor, line of site applications.

Signals in an industrial environment do not usually follow a straight path on their way from the transmitter to the receiver and often propagate around numerous objects and obstacles. Understanding how wireless signals make their way passing through obstacles is important when considering how to position the wSIM devices and Repeaters in a wireless mesh network.

When a wireless signal meets an obstacle in its path, a combination of events can occur. Some of the signal may pass through the object, some may be absorbed by the object, or some may be subjected to reflection, diffraction, or scattering.

**Absorption** - Certain insulating materials, such as concrete, water, or ceramics can absorb electromagnetic energy by converting it to heat. Locations surrounded by absorbing or shielding material may require the positioning of additional Repeaters at appropriate locations within the mesh network.



**Reflection** – When electromagnetic waves encounter objects that are much larger than the frequency of the wave, the waves can reflect or bounce back. Also, the signals can reflect more readily off conductive materials than insulators.



**Diffraction** - When electromagnetic waves encounter objects with sharp edges, like the corner of walls, the signal can split into secondary waves. If a signal is diffracted, the signal can then appear to bend around the object.



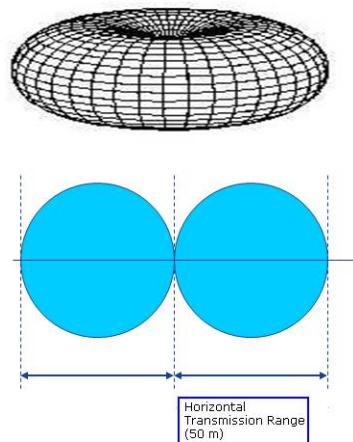
**Scattering** - When electromagnetic waves encounter objects that are much smaller than the frequency of the wave, the signal can diffuse or reflect in multiple directions. Scattering can occur when the signal encounters small surfaces. Rain, mist, hail, or snow can also cause scattering of signal.



Although it is not possible to list specific guidelines about how to minimize these effects, it is important to be aware of these effects whenever the wSIM devices and Repeaters are positioned and mounted. It is also important to know that some of these effects, such as reflection and diffraction, can help the signal reach its destination due to multipath interference. Repeaters should be mounted in proper locations to provide redundant communication links and increase signal strength which will improve network path stability required for highly reliable communication.

An unobstructed, straight path causes the least amount of signal attenuation and results in the greatest path stability. Mounting locations that are high and are as removed from obstructions as possible result in greater path stability.

Antennas used in the components of the wireless system transmit Radio Frequency energy in a toroidal pattern horizontally from the antenna as shown in the blue region in the diagram below. Because of the shape of this transmission pattern, the typical transmission range of 200 m is oriented in a perpendicular direction from the axis of the antenna.



The following are key points to remember during deployment:

- The typical transmitting range of a wSIM device or a Repeater is 200 m.
- Every node should ideally see three other nodes to guarantee it has more than one path between it and another node. Multiple communication paths are required to increase network reliability and prevent a

single path failure that would result in a loss of communication.

### 3.1 Designing the Layout

Before commissioning and installing the hardware components, it is necessary to carefully plan a layout for the wireless network. The radiation pattern of the antenna can be a factor when deciding on the location and mounting orientation of a wSIM device or Repeater.

Follow the steps given below to plan the layout of the BN Protocol wireless system.

1. Mark the locations of machines to be monitored on a paper copy of a plant map.
2. Identify the location of the Manager Gateway and the wSIM devices on the plant map.
3. Use the map scale to draw 200 m circles around each proposed wSIM device location.
4. Use the 200 m rule to verify that there are typically three other nodes within a 200 m radius. At least two adjacent nodes within a 200 m radius is the minimum requirement, but will result in decreased network reliability.
5. Add Repeaters as necessary to ensure that each node has two or more paths between itself and other nodes in the mesh network.

Follow the steps given below to plan the layout of the ISA100 Protocol wireless system.

1. Mark the locations of machines to be monitored on a paper copy of a plant map.

2. Identify the location of the Manager Gateway and the wSIM devices on the plant map.
3. Use the map scale to draw 200 m circles around each proposed wSIM device location.
4. Consult with the manufacturer gateway documentation to understand the requirements as defined for that specific gateway. Different manufacturers limit the number of hops and the exact makeup of the network topology in different ways.

## **4. Commissioning/Provisioning**

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Commissioning is a process used to form a wireless mesh network using the components of the Essential Insight.mesh wireless system. This is a pre-installation step that is usually performed indoors in an equipment room, or similar environment. This process requires both the hardware and software components.

Each network protocol support by the Essential Insight.mesh platform utilizes a different commissioning process.

### **4.1 Commissioning BN Protocol Devices**

Follow the commissioning steps shown below:

1. Attach power modules to the wSIM devices and Repeaters
2. Setup the Manager Gateway
3. Configure the Network ID
4. Configure the Join Key
5. Commission the wSIM devices and Repeaters
6. Verify the operation

#### **4.1.1 Attach Power Modules to wSIM Devices and Repeaters**

Attach the power modules to the wSIM devices and Repeaters so that they charge up for approximately 45 minutes prior to turning them on. The battery power module is attached to a wSIM device or Repeater using six #6 socket head cap screws (SHCS)

that are integrated (captured) into the power module housing. When connecting the battery power module, ensure that the o-ring is in place on the top of the battery module and that the interface pins on the bottom of the wSIM device or Repeater are lined up with the contacts on the battery module. Tighten the screws using a 7/64 in. hex wrench.



#### 4.1.2 Setup the Manager Gateway

For this step, the Manager Gateway should be close to the commissioning computer. It can later be installed at another location.

Follow the steps given below to setup the Manager Gateway:

1. Remove the Manager Gateway (and power supply if required) from the box. Place the Manager Gateway on a flat surface near the commissioning computer.
2. Remove the Ethernet crossover cable from the case. Plug in one end into the Manager Gateway Ethernet port and the other end into an Ethernet port on the commissioning computer.
3. Wire the +24Vdc power supply to the Manager Gateway power connector.



### NOTE

Ensure that the power supply is de-energized during this step.

4. Set a static IP address on the commissioning computer that can communicate with the Manager Gateway's default IP address: 192.168.99.100.
5. Energize the +24Vdc supply attached to the Manager Gateway.

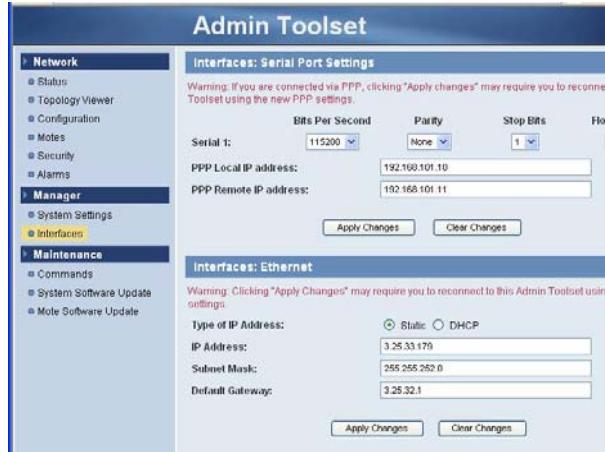
### NOTE

Be sure the computer or network switch is powered on and ethernet cable connected before the Manager Gateway is powered on. Powering the Manager Gateway prior to attaching it to an energized network will result in failure of the Manager Gateway ethernet communications. The correct power up sequence must be used.

6. Verify a successfully ping (command executed at the Windows command prompt) of the Manager Gateway to validate Ethernet communication.
7. Launch the embedded webpage on the Manager Gateway (Admin Toolset) by typing the following in the Internet Explorer menu bar: <http://192.168.99.100>

8. Click the **Yes** button if the Security Alert window appears. Sign in using the default user name: **system** and password: **system**.

9. Click **Interfaces**. Select either DHCP or Static IP address type. Assign a valid IP Address, Subnet Mask and Default Gateway for the network the Manager Gateway will reside on. Click **Apply Changes**.



#### 4.1.3 Configure the Network ID

The Access Point Network ID establishes a mesh network through which the wSIM devices and Repeaters communicate with the Manager Gateway. When Manager Gateways are shipped from the factory, they come with default Access Point Network ID 1229. When this default setting is changed to a new setting, the mesh network is created.

## Section 4 - Commissioning Process



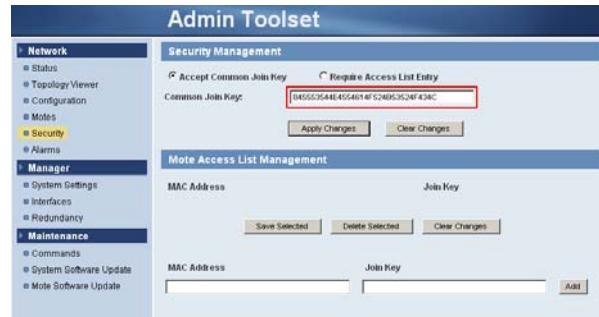
This setting can be changed in the Configuration page of the Admin Toolset software.

### 4.1.4 Configure the Join Key

A "Join Key" encrypts a request to join the network and thereby secures it. The Join Key for all the nodes on a Manager Gateway must be the same. Nodes whose Join Key does not match the Join Key configured in the Admin Toolset will not be allowed to join the Manager Gateway and therefore be prevented from joining the mesh network.

Manager Gateways shipped from the factory come with default settings for the Join Key. Changing the join key from the default setting is strongly recommended.

The join key is configured on the Security page of the Admin Toolset software as shown in the image below.



The Join Key consists of 32 hexadecimal characters. The following is an example of a valid Join Key:

445553544E4554574F524B53524F434B

#### 4.1.5 Commission wSIM Devices and Repeaters

wSIM devices and Repeaters must be commissioned to a Manager Gateway before being installed in the field.

Follow the steps given below to commission a wSIM device or Repeater to a Manager Gateway:

1. Turn on the wSIM device or Repeater by holding the magnet wand above the top LED and against the housing of the device for approximately 3 seconds.



2. The bottom LED will turn on for <1 sec. This will then be followed the second LED from the bottom turning on for 1-2 seconds. Next the second LED from the top blink on, then off once. About 4 seconds later the LED will

blink a second time. After another short delay, the LEDs blink in a sweeping pattern from top to bottom and back indicating the microprocessor is in its startup sequence. The complete power up sequence takes about 15 seconds.

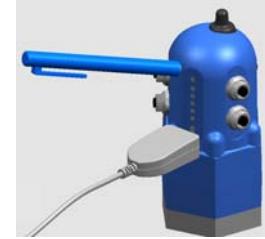
3. Attach the USB to SIR converter to the commissioning computer. Install the SIR drivers from the CD included with the USB to SIR converter if commissioning for the first time.

<b>NOTE</b>
If the commissioning computer has an internal IrDA port, and the USB SIR connector is being used, disable the internal IrDA port.

If the commissioning computer has an internal IrDA port, and the USB SIR connector is being used, disable the internal IrDA port.

4. Click **Start, Programs, System 1, Tools, Essential Insight.mesh Utility.**
  - (a) Click **Open Manager Gateway.**
  - (b) Enter the Manager Gateway's IP Address.
  - (c) Enter the default user name: **admin** and password: **admin**, and click **OK**.
  - (d) Click the **Uncommissioned Nodes** tab.
5. Hold the SIR reader such that it is pointing directly at the infrared transceiver window (below the bottom LED) on the wSIM device or Repeater to be commissioned to the Manager Gateway. It must be held in place pointing at the window for the commissioning process to be successful.

6. Hold the magnet wand for 1 second above the top LED to activate the SIR communications. The LEDs blink in a sweeping pattern from top to bottom and back indicating the SIR communications are on. The SIR communications will remain active for 20 seconds. If the device is not commissioned during this time frame the node will need to be swiped with the magnet wand again to initiate the process.



7. Click the **Commission Nodes** button. The SIR icon in the tool tray change. The MAC address of the nodes will be displayed in the window. The “Successfully transmitted message” text will appear next to the node. The process takes about 30 seconds, during which time the SIR converter needs to be held steady. When complete the message next to the node will change to Commissioned.
8. When the last node is commissioned, close the Essential Insight.mesh Utility.

When the wSIM device or Repeater is commissioned to a specific Manager Gateway, the nodes will appear in that Manager Gateway's table. The node's MAC address, name and other information is stored in the Manager Gateway's table.

#### 4.1.6 Verify Operation

wSIM devices and Repeaters that have been successfully commissioned into the network show up in the Essential Insight.mesh Utility software in the left hand pane with a status of *Operational*.

The Admin Toolset software also shows the status of commissioned wSIM devices and Repeaters. On the **Network** menu, click **Motes** to view the status. After all of the wSIM devices and Repeaters have been commissioned and are operational, the wireless mesh network begins to form.

#### NOTE

Network formation time increases as network reliability decreases. Some steps can be taken to reduce the time for the network to form. Keep the distance between nodes to 200 m or less. Verify there are 3 other nodes within a 200 m radius around the node. This will ensure there are multiple paths for communication to be established.

## 4.2 Provisioning ISA100 Devices

The provisioning process for ISA100 devices is unique to each gateway manufacturer. The provisioning process is generally described as follows:

1. Attach power modules to the wSIM devices and Repeaters (See Section 4.1.1)
2. Setup and configure the gateway per manufacturer instructions

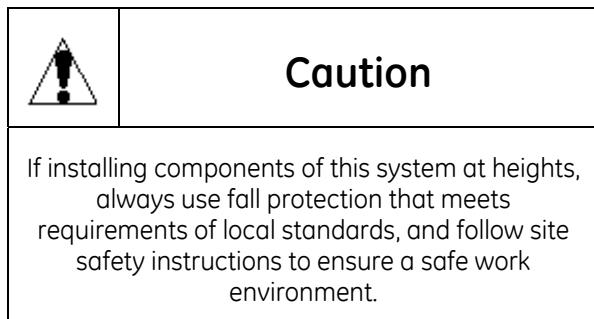
3. Provision the wSIM devices and Repeaters
  - a. Turn on wSIM device or Repeater
  - b. Enable Infrared communications  
(See Section 4.1.5 Step 6)
  - c. Follow gateway manufacturer's provisioning procedure, using recommended provisioning device
4. Verify the operation (See Section 4.1.6)

## 5. Installing Hardware

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The hardware components are installed in the following order:

1. Install the Manager Gateway
2. Install the wSIM devices or Repeaters
3. Install Vibration Energy Harvesters  
(if applicable)



### 5.1 Installing the Manager Gateway

Considerations for installing a Manager Gateway:

- Location
- Power availability
- Accessibility to plant network
- Proximity to nodes in the mesh network and antenna placement
- Accessibility to nearby nodes for redundant paths

### 5.1.1 Rack-Mount Manager Gateway

The rack mount Manager Gateway configuration allows installation of the Manager Gateway (P/N 185510-01) in an industry-standard 19-inch instrument rack.

1. Attach the antenna included to the Manager Gateway after mounting in the rack.

If 110/220 VAC power is available, use the +24 Vdc industrial power supply to power the Manager Gateway.

If the rack mount Manager Gateway is mounted in a location where it cannot communicate with the nearest wSIM devices or Repeaters then an optional antenna kit will be required (P/N 185519)

If an optional antenna kit is used, the antenna and cable included in the kit must be used together.

1. Attach the remote mount antenna to the cable included.
2. Attach the RF cable provided with the kit to the Manager Gateway.
3. Mount the antenna in the desired location using the bracket provided with the kit.

#### NOTE

**Any changes or modifications not expressly approved by Bently Nevada, Inc. could void the user's authority to operate the equipment**

<b>NOTE</b>
The Manager Gateways is designed to operate with the antennas listed in Section 2.3.2 that have a maximum gain of 2 dB. Antennas and cables not included in Section 2.3.2 or having a gain greater than 2 dB are strictly prohibited for use with this device. The required antenna impedance is 50 ohms.
To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropic radiated power (e.i.r.p.) is not more than that permitted for successful communication.



### 5.1.2 ISA100 Manager Gateway

See manufacturer specific instructions for installation of the gateway.

## 5.2 Installing a wSIM Device or Repeater

As both wSIM devices and Repeaters operate as wireless routers, ensure that the radio transmission issues have been considered during the mounting and installation of the wSIM devices and Repeaters. Steps for mounting a wSIM device or Repeater are:

- Choosing a mounting location.
- Mounting a wSIM device or Repeater.
- Connecting transducers to the wSIM device.

	<b>Caution</b>
<p>It is recommended that Repeaters are installed permanently using a hex base and a drilled &amp; tapped hole. If a Repeater is used with a magnet mounting base, a fall prevention mechanism is recommended. Repeaters should be secured to a suitable support to prevent the device from falling inadvertently.</p>	

wSIM devices and Repeaters are designed for Zone 0 hazardous area approvals. Check with the local Bently Nevada representative to find out which approvals are available for the installation region.

### 5.2.1 Choosing a Mounting Location

Mount the wSIM devices and Repeaters in locations such that:

- The wSIM devices and Repeaters are not subjected to continuous vibration in excess of 5 g's RMS.

## Section 5 - Installing Hardware

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- The field wiring can be routed between the transducers and the wSIM devices.
- The wSIM devices and Repeaters are installed such that there are up to 3 other nodes (or as limited/recommended by the gateway manufacturer) within a 200 m radius around each node. This will ensure that each node will have multiple paths to communicate, resulting in highly reliable communications.
- Energy harvester cabling can be routed between energy harvesters and wSIM devices and Repeaters (if applicable).

The mounting location for wSIM devices and Repeaters requires a metal surface for the magnet mount option, strut channel, or an adequate substrate for drilling and taping a ½-20 UNF or M12 hole to permanently mount the hex base. The magnet mount may be used only on a ferrous metal surface.

The wSIM device must be mounted such that the cable can be safely routed and secured between the wSIM device and transducer. See Section 2.7 for available cable lengths and options.

The 200125 K-Type thermocouples are supplied with an integrated cable. Field connectors must be installed using the field termination connector kit (P/N 162438-01). These field termination connectors can also be used with industry standard K, J, T, and E-Type thermocouples. See Section 5.2.5 for field wiring diagrams.

## NOTE

The radiation pattern of the wSIM device or Repeater antenna can be a factor when deciding on the location and mounting orientation of a wSIM device or Repeater. Mount the wSIM devices and Repeaters vertically for best results.

### 5.2.2 Mount a wSIM Device or Repeater

To mount a wSIM device or Repeater:

1. Identify the mounting hardware.
2. Install the mounting base.
3. Mount the wSIM device or Repeater to the mounting base and secure.

After a mounting location has been determined, mount the wSIM device or Repeater using one of several options.

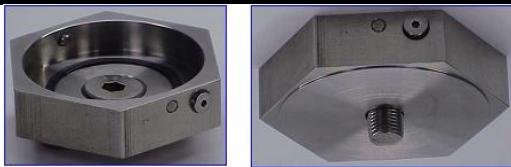


Hex Mounting Base and  
Screw

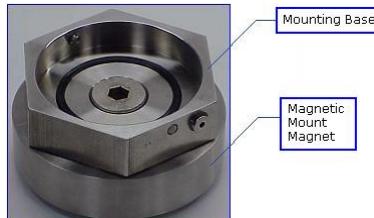


Magnet Mount  
Assembly

The screw provided allows the option to attach the hex mounting base to either a drilled & tapped substrate, or to the threaded hole in the magnet mount assembly.



**Hex Mount Base with Screw**



**Hex Base Attached to Magnet Mount Assembly**

**Screw Mount:** The screw mount option requires a substrate thick enough to drill and tap a 12.7-mm (0.5 inches) deep hole. Standard drilling and tapping tools are required. The mounting hole should be perpendicular to the surface. Drill and tap to match the thread of the mounting screw (see Section 2.8 for mounting screw details). Install mountain base by tightening mounting screw into countersunk hole. English threaded screws will require a 5/16" hex key, and metric screws will require an 8 mm hex key.

**Magnet Mount:** The Magnet mounting system uses a strong magnet to provide a fast and reliable method of attaching wSIM devices or Repeaters to ferrous metal surfaces. The mounting surface should be flat or larger in diameter than the magnet mount assembly.

	<b>Caution</b>
Pinch hazard – Magnet mounts have pull strength of up to 200 lbs.	

**Industrial Strut Mount:** wSIM devices and Repeaters may be mounted to 1-5/8" industrial strut channel (e.g. Unistrut® channel) directly or through the use of an angle bracket. Appropriate mounting hardware should be selected to achieve the most suitable antenna orientation as described in Section 3.

If directly mounting the wSIM device or Repeater to the strut channel, the following procedure shall be applied.

1. Insert spring nut (P/N 287106) into strut channel.
2. Place hex base over strut channel and tighten mounting screw (P/N 287107) into nut.

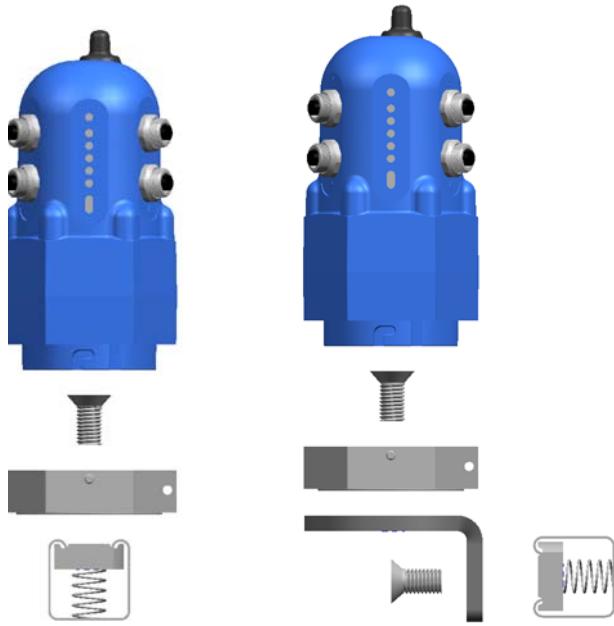
If using the angle bracket mount, the following procedure shall be applied.

1. Insert spring nut (P/N 287106) into strut channel.
2. Align the countersunk hole in the angle bracket with the spring nut and orient the angle bracket for optimum antenna orientation. Tighten mounting screw (P/N 287107).
3. Mount hex base to top of angle bracket by centering the base on the bracket and tightening the second mounting screw into the bracket.

Both mounting methods are shown in the following figures.

## Section 5 - Installing Hardware

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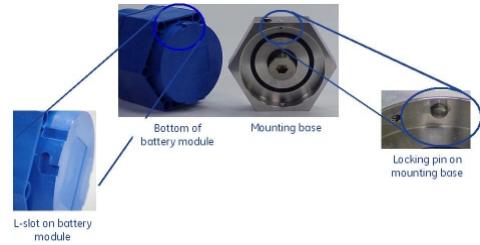


Direct Mount

Mount with Angle Bracket

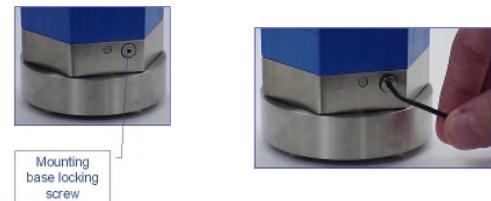
### 5.2.3 Mount a node to a Hex Mounting Base

A wSIM device or Repeater is installed and secured to the Hex mounting base as shown below:



Follow the steps given below to install a wSIM device or a Repeater on the mounting base:

1. Slide the base of the battery power module so that the two slots on the battery module line up with the locking pins on the hex mounting base.
2. Twist the battery module clockwise until the locking pin slides to the end of the slot on the battery module and the corners of the hexagon surfaces are aligned.
3. Tighten the locking screw on the mounting base using a 7/64" hex wrench.



**NOTE**

A locking screw is used to prevent the battery module from accidentally vibrating and becoming loose from the mounting base.

#### 5.2.4 Connecting Transducers to wSIM Devices

Transducers are connected to wSIM devices using cables.

These are some guidelines for routing and protecting the cables from damage.

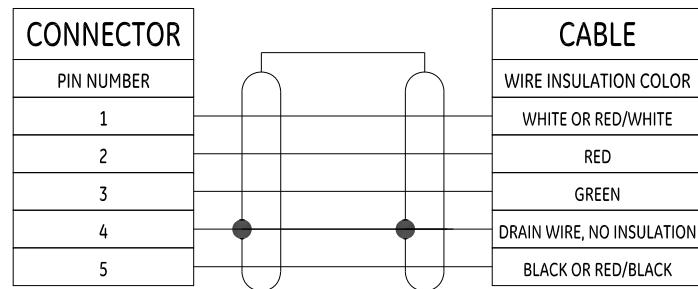
- Secure the cable at the transducer end and the wSIM device end to protect the cable and the connectors.



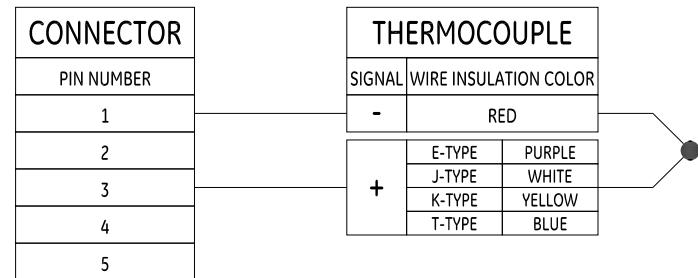
- Route the cables so that they are not damaged or cause safety issues.
- Secure the cables at regular intervals.
- Avoid exceeding the minimum bend radius specification of the cable.

## 5.2.5 Transducer Field Termination

All thermocouples must be connected to wSIM devices using the field termination connector kit (P/N 162438-01), and this same kit may be used to field terminate accelerometer cables when a non-standard length is required. The following diagrams indicate how the connector must be wired to the transducers.



Accelerometer Wiring Diagram



Thermocouple Wiring Diagram

**NOTE**

Application of excessive torque when tightening connector to wSIM device receptacle may permanently damage both the connector and the wSIM.

Tighten assembled connector to wSIM device by hand using knurled metal coupling only.

Do not grip connector by plastic body when tightening to wSIM device receptacle.

Do not use tools of any kind to attach connector to wSIM device receptacle.

Always install insulating sleeve over center terminal to prevent short circuits between conductors.

## 5.3 Installing a Vibration Energy Harvester

### 5.3.1 Finding the Right Location

The Vibration Energy Harvesters are precisely tuned to a specific frequency band and must be installed in a location with sufficient vibration within the specified band. Assuming a default data collection configuration on a wSIM device, the Vibration Energy Harvester must be excited with approximately 35 mg or more vibration to sustain wSIM device or Repeater operation without consuming batteries. Magnetic mounts are recommended for testing Vibration Energy Harvester output at potential locations prior to establishing a fixed installation.

### 5.3.2 Mounting a Vibration Energy Harvester

Vibration Energy Harvesters may be mounted using direct stud mount, through bolt mount, or magnetic mount.

**Stud Mount:** The Vibration Energy Harvester provides 3/8-24 UNF thread for direct stud mounting a drilled and tapped substrate. The mounting surface shall be drilled, tapped, and faced, and the harvester may be mounted using one of several available mounting studs.

**Through-Bolt Mount:** The Vibration Energy Harvester provides a through-hole for bolting to a drilled and tapped substrate. The through hole is sized for 1/4" or M6 hardware.

**Magnet Mount:** The magnet mounting system uses a strong magnet to provide a fast and reliable method of attaching Vibration Energy Harvesters to magnetic surfaces. The mounting surface should be flat or larger in diameter than the magnet mount assembly. An adapter stud (P/N 87910-01) must be threaded into the harvester for attachment to the magnet.

	<b>Caution</b>
Pinch hazard – Magnet mounts have pull strength of up to 200 lbs.	

### 5.3.3 Connecting to a wSIM Device or Repeater

The Vibration Energy Harvester is connected to the External Power Module (P/N 185548-01) of a wSIM device or Repeater using the Energy Harvester Cable Kit (P/N 185546-01). The cable kit includes a 10m

## Section 5 - Installing Hardware

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cable and connector for field termination. The Vibration Energy Harvester shall be connected to a wSIM device or Repeater using the following procedure.

1. Establish mounting locations for both the Vibration Energy Harvester and wSIM device or Repeater.
2. Route the cable between the Energy Harvester and wSIM device or Repeater with the cable's integral connector at the Vibration Energy Harvester end.
3. Trim excess cable length and attach connector to cable by matching the individual conductor insulation colors with the color coding within the connector. The connector shall be assembled according to the instructions supplied with the connector.
4. Plug the cable into both the Vibration Energy Harvester and the External Power Module of the wSIM device or Repeater.



## **6. Configuring Essential Insight.mesh in System 1 Software**

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The Manager Gateway, the wSIM devices and Repeaters commissioned to it, are grouped under the Essential Insight.mesh object using System 1 Configuration software. A mesh network consists of the Manager Gateway and the wSIM devices and Repeaters commissioned to it. Components can be added to a configuration after they have been commissioned. Components are commissioned using the Essential Insight.mesh Utility software.

### **6.1 Configure the Plant Network**

#### **6.1.1 BN Protocol**

The Essential Insight.mesh system utilizes several network ports for communication, and these ports must be opened in any network firewalls between the Manager Gateway and the System 1 server and any other computers with which it will communicate. The list below indicates the ports and associated applications applicable to the Essential Insight.mesh system.

Port	Application
22	SSH terminal (optional)
80	HTTP – Admin Toolset
123	Time sync with NTP server (optional)
443	HTTPS – Admin Toolset
4445	Manager Gateway default control port
24112	Manager Gateway default data port

### 6.1.2 ISA100 Protocol

Refer to the gateway manufacturer's instructions for configuring the plant network to interface to the gateway.

## 6.2 Configure Essential Insight.mesh Network

Follow the steps listed below to configure an Essential Insight.mesh network using the System 1 Configuration software:

1. Select **Start, Programs, System 1, System 1 Configuration**.
2. Connect to an Enterprise.
3. To add an Essential Insight.mesh device, in the Instrument Hierarchy, right-click the **DAQ** object, point to **Add Instruments**, and click **Essential Insight.mesh** from the list of available options. Note: Only one Essential Insight.mesh object is allowed per DAQ.
4. To add a Manager Gateway, right-click the **Essential Insight.mesh** object and click **Properties**. The **Essential Insight.mesh Configuration** dialog box will be displayed.
5. In the **Essential Insight.mesh Configuration** dialog box, click the  button.
6. Type the unique IP address assigned to the Manager Gateway in the **Manager Gateway IP Address** field. Enter the appropriate information in the **Manager Gateway Port**, **Manager Gateway User Name**, and **Manager Gateway**

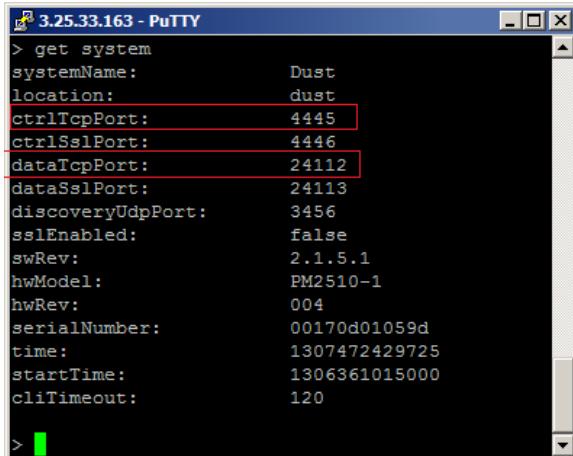
## Section 6 - Configuring Essential Insight.mesh

**Password** boxes if this was changed through the Admin Toolset.

7. To add a wSIM device or Repeater, in the **Essential Insight.mesh Configuration** dialog box, select the **Manager Gateway**, and then  click the **detect nodes** button.
8. Click **OK**. The Essential Insight.mesh device is added to the Instrument Hierarchy.
9. Save the Enterprise.

### NOTE

If the port of the Rack-Mount Manager Gateway (185510-01) is ever changed from the default, it may be retrieved using the "get system" command when logged into the manager using an SSH client.



A screenshot of a PuTTY terminal window titled "3.25.33.163 - PuTTY". The window displays the output of a "get system" command. The configuration parameters listed are: systemName: Dust, location: dust, ctrlTcpPort: 4445, ctrlSslPort: 4446, dataTcpPort: 24112, dataSslPort: 24113, discoveryUdpPort: 3456, sslEnabled: false, swRev: 2.1.5.1, hwModel: PM2510-1, hwRev: 004, serialNumber: 00170d01059d, time: 1307472429725, startTime: 1306361015000, cliTimeout: 120. The "ctrlTcpPort", "ctrlSslPort", and "dataTcpPort" lines are highlighted with red boxes.

```
> get system
systemName: Dust
location: dust
ctrlTcpPort: 4445
ctrlSslPort: 4446
dataTcpPort: 24112
dataSslPort: 24113
discoveryUdpPort: 3456
sslEnabled: false
swRev: 2.1.5.1
hwModel: PM2510-1
hwRev: 004
serialNumber: 00170d01059d
time: 1307472429725
startTime: 1306361015000
cliTimeout: 120
> █
```

## 6.3 Data collection considerations

A wSIM device collects one type of data (static or dynamic) for one channel at one time. So, for all four channels, it takes 8 different “collections” at different times. In between each collection, the node has to “re-charge”. This recharge time varies depending on wSIM device temperature and channel configuration parameters.

### 6.3.1 Static Data

Static data collection is offset from midnight, so a 2 hour collection rate will attempt to collect data on the even hours (0000, 0200, 0400, 0600, ... 2200) in the day. With a re-charge cycle between each data collection, the data collection cycle for collecting static data every 2 hours is as follows.

Collect Channel 1 static...

Re-charge

Collect Channel 2 static...

Re-charge

Collect Channel 3 static...

Re-charge

Collect Channel 4 static...

Re-charge until next scheduled interval

Assuming a re-charge time of approximately 15 minutes, and a scheduled collection time of 2 hours, the time difference from the first to the last channel could be 45 minutes.

Moreover, transducer type, integration, low frequency high pass filter corners, and high resolution waveforms will result in longer collection

## Section 6 - Configuring Essential Insight.mesh

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periods that consume more power and result in the battery taking longer to recharge. If more power is consumed, it takes more time to recharge before the next measurement can be made.

### 6.3.2 Fast Static Data

The Essential Insight.mesh system is capable of collecting static data as frequently as once per minute. Fast static data sample intervals of 15 minutes or less should be used only as a temporary, bad actor analysis tool. Long-term collection of fast static data will compromise battery life, and may result in delayed data collection on other channels.

The following table may be used as guide for configuring Fast Static Data collection. The table presents the maximum number of channels and maximum PPLs per channel that may be configured for Fast Static Data on a wSIM device before bandwidth limitations are reached. The table below assumes that all measurements are configured per the default configuration, except for the Fast Static Data collections described.

Collection Interval (minutes)	Maximum Number of Channels Configured for Fast Static Data	Maximum PPLs per Channel
1	1	2
2	2	2
5	4	4
10	4	4
15	4	4

Additional details, including a Data Collection Worksheet, are available within System 1 Help.

### 6.3.3 Dynamic Data

In order to not conflict with other schedule times, dynamic data should be scheduled in between the static data collection times. It is recommended that dynamic data be collected on the odd hours of the day, if have a 2-hour static collection interval is configured.

High-resolution waveforms should only be used as a temporary, analysis tool during trouble shooting. For example, when trying to identify a specific bearing defect, the recommended configuration is:

Channel 1 Static - 2 hours

Channel 2 Static - 2 hours

Channel 3 Static - 2 hours

Channel 4 Static - 2 hours

Channel 1 Dynamic – 1 per day scheduled on the odd hour (example 11 AM)

Channel 2 Dynamic – 1 per day scheduled on the odd hour different from other channels (example 1 PM)

Channel 3 Dynamic – 1 per day scheduled on the odd hour different from other channels (example 3 PM)

Channel 4 Dynamic – 1 per day scheduled on the odd hour different from other channels (example 5 PM)

## 7. Verifying Setup

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Verify that the configuration of the Essential Insight.mesh network is successful and that data has been collected.

Follow the steps given below to verify the collection of static data:

1. Start the System 1 DAQ.
2. Click **Start**, **Programs**, **System 1**, and **System 1 Display**.
3. Connect to an Enterprise.
4. Navigate to the Manager Gateway node in the Instrument Hierarchy.
5. Expand the Manager Gateway hierarchy to view the operational wSIM devices and Repeaters.
6. Right-click the **Manager Gateway** node, and click **Bargraph**.

Follow the steps given below to verify the collection of dynamic data:

1. Start the System 1 DAQ.
2. Click **Start**, **Programs**, **System 1**, and **System 1 Display**.
3. Connect to an Enterprise.
4. Navigate to the Manager Gateway node in the Instrument Hierarchy.
5. Expand the Manager Gateway hierarchy to view the operational wSIM devices and

Repeaters and one of the configured vibration channels.

6. Click the expand icon next to the **Acceleration** channel.
7. Right-click the appropriate Asynchronous Waveform, and click **Timebase** or **Spectrum Plot** to see the dynamic data.

### NOTE

By default, the static data is collected every two hours, and dynamic data is collected once per day. It will be necessary to wait until the saved configuration has been sent to the wSIM devices, the configured collection interval has elapsed, and the data has had time to be sent to System 1 software. It can take several hours for all waveform packets to be sent over the mesh network.

To accelerate this process for individual measurements, the Data on Demand feature may be used as described in Section 8.

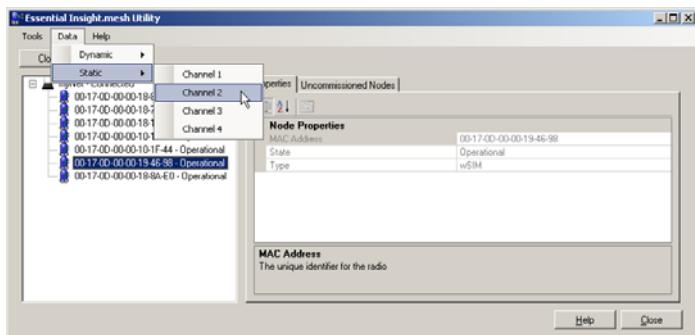
## 8. Data on Demand

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The Essential Insight.mesh system allows the collection of both static and dynamic Data on Demand using the Essential Insight.mesh Utility within the System 1 Tools. Static or Dynamic data may be requested for one channel on wSIM device at a time, and Data on Demand requires the wSIM device to already have a valid measurement configuration for the channel on which data is to be collected.

To collect Data on Demand:

1. Open the Essential Insight.mesh Utility and connect to the Manager Gateway.
2. Select the wSIM device from which data is desired by clicking on it in the tree.
3. Use the Data menu as shown below to browse to the desired data type and channel.
4. Use System 1 Display to view the data after it is returned from the wSIM device.



## NOTE

Although data collection will occur very shortly after a Data on Demand request is initiated, large dynamic data waveforms may require several hours to transmit to System 1 software.



## 9. Troubleshooting

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### 9.1 Replacing a Battery Power Module

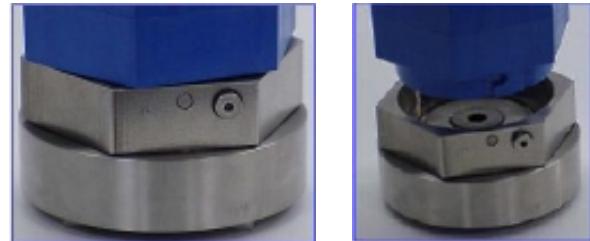
Battery power modules are attached to the bottom of the wSIM devices or Repeaters using six socket head cap screws (SHCS). The battery module is an encapsulated unit; therefore, the whole module must be replaced when the batteries are exhausted.

The battery module can be replaced while the unit is running. There is no reason to disconnect transducer cables or turn the unit off. The following process shall be used to replace a battery power module.

1. Loosen the locking screw on the mounting base.



2. Unlock the battery power module by turning it counterclockwise, and then lifting it out of the hex mounting base.



## Section 8 - Troubleshooting

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3. Remove the battery power module by removing the six screws.



4. Remove the battery power module from the wSIM device or Repeater. Note the screws are integrated into the battery power module housing.



5. Install a fresh battery power module. When installing fresh battery power modules, ensure that:
  - a. The O-ring is in place on the top of the battery module.
  - b. The interface pins on the bottom of the wSIM device or Repeater are lined up with the contacts on the battery module.
6. If the wSIM device or Repeater was off as the result of a totally depleted power module, turn on the device using the magnetic wand.

	<b>Caution</b>
Transportation regulations often restrict the shipment of batteries that have been fully or partially consumed. Consult appropriate regulations prior to disposing batteries or seeking service.	

## 9.2 Replacing a Faulty Transducer

Transducers that are connected to wSIM device can be replaced or changed while the wSIM device is online.

If the replacement transducer is of same type as the old transducer, simply disconnect the old transducer from the wSIM device connector, and connect the new one. The existing channel configuration is used to take a measurement from the channel the new transducer is connected to.

If the replacement transducer is a different type than the old transducer, connect the new transducer, and reconfigure the wSIM device channel for the new transducer using the System 1 Configuration software.

If the wSIM device attempts to collect data while the transducer is disconnected or before the new configuration has arrived at the wSIM, a transducer error event will be added to the System Event List for that channel.

<b>NOTE</b>
The new configuration takes some time to traverse the mesh network from the Manager Gateway and the wSIM device.

## 9.3 Replacing a Faulty wSIM Device or Repeater

To replace a faulty sensor unit, follow the steps given below:

1. Turn off the faulty wSIM device or Repeater.
  - a. Turn the faulty device off and verify its status changes to **Lost**. This will typically take 10 minutes or longer to propagate to the Manager Gateway.
2. Delete the wSIM device or Repeater from the Manager Gateway's network table.
  - a. BN Protocol Manager Gateway
    - i. Launch putty or a similar utility. Login the Manager Gateway using the default username: **dustcli** and password: **dustcli**.
    - ii. Once logged in, use the **sm** (show motes) command to display a list of nodes. Identify the **mote ID** of the node that will be deleted from the Manager Gateway table.
    - iii. Use the **delete mote XX** command to delete the node from the Manager Gateway's network table. (XX is the mote ID from the show motes list).
    - iv. Close the putty utility.

- b. ISA100 Protocol Gateway
    - i. Launch the interface for the gateway.
    - ii. Follow the manufacturer instructions to remove the device.
3. Delete the wSIM device or Repeater from the System 1 configuration.
  - a. In the **Essential Insight.mesh Configuration** dialog box click the  **detect motes** button. The wSIM device or Repeater that was removed from the Manager Gateway network table will be displayed with a red mark through it.
  - b. Select the wSIM device or the Repeater with the red mark, and click the  **Delete** button.
  - c. Click **OK** and save the Enterprise.
4. Commission a new wSIM device or Repeater.
5. Install the new wSIM device or Repeater and configure using the System 1 Configuration software. See the commission wSIM devices and Repeaters section of the manual for directions.

## 9.4 Changing the Manager Gateway Password

### 9.4.1 BN Protocol

To change the password of a Manager Gateway, 185510-01, open the Essential Insight.mesh Utility software.

1. Click **Start, Programs, System 1, Tools, and Essential Insight.mesh Utility.**
2. Click **Open Manager.**
3. In the **Manager Properties** dialog box, type the **Port, IP Address, User Name, and Password** information.
4. On the **Tools** menu, click **Change Password.**

### 9.4.2 ISA100 Protocol

Refer to the gateway manufacturer's instructions for changing the password of an ISA100 gateway.

## 9.5 Reset a Manager Gateway to Factory Defaults

### 9.5.1 Resetting BN Protocol Manager Gateway

A Manager Gateway may need to be forced to the original factory default. This may be required if the device is decommissioned, but was not reset to the default state using the Admin Toolset web server during decommissioning. If communication cannot be established with a Manager Gateway that was previously used try the "hard" factory reset procedure.

The following procedure may be used to reset the gateway to the factory defaults.

1. Power up the Manager Gateway.
2. Insert probes into the "A" and "B" holes on the Manager Gateway housing.
3. Press and hold the probes in the "A" and "B" holes until the **Reset** LED on the Manager Gateway turns on and remains lit. Hold the probes to keep the LED on for 4 seconds.
4. Release the probe in "A" and keep holding the "B" probe. The Ethernet Subscription LED will blink 3 times.
5. Release the probe in the "B" hole.
6. Wait 90 seconds.
7. De-energize the Manager Gateway. The Manager Gateway is now in the factory default state and the IP address has been reset to 192.168.99.100. It can now be commissioned like a new Manager Gateway.

### **9.5.2 Resetting ISA100 Manager Gateway**

Refer to the gateway manufacturer's instructions for resetting an ISA100 gateway.