

# Ranger Pro Wireless Condition Monitoring Device

## User Guide

Bently Nevada Machinery Condition Monitoring

125M6113 Rev. D



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# 1. General Safety

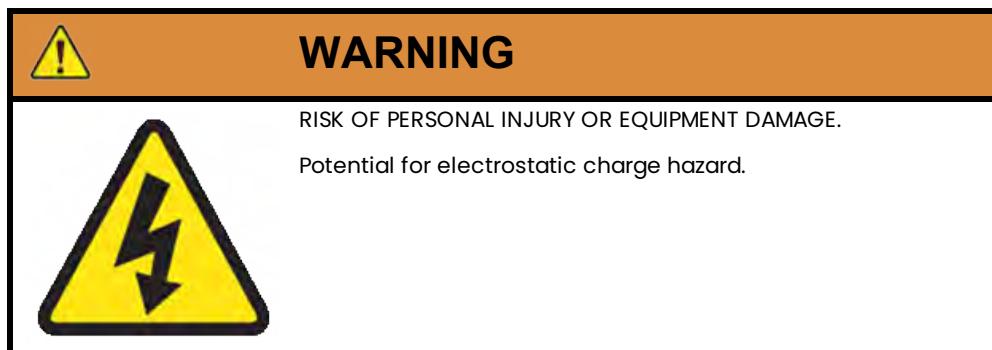
## 1.1 Handling and Storing Considerations

Proper handling of components, best practices for system installation, and diligent inspection procedures will prolong the service life of the system. Additionally, procedures for dealing with system components that have been replaced are detailed below, to allow compliance with regulations relating to electronic waste.

## 1.2 Personal Safety Warnings

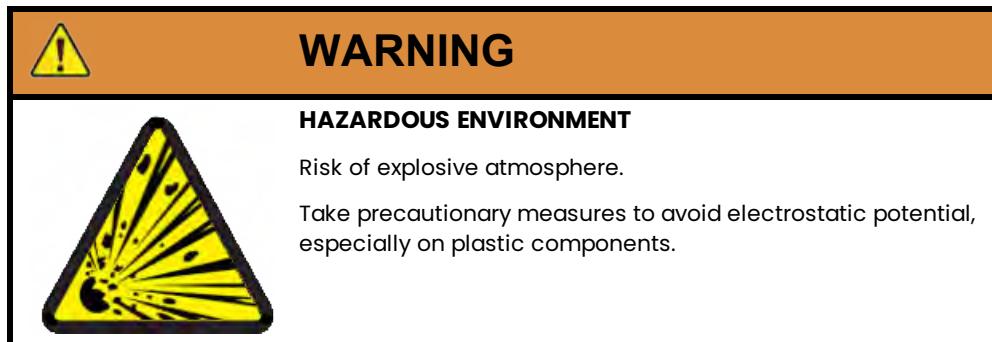
Labels and markings are provided to guide the system integrator in the processes of choosing appropriate interface equipment, determining safe use conditions, and identifying recommended installation procedures. The format of these markings are governed by the standards that dictate safe use and environmental compliance in a variety of regions and regulated settings. More specific product safety warnings are described in **Ranger Pro - Warning, Special Conditions and Additional Information** (document 126M6550).

### Potential Electrostatic Charge Hazard



- Electrostatic discharge could cause a spark that may ignite and cause an explosion. In addition, electrostatic discharge could damage the product.
- Use extra caution during dry weather. Relative humidity less than 30% tends to multiply the accumulation of static charges on any surface.

## Hazardous Environment for Transducers

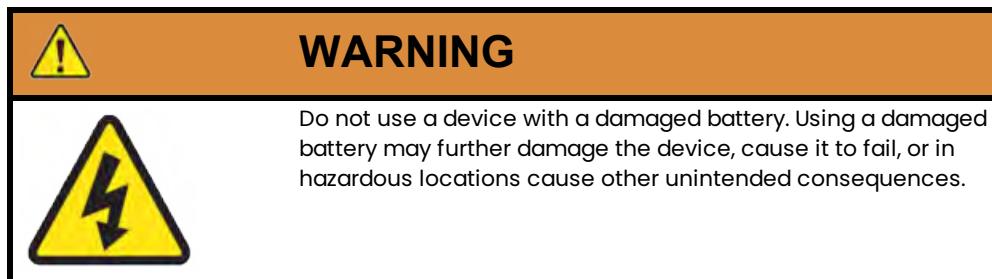


Installations and maintenance tasks performed in potentially hazardous areas must be performed only after the area has been verified to be free of hazardous materials, atmospheres, and conditions.

The following situations could cause a spark enough to ignite an explosion:

- Electrostatic discharge from non-conductive components
- Removal or placement of an energized connection.

## Lithium Batteries

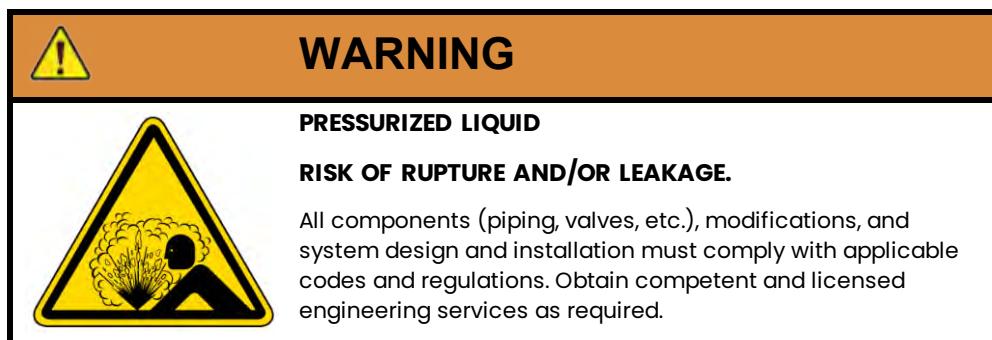


Lithium batteries are volatile. When handling and storing lithium metal batteries, follow these precautions:

- Store and handle lithium metal batteries to avoid contact with other lithium batteries.
- Don't place lithium metal batteries on metal work surfaces.
- Avoid exposing lithium metal batteries to extreme temperatures.
- If you store an inactive Ranger Pro sensor, remove the battery.
- Dispose of depleted or defective batteries in keeping with applicable statutes and regulations as well as site-specific safety requirements.

The lithium batteries will typically last up to five years. Use the Ranger Pro software or your wireless network vendor's system status application to monitor battery performance and replace batteries as needed.

## Pressurized Liquid



## 1.3 Safe Disposal

### Replacing Device and Failure Analysis

Visit [Bently.com](https://Bently.com) for information on returning parts under warranty and/or requesting failure analysis.

### Hazardous Materials

This device does not use hazardous materials outlined by RoHS or battery directive statutes. These regulations confirm that lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls, polybrominated diphenyl ether, and battery-related materials such as lithium are limited to no more than trace amounts within the system.

### Recycling Facilities

Decommissioning of instrumentation should endeavor to minimize the impact of the waste created by disposal of system components. Refer to local or regional waste removal administration for information on proper material collection, reuse, and recycling.

### Product Disposal Statement

Customers or third parties who are not member states of the European Union, and who are in control of the product at the end of its life or at the end of its use, are solely responsible for diligent product disposal. No person, firm, corporation, association, or agency shall dispose of the product in a way that is in violation of any applicable international, federal, state, or local regulations. Baker Hughes, a GE company, LLC ("BHGE") is not responsible for product disposal at the end of its useful life. Visit [www.weerohsinfo.com](http://www.weerohsinfo.com) for recycling information.



## 2. Hardware

### 2.1 Intended Use

Ranger Pro devices are intended for monitoring purposes only and should not be used in control or safety systems.

### 2.2 Compliance Information

This device complies with part 15 of the FCC Rules and contains license-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's license-exempt RSS(s). Operation is subject to the following conditions:

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

For complete compliance and hazardous location approval information, see the **Ranger Pro Wireless Condition Monitoring Datasheet** (125M5237) and **Ranger Pro - Warning, Special Conditions and Additional Information** (document 126M6550) available from [Bently Nevada Technical Support](#).

### 2.3 Description

The Ranger Pro ISA100.11a wireless sensor measures temperature, acceleration, and velocity. Ranger Pro sensors detect acceleration using piezoelectric ceramic sensing elements in the sensor base. The sensors derive velocity from the acceleration signal. The Ranger Pro sensors also measure surface contact temperature using a sensor in the device base. The sensor reports a single temperature per device. You can choose what units are used to measure the data.

Temperature	A sensor embedded in the device base measures contact temperature.
Acceleration Overall	Discrete, piezoelectric sensing elements measure acceleration in the Z axis for Uni-Axial Ranger Pro Wireless Sensors and in the X, Y and Z directions for Tri-Axial Ranger Pro Wireless Sensors. Overall acceleration is calculated over 2.5 seconds.
Velocity Overall	Calculated from the acceleration waveform and the overall value is calculated over a 2.5 second duration.

There are four versions of the device:

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WirelessHART tri-axial sensor (70M403)	Detects velocity and acceleration in three axis (X, Y, and Z) and measures surface temperature.
ISA100 tri-axial sensor (70M303)	Detects velocity and acceleration in three axis (X, Y, and Z) and measures surface temperature.
ISA100 single axis sensor (70M301)	Detects velocity and acceleration in one-axis (vertical, or Z) only and measures surface temperature.
ISA100 repeater (70M300)	Enables you to extend the range between sensors and network access points.

---

For ISA100 networks, both the tri-axial and uniaxial sensors can also act as routers, although using the router mode depletes the unit's battery more quickly.

If a Ranger Pro device can't communicate with an backbone router, you can use the Ranger Pro ISA100 repeater or a Ranger Pro ISA100 device enabled as a router to extend your network. We recommend connecting no more than three Ranger Pro sensors to a Ranger Pro router, although you may be able to connect up to eight.

## 2.4 System Components Required

To install, configure, and use the Ranger Pro Ranger Pro wireless sensor, you need:

- Lithium-thionyl chloride batteries, one per device. For approved battery types, see the **Ranger Pro - Warning, Special Conditions and Additional Information** (document 126M6550).
- Battery installation tool.
- Ranger Pro, either or both tri-axial and uniaxial devices, with batteries installed.
- (Optional) Ranger Pro repeaters with batteries installed.
- Mounting hardware (plus adapters, if needed).
- A compatible USB NFC reader. Contact [Bently Nevada technical support](#) for a list of compatible readers.
- Ranger Pro Configuration Software (121M7997, available from [Bently Nevada technical support](#)).
- Spot facing tool, if required. (Not provided by Bently Nevada.)
- Torque wrench with  $\frac{1}{4}$  inch drive, capable of tightening devices in the 5-7 Nm (44 to 62 in lb) range. (Not provided by Bently Nevada.)

An Installation Kit (130M5452) is also available. The installation kit can be ordered with or without the USB NFC reader. For ordering information, see the **Ranger Pro Datasheet** (document 125M5237).

## Ranger Pro Components

The Ranger Pro device is composed of these parts:

- Case. Contains the vibration and temperature sensors and forms the device housing (316 stainless steel body).
- Wireless e-module (glass-reinforced, impact-resistant PPS).
- E-module retaining ring (316 stainless steel body).
- Battery (replaceable D-sized 3.6V lithium-thionyl chloride).
- Battery retaining ring (316 stainless steel body).
- Two O-ring seals (35x1mm on sensor body and 34x1 mm on e-module).



Use only approved D-sized lithium-thionyl chloride batteries for the Ranger Pro sensors and repeaters. If you use the wrong battery, you can negatively affect device performance, produce inaccurate readings, and void the Ranger Pro warranty. You can purchase approved batteries from Bently Nevada or third-party suppliers. For details and ordering information, see the **Ranger Pro Datasheet** (document 125M5237).



## Network Requirements

Ranger Pro devices operate on compatible WirelessHART and ISA100.11a wireless networks and gateways. Additional licenses may be required to activate these gateways.

### ISA100 Network requirements

Manufacturer	Gateway	Router
Bently Nevada	Ranger Pro Gateway	N/A
Yokogawa	YFGW410 (R2.01.04 or equivalent)	YFGW410 (R2.01.04 or equivalent)
Honeywell <sup>‡</sup>	WDM (R310.2-4 or later)	FDAP (OW 230 or later) CISCO 1552S

<sup>‡</sup> Honeywell OneWireless Wireless Device Manager using firmware R310.2-4 limits the maximum number of Ranger Pro wireless devices to 140 per gateway. To increase the limit to 160 or more devices, upgrade to a newer version of the firmware when available.

## WirelessHART Network requirements

Manufacturer	Gateway	Router
Emerson	Wireless 1410/1420 Gateway (4.7.84 or later)	N/A

## 3. Network Design

Ranger Pro sensors operate on the 2.4 GHz band on ISA100.11a and WirelessHART networks. To enhance security, the sensors use 128-bit AES encrypted packets.



Installing and configuring wireless networks is beyond the scope of this user guide. For details, refer to your vendor's wireless network documentation.

### Setup Overview

The Ranger Pro Wireless Condition Monitoring Device operates on the ISA100.11a and WirelessHART wireless network protocols. To add Ranger Pro sensors to your network, complete these steps:

1. Survey your installation location.
2. Decide where to install Ranger Pro sensors and identify mounting points.
3. Locate and install access points.
4. Locate and install a device manager.
5. Install batteries in each sensor.
6. Provision Ranger Pro sensors (and repeaters, if needed).
7. Mount sensors.
8. Test and verify your installation.
9. Monitor and maintain your sensors and network.

#### 3.1 Consider Sensor Range

A sensor can transmit data up to 150 meters (164 yards) to an access point when unimpeded by environmental influences. A sensor can optimally transmit data to another sensor up to 100 meters (109 yards) or more, but greater distances may negatively affect performance.

The range of Ranger Pro devices is affected by several factors, including:

- Device location
- Line of sight to routing devices or access points
- Proximity to routing devices or access points
- Routing devices or access point antenna type
- Orientation of the e-module
- Obstacles, including the density and type of materials nearby.

Generally, the denser the industrial environment, the weaker the signal.

You can mount devices in any orientation necessary to monitor the machine or connect to the network. However, the radio transmission is strongest above and around the device, and weakest below it. Generally, if you mount a device horizontally, we recommend aligning it with the X-axis horizontal and Y-axis vertical.

## 3.2 Consider Battery Life

Batteries for the Ranger Pro device have a typical life of five years under the following conditions:

- The Ranger Pro ISA100 sensors are configured as a I/O device (not a router).
- Ambient temperatures under 40°C (104°F).
- Good quality radio frequency communications.
- Measurement interval of 30 minutes.

To maximize Ranger Pro device battery life:

- Minimize the number of hops between devices and access points. Poor quality radio frequency communications increase packet retransmission and reduce battery life.
- Avoid environments with elevated temperatures. Temperatures above 40°C (104°F) cause the device to consume more power and the battery to discharge more quickly. Elevated temperatures can reduce battery life by up to 40%.
- Avoid using Ranger Pro ISA100 devices as both sensors and repeaters. Using a sensor as a router can reduce battery life to 18 to 24 months.
- Minimize the number of Ranger Pro ISA100 devices routed through Ranger Pro Repeaters. Avoid connecting more than eight devices through a single Ranger Pro ISA100 Repeater, or more than five devices through a sensor with router enabled. Since Ranger Pro ISA100 Repeaters are continually in listen and transmit mode, their battery life is less.
- Use the lowest reasonable measurement interval to monitor vibration and temperature. More frequent vibration measurements consume more power. For example, changing the interval from 30 to 10 minutes reduces battery life by about 30%.

## 3.3 Choose Network Topology

The two most commonly used ISA100.11a network configurations are star and mesh topologies while WirelessHART networks inherently form mesh topologies. Your existing network infrastructure may determine the number of devices you can connect to backbone routers (ISA100) or access points (WirelessHART) or the maximum number of hops permitted. A star topology is recommended for ISA100 networks, although you may use a combination of both, depending on your needs. Consult your network infrastructure documentation for details.

### Star Topology

A star topology is the most efficient method for building a ISA100 network. It is suitable for smaller areas where all devices can directly communicate with an access point.

### Mesh Topology

A mesh topology creates redundant communication paths for devices on the network. Mesh topologies are suitable for devices that cover a large area. When planning a mesh network, it's critical to avoid a choke point, where many devices attempt to connect to a single point. Avoid network topologies that require more than three hops and too many nodes routed through a single node, creating a choke point.

## 3.4 Plan Device Placement

We recommend a site survey and device placement plan for wireless installations. To plan device placement, obtain or develop an accurately scaled site plan detailing the placement of the machinery you need to monitor, including architectural details like walls and pillars. Then complete a site survey and plan.

To develop a survey and plan:

1. On the accurately scaled site plan, mark the locations where you need to install sensors.
  - Mount sensors as close as possible to the machine point being monitored.
  - To avoid destructive interference, install devices at least 18 inches apart.
  - Whenever possible, avoid obstructions such as machinery or walls that might "hide" devices from routing devices or access point antennae.
  - Allow clearance for mechanical installation and suitable clearance around the top (100 mm or 4 inches).
  - If possible, install devices at least two meters (6 ½ feet) above ground level with clear line of site to at least two other devices.
2. Determine the optimal wireless range for each device. Use the map scale and draw a circle representing the nominal radio frequency range around the proposed location of each Ranger Pro device. (When connecting to a backbone router or access point, the range is about 50% greater.)

When the device is placed among:	Draw a circle with:
Dense metal structures with no line-of-sight	25 m (82 ft) radius
Sparse metal structures with limited line-of-sight	50 m (164 ft) radius
Unobstructed, clear line-of-sight locations	100 m (328 ft) radius

3. Identify the locations of any existing gateways, routers, or access points.
  - If you're installing sensors in extremely congested plant areas or in areas with insufficient wireless connectivity, consider installing additional gateways, backbone routers, and access points.
  - Add locations where you need to install additional gateways, backbone routers, and access points.
  - When placing gateways, backbone routers, and access points, consider the location of line power and suitable connections to the existing plant network.

Place gateways, backbone routers, and access points in locations where as many devices as possible can connect directly to each gateways, backbone routers, and access points. Refer to your network hardware vendor documentation for the maximum number of devices supported.



Where possible, minimize the distance from the access point to the furthest Ranger Pro device.

4. Plan for multiple connections for each device.
  - Multiple communication paths are required to increase network redundancy and prevent a single path failure that would result in a loss of communication.
  - Depending on the circle (short, medium, or long) that applies to the location of each Ranger Pro sensor, verify that each device is within range of at least two, and preferably three, routing devices or access points.
  - Avoid connecting more than five devices through a single Ranger Pro ISA100 sensor, or more than eight devices through a single Ranger Pro ISA100 Repeater.
5. To extend the range of an ISA100 wireless network or to reach devices beyond the range of a gateway or an backbone router, consider adding Ranger Pro repeaters. Repeaters ought to be positioned:
  - Relatively high above the sensors, preferably at least two meters (6 ½ feet) above grade. Higher placement dramatically increases signal strength.
  - To improve radio frequency transmission, we recommend you install the repeaters upside down and at least 33 cm (1 ft) from walls and pillars.
  - Within a clear line of sight to two other repeaters or access points.
6. Plan for a maximum of four hops between each Ranger Pro device and a gateway, backbone router, or access point, although we recommend a maximum of three hops.
7. If your installation is complex or likely to require additional gateways, backbone routers, or access points, consider temporarily installing your network access points and Ranger Pro devices to test your plan. Use temporary magnetic mounting adapters to test device placement.

To obtain optimal results, carefully plan your network. For complete information, see your network infrastructure documentation.

## 4. Installation and Configuration

### 4.1 Install Battery

We recommend that you install batteries in Ranger Pro devices in an indoors equipment room or a similar environment. Do not replace batteries in a hazardous area.



To maintain the device's IP67 dust and water-resistant rating, assemble the device carefully.

To install a battery in a Ranger Pro device:

1. Turn the e-module retaining ring counter-clockwise and stop when resistance decreases. Place the device on a flat surface. Use your index finger and apply firm pressure to the top of the e-module. Use your other hand and continue to unscrew and remove the retaining ring.



2. Hold the device and e-module as shown. Use your thumb to press against the e-module just above the metallic tab on the case. Apply a slight radial force and push upward until the e-module is separated from the case.



3. Use the battery installation tool to remove the battery retaining ring. Turn the ring counter-clockwise. Use the magnet in the tool to lift the ring from the device case.

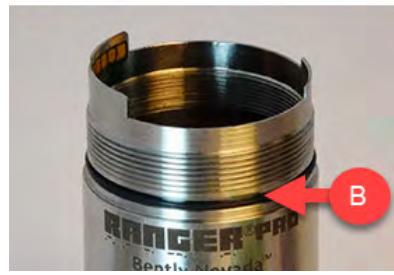


4. Inspect the O-rings on the e-module and case to verify they are present, clean, and undamaged. Apply a very light coating of silicon-based O-ring grease to the O-rings. (When replacing the battery, always replace the O-rings.)

The Ranger Pro device uses two O-rings to seal the unit against dust and moisture.



**A** 34x1mm O-ring on the e-module



**B** 35x1mm O-ring on the case



To maintain the device's IP67 dust and water-resistant rating and prevent leaks, you must install and lubricate the O-rings properly.

5. Inspect the interior threads of the e-module retaining ring to be sure they aren't damaged.
6. Verify that the positive end of the battery is up and then insert the battery.



Use only approved D-sized lithium-thionyl chloride batteries for the Ranger Pro sensors and repeaters. For ordering information, see the **Ranger Pro Datasheet** (document 125M5237).

7. Use the magnetic Ranger Pro battery installation tool to tighten the battery retaining ring. Hand-tighten the ring until it contacts the battery, then torque to 5 N·m (44 in-lb).



8. To avoid damaging the e-module, you must first align the contact pins of the e-module with the contact points in the case. Angle the e-module and align the contact pins and back keyway.



9. Now rotate the e-module downward to align the notch on the other side of the e-module with the notch in the case and press firmly. You can feel or hear a click when it is in place. If necessary, hold the sensor in place with your finger.

Inspect the exterior threads of the sensor case as well as the interior threads of the e-module retaining ring to be sure they are not damaged.



10. Align the e-module retaining ring over the e-module. If needed, hold the sensor in place with your finger.



11. To maintain the device's IP67 rating, be careful to avoid damaging the O-rings. Turn the e-module retaining ring clockwise two to three turns, and then counter-clockwise about  $\frac{1}{4}$  turn, and repeat until the ring is hand-tight.

12. Verify that the device is tightly sealed. There shouldn't be any gap between the e-module retaining ring and the case, as shown below.



## 4.2 Configure Network

Refer to your network infrastructure vendor documentation to configure gateways, device managers, backbone routers or access points as applicable. Configuration may include assigning IP addresses, wireless network IDs and wireless join keys.

### Ranger Pro Configuration Software

The Ranger Pro configuration software is used to provision, configure, monitor, and maintain Ranger Pro devices using either a USB NFC reader or over the air using an appropriately configured gateway.

Ranger Pro configuration software functions include:

- Device provisioning
- Rebooting the device
- Unprovisioning
- Device configuration including
- Applying default configurations
- Saving, loading, and applying custom configurations
- Device diagnostics including
- E-module status
- Sensor status
- Device application firmware management

## 4.3 Provision Devices

Before installing Ranger Pro devices, we recommend that you prepare each device to join your network. Depending on your network infrastructure, you can provision multiple devices over-the-air (OTA) or individually using the Ranger Pro USB device NFC reader.

When you provision the device, you provide it as needed with:

- The correct UTC adjustment
- A new network ID
- A new network join key

Depending on the number of Ranger Pro devices and their current sleep state, provisioning can take up to several hours. If a device fails to join the network, [see Reboot the Device on page 28](#).

## Before You Begin

### ISA100 Devices

Ranger Pro ISA100 devices must be in an unprovisioned state to use over-the-air (OTA) provisioning and join the network.



If over-the-air provisioning fails, you may be required to use the NFC reader and Ranger Pro software to reboot or unprovision the device.

### WirelessHART devices

Ranger Pro WirelessHART devices are shipped with an assigned Network ID and Join Key. The default WirelessHART device values are:

- Network ID: 32498
- Join Key: 00001631 00001631 00001631 00001631

If you are using a:

- Yokogawa or Honeywell ISA100 gateway, you must provision devices over the air.
- Bently Nevada Ranger Pro ISA100 gateway, [see Provision Using a USB NFC Reader on page 1](#).
- WirelessHART gateway, [see Provision Using a USB NFC Reader on page 1](#).

If a Ranger Pro device does not join the network, it may be in a sleep state. It periodically wakes from the sleep state to attempt to join the network. To reset the sleep cycle, [see Reboot the Device on page 28](#).

### ISA100 Sleep State

Once you install a battery into a Ranger Pro ISA100 device, it is ready to be provisioned over-the-air or join the provisioned network. To conserve battery power, if a Ranger Pro ISA100 device is not provisioned within a certain period of time, it enters a sleep cycle. It periodically wakes from sleep mode to attempt to join the network. To reset the sleep cycle, [see Reboot the Device on page 28](#).

Interval after battery is inserted or sensor is disconnected from a network:	Sensor tries to connect every:
0 to 20 minutes	2 min
>20 min to 120 min	5 min
>120 min to 10 hours	15 min
>10 hours to 48 hours	30 min
>48 hours	60 min

## WirelessHART Sleep State

The WirelessHART device radio listens for advertisements from the configured network for a one-hour period at periodic intervals. This is followed by a one-hour deep sleep period, after which the device reinitiates searching for the network as it did during the first hour. This cycle continues until it successfully joins the network or is rebooted.

## Provision Using the Yokogawa ISA100 Gateway

Before you can provision Ranger Pro devices on a Yokogawa gateway, you must first add the devices to the network configuration.

For more information and detailed instructions, refer to the Yokogawa documentation.

### Add Devices

To add devices to a Yokogawa ISA100 network:

1. In the Yokogawa **Field Wireless Management Console**, open **Configurator**.
2. Add Ranger Pro devices to the Field Wireless Network on the **Field Devices** tab.
  - a. Set the **Device Tag**.
  - b. Check **OTA Provisioning**.
  - c. Select the **Device Role** as **IO**, **IO Auto**, or **IO+Router**.
  - d. (If applicable) Select the **Primary Router**.
  - e. (If applicable) Select the **Secondary Router**.
3. Click **Download** to apply the updated configuration to the gateway. When successful, a confirmation message is displayed.

### Apply capabilities file

After you add the devices, provision the devices. We recommend configuring the device **Sampling Data** before provisioning devices. The capabilities file (CF) required to configure devices is available from Bently Nevada Technical Support.

To apply a CF file to the Ranger Pro devices:

1. In the Yokogawa Field Wireless Management Console, open **Configurator**.
2. Select **Sampling Data**. The **Sampling Data** pane is displayed.
3. Click **Add**. The **Sampling Settings** dialog box is displayed.
4. In the **Device Tag** field, click browse and select the check box of the device you want to modify. You can select multiple devices of the same type. Click **OK**.
5. In the **CF / DD** pane, select **CF File**. If the CF file is not yet displayed:
  - a. Select **Load CF/DD**. The Windows **Open** dialog box is displayed.

b. Navigate to the Windows directory location of the device compatibility file you previously downloaded from Bently Nevada tech support. Select the capability file matching the device you want to upgrade, as shown below.

Ranger Pro Device	Yokogawa Model	Capability File Name
70M300 Repeater	GE/70M300	BHGE-RP-70M300 v6.1.CFF
70M301 Single Axis	GE/70M301	BHGE-RP-70M301 v6.1.CFF
70M303 Tri-Axis	GE/70M303	BHGE-RP-70M303 v6.1.CFF

c. Click **Open**. The CF file is displayed in the **CF File** field.

6. Select the CF file compatible with the devices displayed in the **Device Tag** field.

7. For each type of Ranger Pro device, modify these Concentrator OID:11 **Read Parameters**:

OID Concentrator Value	70M300 Repeater	70M301 Single Axis	70M303 Tri-Axis
Update policy	Periodic	Periodic	Periodic
Publication period	0 (zero)	150	150
Stale limit	Default	5	5
Retry mode	Normal	Normal	Normal

8. For each type of Ranger Pro device, verify these additional Concentrator OID:11 **Read Parameters**:

OID Parameter	70M300 Repeater	70M301 Single Axis	70M303 Tri-Axis
UAPMO Diag_Status	To prevent session timeout, select the <b>UAPMO Diag_Status</b> parameter (if displayed) and click the "<" button. The parameter is moved to the list of <b>Available Parameters</b> .		
AI_01 AI_02 AI_03 AI_04 AI_05 AI_06 AI_07 AI_08	Not available	AI_01 - AI_05: available AI_06 - AI_08: unavailable	AI_01 - AI_08: available

9. For each type of Ranger Pro device, configure the Concentrator OID:12 **Read Parameters**.

OID Concentrator Value	70M300 Repeater	70M301 Single Axis	70M303 Tri-Axis
Update policy	Default	Periodic	Periodic
Publication period	Default	10	10
Stale limit	Default	10	10
Retry mode	Default	Normal	Normal

10. Restart the devices that you changed. Select the **Download** button. The **Error Check** dialog box is displayed.
11. Click **OK**. The **Download Configuration** dialog box is displayed.
12. Click the check box next to each device you need to restart. Click **Start Download**.  
Restarting a device may take one or five minutes.
13. Verify the status of device(s) you restarted.
  - a. In the Yokogawa Field Wireless Management Console, open **Monitor**.
  - b. In the tool bar, click the **Field Device List** button. The **Field Device List** dialog box is displayed.
  - c. For each type of device, verify that the status of each type of Ranger Pro device is:

	70M300 Repeater	70M301 Single Axis	70M303 Tri-Axis
Configuration Status	Not Published	Published	Published



If the status is **Session Timeout**, you must resolve the timeout issue before proceeding.

14. To verify the device status:
  - a. In the Yokogawa Field Wireless Management Console, open **Configurator**.
  - b. Select **Sampling Data**. The **Sampling Data** pane is displayed.
  - c. Click **Edit**. The **Sampling Settings** dialog box is displayed.
  - d. Verify that the firmware version, CF file version, and OID parameters are correct for the device.

## Provision Devices

To provision Ranger Pro devices on a Yokogawa ISA100 gateway:

1. In the Yokogawa Field Wireless Management Console, open **Monitor**.
2. Choose **Tools > OTA Provisioning Manager**.
3. To allow unprovisioned devices to join, select **Enable Provisioning Network**. Wait for unprovisioned Ranger Pro devices to display in the **Provisioning Network** list. Wait time may be 5 to 30 minutes and depends on the 3rd party ISA network.
4. In the **Target Device** tag field, select the device tag assigned to the device.
5. Select the devices desired and choose **Start Provisioning**.
6. Wait for all devices to be provisioned and display in the **Operating Network** List.

Depending on the number of devices and their current sleep state, provisioning may take up to several hours. If a device fails to join the network, [see Reboot the Device on page 28](#).

## Provision Using the Honeywell ISA100 Gateway

Before you provision Ranger Pro devices using a Honeywell Gateway, we recommend you apply the correct device descriptor (DD) file required for each type of device. You must first obtain the ISA100.11a Device Description (DD) config file from [Bently Nevada Tech Support](#). You only need to add a DD file to the gateway once for each device type.

For more information and detailed instructions, refer to the Honeywell documentation.

To provision Ranger Pro devices on a Honeywell gateway:

1. Open Honeywell OneWireless Device Manager (WDM).
2. Select **Maintenance > Templates**. The **Load ISA100.11a DD / Modbus config file** dialog box is displayed.
3. Click **Load ISA100.11a DD / Modbus file**. The Windows **Open** dialog box is displayed.
4. Navigate to the Windows directory location of the DD file. Select it and click **Open**. The DD is listed in the dialog box.
5. Select an appropriate access point on which Ranger Pro devices have been installed.
6. Expand the **Property Panel**.
7. Select **ISA100 Over the Air Provision**.
8. Click **Enable for 60 Minutes**. Wait for the unprovisioned devices to display in the **Property Panel**. This may take five to ten minutes.
9. Select the un-provisioned devices and click **Accept**.
10. If a device fails to display in the **Property Panel**:
  - a. Delete the device from WDM and allow it to rejoin.
  - b. Select the device.
  - c. Select **Property Panel > Input Publication**.
  - d. Verify that the **Attribute** value is **PV**.

If a device fails to join the network, [see Reboot the Device on page 28](#).

After the Ranger Pro devices are provisioned, use the OneWireless device manager to configure each device's tag name, routing assignment, and join assignment.

## Provision Using a USB NFC Reader

To provision ISA100 Ranger Pro device on other than a Yokogawa or Honeywell gateway, use the Ranger Pro Configuration Software. The software displays device details, including current provisioning and configuration, sensor values, hardware model numbers, firmware version numbers, and enables you to perform maintenance and diagnostics tasks.

For WirelessHART devices, you can use the default the **Network ID** and **Join Key**, or use the USB NFC reader to modify them as needed.



Placing the NFC reader on a bare metal surface may cause interference. Insulate the NFC reader from the metal surface by placing a 2.5 cm (1 in.) thick book or similar material under the NFC reader.

To provision sensors using a USB NFC reader, you need:

- Ranger Pro Configuration Software (available from [Bently Nevada technical support](#)).
- Supported USB NFC reader
- Ranger Pro sensors with batteries installed
- Network ID
- Join key
- Radio (device) tag

For details about your network's Network ID and Join Key, refer to the vendor's network documentation.

To provision sensors using Ranger Pro Configuration Software and a NFC reader:

1. Open the Ranger Pro configuration software.
2. Select the **NFC Manager** tab.
3. Connect the **NFC reader** to the computer running the Ranger Pro software. If necessary, install any drivers required. To obtain drivers, visit the website of the NFC reader vendor.
4. Select the appropriate USB NFC reader in the **NFC Manager** tab header.
5. Place the Ranger Pro device upside down on the USB NFC reader pad.
6. Verify that the NFC status in the footer is **Ready**.
7. Select **Configuration Manager** > **Live Configuration**.
8. Click **Provision**.
9. Enter the **Network ID** and **Join Key**.
10. Click **Provision Sensor**.

## 4.4 Unprovision Devices

If you need to remove an ISA100 device from the network, move it to another network, or if you need to disable it for any reason, you can unprovision it.

When you unprovision a WirelessHART device, the radio status state is **Suspended**. You can then modify the **Network ID** and **Join Key** and the WirelessHART device will join the new network.

### Unprovision Using the Yokogawa ISA100 Gateway

To unprovision Ranger Pro devices using the Yokogawa Field Wireless Management Console:

1. Open Yokogawa Field Wireless Management Console.
2. Select **Monitor**.

3. Select **Tools > OTA Provisioning Manager**. The **OTA Provisioning Manager** dialog box is displayed.
4. Click the check box of one or more devices that you want to unprovision.
5. Click **Reset Provisioning Information** and then click **Apply**. The device is removed from the channel and reset to its original mode.

## Unprovision Using the Honeywell ISA100 Gateway

To unprovision Ranger Pro devices using the the Honeywell OneWireless device gateway:

1. Open Honeywell OneWireless Wireless Device Manager.
2. Expand the **Selection Panel**.
3. Select one or more Ranger Pro device(s).
4. In the tool bar, click **Channel > Inactivate**. The **Inactivate Channels** dialog box is displayed.
5. Select the device(s) you want to inactivate and click **Inactivate**. The device is inactivated and its status is changed to out of service (OOS).
6. In the tool bar, click **Provisioning > Delete**. The **Delete Devices** dialog box is displayed.
7. Select the device(s) you previously inactivated.
8. Click **Delete**. The device is removed from the network. It is restarted and reset to its factory defaults.



When you inactivate a devices' IO channels on a Honeywell gateway, the device IO channel remain inactivated when the device is re-provisioned to the same or different network. You must reactivate the IO channels for data to publish from the sensor. Reactivate using the "activate" feature or by manually setting the IO channel mode to "Auto".

## Unprovision Using a NFC Reader



Placing the NFC reader on a bare metal surface may cause interference. Insulate the NFC reader from the metal surface by placing a 2.5 cm (1 in.) thick book or similar material under the NFC reader.

To unprovision a single device using the Ranger Pro Configuration Software and a NFC reader:

1. Connect the NFC reader to the computer running the Ranger Pro software.
2. Open the Ranger Pro Configuration Software.
3. Select the **NFC Manager** tab.
4. Connect the USB NFC reader to the PC running the configuration software. If necessary, install any drivers required. To obtain drivers, visit the website of the USB NFC reader vendor.
5. Select the appropriate USB NFC reader in the **NFC Manager** tab header.
6. Place the Ranger Pro device upside down on the USB NFC reader pad.
7. Verify that the NFC status in the footer is **Ready**.
8. Select the **Configuration Manager** > **Live Configuration** tab and click on the Unprovision button.
9. Click **Unprovision**. Before removing the device from the NFC reader, wait 10 seconds.

Upon completing these steps for ISA100 devices, the Ranger Pro device is unprovisioned, disconnects from the network, and is ready to be provisioned for the same or a new ISA100 network.

Although not required when changing networks, WirelessHART devices can be unprovisioned using a USB NFC reader to place the device into a deep sleep state.

## 4.5 Reboot the Device

If after several hours the device fails to join the network, reboot the device. Remove the device from the field and reboot the device in an equipment room or similar environment.

To reboot a single device:

1. Open the Ranger Pro Configuration Software.
2. Connect the USB NFC reader to the computer running the Ranger Pro software.
3. Place the Ranger Pro device upside down on the NFC reader pad.
4. Select **NFC Manager** tab.
5. Verify that the NFC status is **Ready**.
6. Verify that the Ranger Pro device status is **Ready**.
7. Expand **Sensor Maintenance** > **Power Control**.
8. Click **Reboot**. The device is restarted.

## 4.6 Configure Devices

Use the Configuration Software to configure sensor data. You can save configuration settings as a file to your hard drive, share the settings file locally and remotely, and apply the saved settings to multiple sensors over the network.

Configuration files include:

- Configuration version
- Identification information
- Acquisition timing and scheduling settings
- Temperature measurement settings
- Vibration measurement settings

You can configure Ranger Pro devices two ways:

Network Manager Mode (over-the-air Configuration)	Configure one or many sensors over the network using Ranger Pro Configuration Software.
NFC Manager Mode (using NFC reader)	Configure Ranger Pro devices one at a time at your desk or in a safe area.

## Configuration Modes

You can use the Ranger Pro Configuration Software to define sensors settings using two modes:

Live Configuration	<ul style="list-style-type: none"><li>• View, modify and update sensor configurations in real-time.</li><li>• Most often used to change device configuration on a single device.</li></ul>
Preset Configuration	<ul style="list-style-type: none"><li>• View, modify, save, and apply saved settings to multiple sensors over the network.</li><li>• Most often used with customer defined configuration templates.</li></ul>

## Manage Gateways

To view or add a gateway:

1. Open the Ranger Pro configuration application.
2. Select **Network Manager > Gateways**. All current gateways are displayed.
3. Click **Add**. The **Add Gateway** dialog box is displayed.
4. Enter the **Site Name, Gateway Name, Gateway Address** and **Gateway Port**. For ISA100, the default for **Gateway Port** is 4901. For WirelessHART, the default is 5094. For more information, refer to the vendor's network infrastructure documentation.
5. Click **Add Gateway**. The new gateway is displayed. The gateway immediately begins to acquire a list of all devices on the network. The number of devices discovered and configured is displayed.

To modify gateways:

1. Open the Ranger Pro configuration application.
2. Select **Network Manager** > **Gateways**. Existing gateways are displayed.
  - To modify a gateway:
    - a. Select the gateway and click **Modify**. The **Modify Gateway** dialog box is displayed.
    - b. Modify the **Site Name** or **Gateway Name**.
    - c. Click **Modify Gateway**.
  - To remove a gateway:
    - a. Select the gateway and click **Remove**. The **Remove Gateway** dialog box is displayed.
    - b. Click **Remove Gateway**.
  - To reset gateways:
    - a. Select an individual gateway and click **Reset**.
    - b. Click **Reset All**.

To view available devices on the gateway:

1. Open the Ranger Pro configuration application.
2. Select **Network Manager** > **Gateways**. Existing gateways are displayed.
3. In **Gateways**, select a gateway from the list.
4. Double-click on the gateway name. The **Sensors** pane displays all devices and their status.

If using System 1, to modify the gateway IP address, refer to the System 1 online help or user guide.

## Configure Sensors Over the Network

To configure sensors over the network:

1. Open the Ranger Pro configuration application.
2. Select **Network Manager** > **Sensors** tab. Current devices are displayed.
3. Select **Configuration Manager** > **Live Configuration**.
4. Select a sensor device. Verify that the sensor status in the application footer is **Ready**.
5. Modify configuration options as needed.
6. Unsaved changes are highlighted in blue. To save the changes, click **Apply**. Pending changes are displayed in orange. Completed changes are displayed in black.

To save sensor configuration settings:

1. Open the Ranger Pro configuration application.
2. Select **Network Manager** > **Sensors**. Current devices are displayed.
3. Select **Configuration Manager** > **Preset Configuration**.

4. Modify configuration options as needed. When complete, click **Save Preset**. The Windows **Save As** dialog box is displayed.
5. Enter a file name. Do not modify the file type (\*.RPCFG). Note the directory location for future use. Click **Save**.

To apply preset sensor configuration settings to multiple sensors:

1. Open the Ranger Pro configuration application.
2. Select **Network Manager** > **Sensors**. Current devices are displayed.
3. Select **Configuration Manager** > **Preset Configuration**. All sensors are displayed.
4. Click **Load Preset**. The Windows **Open** dialog box is displayed.
5. Navigate to the directory location where you saved the preset file. Select the file name.
6. Click **Open**. The **Preset Configuration** pane is updated with the saved preset configuration data.
7. Select the Ranger Pro device(s) to which you want to apply the preset configuration. To select multiple devices, press CTRL or SHIFT.
8. In **Network Manager** > **Sensors**, click **Apply**. The preset configuration is applied to the selected sensors. When the change is complete, the sensor status changes to green.
9. When you apply a preset configuration, or when you change the device unit / sub-units, you must click **Restart** or **Restart as Provisioned**.

## Configure Sensors Using a NFC Manager



Placing the NFC reader on a bare metal surface may cause interference. Insulate the NFC reader from the metal surface by placing a 2.5 cm (1 in.) thick book or similar material under the NFC reader. The NFC reader displays additional detail about device status that is not available using Yokogawa or Honeywell network software.

To configure a Ranger Pro device using a NFC Reader:

1. Open the Ranger Pro Configuration Software.
2. Connect the USB NFC reader to the computer running the Ranger Pro software.
3. Place the Ranger Pro device upside down on the NFC reader pad.
4. Select the **NFC Manager** tab. All sensors and their current status are displayed.
5. Select a sensor device. Verify that the NFC status in the footer is **Ready**.
6. Choose a configuration mode:
  - To modify the existing device configuration, select **Configuration Manager** > **Live**.
  - To apply a default configuration or custom configuration template, select **Configuration Manager** > **Preset**.



Shorter vibration and temperature periods reduce battery life.

7. Unsaved changes are highlighted in blue. To save the changes, click **Apply**. Pending changes are displayed in orange. Completed changes are displayed in black.
8. If the sensor is currently publishing data, wait two measurement intervals for the new units to take effect.

For ranges and complete specifications, see the **Ranger Pro Datasheet** (document 125M5237).

## Advanced Settings

After you connect to a gateway, you can view device settings. These include three features that provide detailed data.

### Data on Demand

Use this option to request immediate data. Data is displayed within 8 to 10 minutes. The most recently scheduled measurements, if any, are canceled. Any additional measurements are delayed 90 minutes.

### Data on Vibration

Use this option to set a vibration threshold which, when exceeded, enables display of overall or dynamic measurements. This can be useful for low vibration machines or machines that are not currently running.

- If vibration is below the threshold, overall values are published as zero and dynamic measurement transfers are skipped.
- If vibration is above the threshold, data is published and transferred as configured.

### Data on Severity

Use this option to display data depending on the severity of the vibration based on user-defined limits.

The severity levels are:

- Green
  - Vibration is below defined limits.
  - Data is collected at the configured interval.
- Yellow
  - Vibration is between the lower and upper defined limits.
  - Acquire a dataset immediately.
  - Revert to collecting data at the configured interval.
- Red
  - Vibration is above the upper defined limit.
  - Acquire a dataset immediately.
  - Set overall measurements to be taken at the shortest allowed interval (10 minutes).
  - Set dynamic measurements

## 4.7 Install and Configure System 1 Plugin

System 1 supports running a mixture of Ranger Pro devices running old and current versions of the firmware under specific conditions.

### Compatibility

System 1 supports Ranger Pro devices running mixed versions of firmware under these compatibility guidelines:



You must upgrade the System 1 Ranger Pro plugin before you upgrade device firmware. If you upgrade device firmware first, System 1 may decommission the installed devices.

System 1 Version	Ranger Pro Plugin Version	Firmware Version	Compatibility
19.1 and earlier	20XXX	2.1.2.2 (ISA100)	Yes
19.1 and earlier	20XXX	2.1.2.2 (ISA100)	Not recommended
19.2 or later	30XXX	2.1.2.2 (ISA100)	Yes
19.2 or later	20XXX	3.1.x.x (ISA100 only)	No
19.2 or later	30XXX	2.1.2.2 (ISA100) 3.1.x.x (ISA100) 3.1.x.x (WirelessHART)	Yes (recommended)

### New System 1 Installation

Install System 1 and the Ranger Pro plugin before adding Ranger Pro devices as follows:

1. Install System 1 version 19.1 or later and appropriate hotfix and/or service packs.
2. Download the appropriate compatible Ranger Pro plugin from the Bently Nevada Flexera licensing server.

3. Install System 1 Ranger Pro plugin build 30XXX or later.
4. Add a compatible wireless gateway to the System 1 configuration.
5. Enable data collection.
6. (If needed) Wait for the **Configuration Out-of-Date** message to display.
7. (If needed) In the **General** properties tab, click **Synchronize** .

## Existing System 1 Installations

If needed, first update System 1 and apply any hot fixes or service packs.

To upgrade the Ranger Pro plugin on System 1:

1. Back up your System 1 configuration.
2. Open the System 1 database on which the Ranger Pro plugin is running.
3. Disable data collection.
4. Close the database.
5. Use Windows **Add or Remove Programs** to uninstall the existing System 1 Ranger Pro plugin.
6. Download the compatible Ranger Pro plugin from the Bently Nevada Flexera licensing server.
7. Install the plugin.
8. Open the System 1 database.
9. Enable data collection.
10. (If needed) Wait for the **Configuration Out-of-Date** message to display.

11. (If needed) In the **General** properties tab, click **Synchronize** .

## 4.8 Mount Devices

### Tools Required

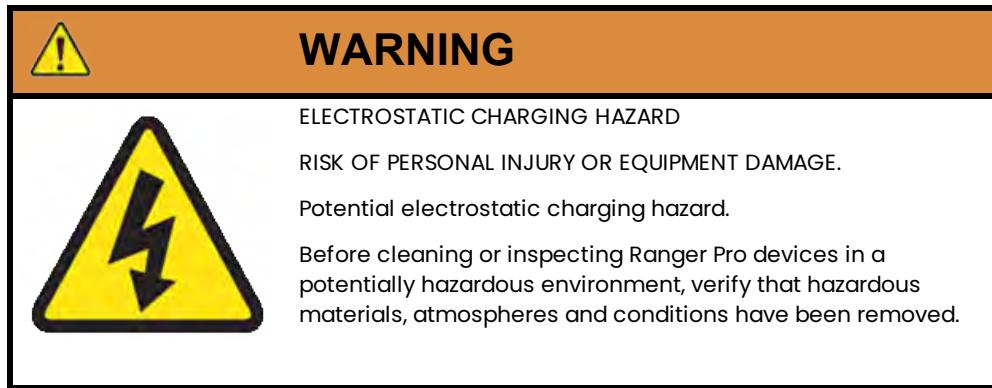
To mount Ranger Pro devices, you need:

- Ranger Pro C-spanner and flat wrench. Available as part of the installation kit, described in the **Ranger Pro Datasheet** (document 125M5237), which is available from [Bently.com](http://Bently.com).

You also need:

- Spot facing tool 40 mm (1½ inches) diameter
- Steel wire brush
- Drills and thread-taps
- Marker pen
- Medium strength thread locking compound, for example, Loctite Blue 242
- Non-curing silicone grease, for example, Dow Corning 4 Electrical Insulating Compound

### Identify Location and Hardware



To select a machine mounting position and hardware:

1. Choose a mounting position on the machine housing.
  - a. Verify there is enough clearance to mechanically install the sensor when using the provided wrench.
  - b. Locate the device to obtain optimal vibration measurements.
  - c. Verify radio connectivity. To improve connectivity, we recommend at least 100mm (4 inches) clearance around the e-module on the top of the device. For more information, [see Consider Sensor Range on page 12](#).
2. Determine what kind of mount you want to use.
  - a. We recommend you drill and tap a mounting hole.
    - Verify that the machine housing is suitable for drilling a mounting hole.
    - Refer to the machine warranty or other documentation.
    - Consider the type of Ranger Pro device you want to mount.
    - Consider placement on the machine relative to its axis.
  - b. If drilling a mounting hole is not feasible, use an adhesive mounting pad instead. See "About Using Adhesives" below.
  - c. Select either a standard stud, adhesive stud, or tri-axial alignment stud. For details and ordering information, see the **Ranger Pro Datasheet** (document 125M5237) available from [Bently.com](#).



If you're mounting a tri-axial Ranger Pro device, it can be difficult to align the device to the axis of the machine being monitored. We recommend you use the tri-axial alignment studs available as spare mounting adapters described in the **Ranger Pro Datasheet** (document 125M5237). Also see "About Using Adhesives" below.

## Complete the Mounting Surface

To finish the mounting surface:

1. Prepare the mounting surface.
  - The mounting diameter should be a minimum of 40mm (1 ½ inches) on the machine at the mounting point.
  - On curved surfaces, use a spot facing tool to provide a flat mounting surface.
  - Use a steel wire brush to remove all paint from the mounting surface.
2. Prepare the attachment point.
  - (Recommended) Drill and tap a suitable hole in the center of the prepared surface, perpendicular to the mounting surface.
  - (Alternative) Cement an adhesive mounting pad onto the prepared surface with a suitable bonding agent. See "About Using Adhesives" at right.

## Attach the Device

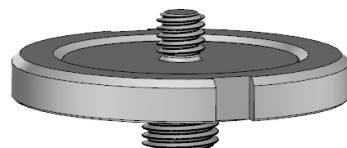
1. Align the axis of the device as needed to the axis of the acceleration being monitored.
  - The vertical or z-axis of the Ranger Pro sensor is the most sensitive.
  - Where possible, mount the device in the axial or radial direction of the machine.
2. Apply a suitable thread locking compound to the machine mounting stud. This is necessary due to vibration.
3. Apply a lower-strength thread locking compound to secure the Ranger Pro device to the mounting stud or pad.
4. To improve high frequency response and reduce transverse vibration, apply a very light amount of silicone grease to the base of the device.
5. Attach the device to the machine surface and tighten the stud.
  - a. If using the M6x1 to M8x1.25 tri-axial alignment stud, tighten the device using a torque wrench to 6 Nm

### About Using Adhesives

To prevent devices separating from the machinery they monitor and to obtain accurate high frequency response, it's important to choose an adhesive that provides excellent adhesion, temperature rating, gap filling properties, and rigidity. Many two-part epoxies and acrylic adhesives are suitable. Two examples are Loctite AA330 or ClickBond CB200.

If you're mounting a tri-axial sensor, it can be difficult to align the device to the axis of the machine being monitored. We recommend you first screw the pad onto the actual sensor. Then mark the sensor's X-direction on the pad. Remove the pad from the sensor before applying adhesive.

Apply 0.5g to 1g of adhesive to the center of the mounting pad, then position the pad on the mounting surface. Align the pad to sensor's X-direction if required. Rotate it back and forth until you feel slight metal-to-metal contact. Your goal is to force most of the adhesive out the sides, forming a slight band around the pad.



(53 in-lb) maximum.

- b. For all other mounts, tighten the device to 6–7 Nm (53 to 62 in-lb).
6. (Optional) Secure the device by passing a 1mm (.04 inch) lanyard (not provided by Bently Nevada) through the fall protection hole in the base. Secure the lanyard to a suitable retaining point.

## 5. Verification

### 5.1 Verify Network Connectivity

Ranger Pro devices can send data to an ISA gateway. The data is then sent from the gateway to the user through Modbus and/or the General Client Interface (GCI).

To collect data from the GCI, the user must have System 1 and the Ranger Pro plugin installed. Furthermore, dynamic data is only sent to the user on GCI.

#### Verify Network Joining

To verify that your sensors have joined your network, use your network vendor's software. It can take several hours for a large number of Ranger Pro devices to join your network.

If a provisioned device fails to join your network after several hours, try these options:

#### Verify/ Reboot the Device

- Reboot the sensor. This increases the frequency that the device attempts to join the network. ([See Reboot the Device on page 28.](#))
- Verify the sensor is provisioned. Ranger Pro devices must be in an provisioned state to join the network.
- Verify the device's network connection. Dismount the device from the machine and position it closer to an access point or router.
- If possible, improve the device's radio frequency communication by relocating it or reorienting the device's axis or orientation relative to the access point.

#### Add a device or Repeater

- In areas that have weak RF coverage (for example, where RSSI < -78dB), configure a Ranger Pro device as IO/Router or, preferably, add a Ranger Pro Repeater. Ranger Pro Repeaters must be set as IO/Router device types.
- Use your network vendor's software to verify, and if necessary, enable the router function of each Ranger Pro devices . You may also need to enable the join property of each device.
- Verify that each device has a good network connection.
- Remember that using a Ranger Pro devices sensor as a router decreases its battery life.
- Remember to stay within the recommended number of hops per device. ([See Plan Device Placement on page 14.](#))
- ISA network device managers limit the number or IO/Router enabled devices. Refer to the vendors documentation for details.

## Move the device or access point

Relocating a device or reorienting its axis or orientation relative to the access point as little as 6 cm (2 1/3 inch), or one-half of a 2.4 GHz wavelength, may improve signal strength. Ranger Pro devices are designed for optimal RF propagation when the device's x-axis is in the horizontal plane.

## Change access points

- Use a higher gain antenna on the access point. Verify that the resulting narrowly focused radio frequency distribution pattern meets your needs.
- Add access points.

## Verify Signal Strength and Packet Error Rates

Check that the devices' signal strength and packet error rate are within your network vendor's guidelines. Use your wireless network gateway to monitor device signal strength and packet error rates.

- Signal strength (RSSI) must be above -85 dBm, and preferably above -78 dBm.
- Packet error rate (PER) must be less than 50%, and preferably less than 20%.

## 5.2 Validate Device Data

Depending on the wireless management system you are using, there are several ways to validate that each device is transmitting data.

- **Honeywell OneWireless device manager:** verify the measurements are displayed in the Honeywell User interface and verify the Input Publication parameter are active.
- **Yokogawa YFGW410 device manager:** verify that the operation status is "published, not published or session timeout".
- WirelessHART TBD

## Data Output

To import the wireless configuration and enable data collection in System 118.2 or later, use the Ranger Pro plugin to the device manager's General Client Interface (GCI) interface.

While you can transmit static overall measurements using either Modbus/OPC and GCI, GCI is the only method that supports sending sensor spectrum and time base data.



To avoid deleting historic data, do not change Ranger Pro units or sub-units after you begin collecting data in System 1.

## Static Process Variable Data

Process Variable (PV) or direct data is used to trend the overall vibration and temperature. PV data can be sent to System 1 through GCI or through Modbus/OPC and conforms to ISA100, foundation fieldbus standard. PV data is timestamped by the gateway and not at the time of acquisition. A user can select the units, sub-units, time interval,  $F_{min}$  and  $F_{max}$  settings.

Measurement Type	Default Mode	Measurement Units	Default Sub-units (RMS or Peak)	Default $F_{min}$ (high pass filter frequency)	Default $F_{max}$ (low pass filter frequency)
Temperature	Enabled	°F, °C	N/A	N/A	N/A
Acceleration Overall	Enabled	g, m/s <sup>2</sup>	RMS	X: 5 Y: 5 Z: 5	X: 5000 Y: 5000 Z: 10000
Velocity Overall	Enabled	mm/s, inches/s	RMS	X: 5 Y: 5 Z: 5	X: 1000 Y: 1000 Z: 1000
PeakDemod Overall	Enabled	N/A	Peak	N/A	N/A

## Dynamic Data

Dynamic data is measured at the interval and start date/time set by the user. You can select the number of samples,  $F_{min}$ ,  $F_{max}$  and time interval. Dynamic data is collected sequentially for each measurement axis and time stamped when the data collection occurs.

Measurement Type	Default Mode	Measurement Units	Default $F_{min}$ (high pass filter frequency)	Default $F_{max}$ (low pass filter frequency)	Other
Acceleration Waveforms	Enabled	g, m/s <sup>2</sup>	N/A	N/A	Measurement samples used: 4096
Velocity Spectrum (rms only sub-units)	Enabled	mm/s, inches/s	X: 5 Y: 5 Z: 5	X: 1000 Y: 1000 Z: 1000	Lines Default FFT Points: 1600
PeakDemod Spectrum (Peak only sub-units)	Enabled (Z axis only)	g, m/s <sup>2</sup>	X: 5 Y: 5 Z: 5	1000	Lines Default FFT Points: 1600

## Modbus Settings

The Ranger Pro sensors publish vibration and temperature (process variable data) values as 32-bit, floating point data. You can output Ranger Pro static data like vibration and temperature using the gateway's Modbus interface.

### Phase 1 Ranger Pro Devices

Devices use firmware version 01.01.06.03 or earlier.

**Byte Order:** Little Endian, 32-bit

**Data type:** float

- CH01\_AI: Tagname.CH01\_AI.PV = Temperature
- CH02\_AI: Tagname.CH02\_AI.PV = X-Accel
- CH03\_AI: Tagname.CH03\_AI.PV = X-Vel
- CH04\_AI: Tagname.CH04\_AI.PV = Y-Accel
- CH05\_AI: Tagname.CH05\_AI.PV = Y-Vel
- CH06\_AI: Tagname.CH06\_AI.PV = Z-Accel
- CH07\_AI: Tagname.CH07\_AI.PV = Z-Vel

### Phase 2 Ranger Pro Devices



Refer to CF file release notes for details on configuring single, tri-axial and repeater AIO objects.

Devices use firmware version 02.01.02.02 or later.

**Byte Order:** Little Endian, 32-bit

**Data type:** float

- CH01\_AI: Tagname.Temperature.PV
- CH02\_AI: Tagname.Z-Axis-Accel.PV
- CH03\_AI: Tagname.Z-Axis-Vel.PV
- CH04\_AI: Tagname.Z-Axis-PkDemod.PV
- CH05\_AI: Tagname.Y-Axis-Accel.PV
- CH06\_AI: Tagname.Y-Axis-Vel.PV
- CH07\_AI: Tagname.X-Axis-Accel.PV
- CH08\_AI: Tagname.X-Axis-Vel.PV

### Phase 3 Ranger Pro WirelessHART Devices

Use these device variable IDs to map WirelessHART Ranger Pro device variables to Modbus registers.

- All Ranger Pro WirelessHART devices use firmware version 3.X.X.X or later.
- Byte Order: Refer to WirelessHART network hardware vendor documentation.
- Data type: float (4-bytes).

Enter a point name in the format, <HartTag.Parameter> for example, for battery life, enter HartTag.243.

<HartTag>	Description	<Parameter>	Default Parameters
HartTag	TEMPERATURE	0	PV (Primary Variable)
HartTag	Z OVL ACC	1	SV (Secondary Variable)
HartTag	Z OVL VEL	2	TV (Tertiary Variable )
HartTag	Z PK DEMOD	3	QV (Quaternary Variable)
HartTag	X OVL ACC	4	N/A
HartTag	X OVL VEL	5	N/A
HartTag	X OVL ACC	6	N/A
HartTag	X OVL VEL	7	N/A
HartTag	BATTERY LIFE (DAYS LEFT)	243	N/A

To modify Modbus settings in the gateway, refer to the vendor's documentation.

## 6. Maintenance

The Ranger Pro device needs minimal maintenance. If a device fails, it may be due to a weak battery, environmental damage, or even a blocked wireless connection.

### 6.1 Monitor Battery Levels

To monitor your Ranger Pro device's battery status, use your network infrastructure software or the NFC reader and the Ranger Pro software. Depending on the device operating mode and configuration, the battery lasts up to five years.

Check the devices' battery status monthly. If a battery status is medium, be sure you have replacement batteries in stock or on order. However, for optimal device life, we recommend that you don't store batteries for more than 12 months. If a battery status is low, replace the battery within a week or two.

Install only approved D-sized 3.6V lithium-thionyl chloride batteries. For details and ordering information, see the **Ranger Pro Datasheet** (document 125M5237) available from [Bently.com](http://Bently.com).

#### Battery Status Monitoring

Battery status is updated once per hour and may be trended. Battery status is affected by low temperatures. A new battery displays 75%. 100% is only used for line powered devices. There are three battery states:

- 75 to 100%: High
- 25–75%: Medium
- 0–25%: Low

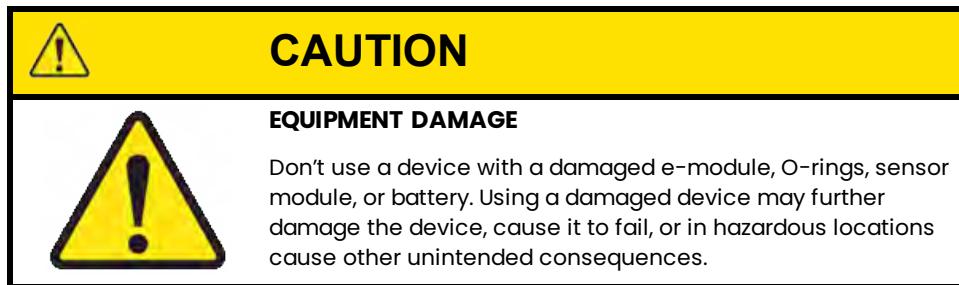
To view battery status:

- Using the Yokogawa gateway:
  - a. Click the **Field Device List** button. The power supply status is displayed in the right column.
- Using the Honeywell gateway:
  - a. Select a device in the **Selection Panel**.
  - b. In the **Property Panel**, expand **Device Management**. The power supply status is displayed at the top.
- Using System 1:
  - a. Select **Display > Devices**.
  - b. In the **Device** hierarchy, select a Ranger Pro device. Expand the device and select **Health**.
  - c. In the **List** pane, the **Health Point Power Supply Status** Measurement value is displayed.

## 6.2 Clean and Inspect Devices

To clean the exterior of the Ranger Pro devices in potentially hazardous environment, use a damp cloth.

Before cleaning or inspecting Ranger Pro devices in a potentially hazardous environment, verify that hazardous materials, atmospheres and conditions have been removed.



### Clean the Exterior

When cleaning a Ranger Pro device in an equipment room or a similar environment:

- Use a clean, dry, non-abrasive, anti-static cloth to clean the exterior. Don't use solvents or solutions.
- To remove deposits from the exterior of the sensor, use an electronic contact or switch cleaner.

### Diagnose Device Status

If a device fails, use the NFC reader to identify the fault. The NFC reader displays additional detail about device status that is not available using Yokogawa or Honeywell network software.



Using the NFC reader on a bare metal surface can cause interference. Insulate the NFC reader from the metal surface by placing a 2.5 cm (1 in.) thick book or similar material under the NFC reader.

To diagnose a fault in a device:

1. Connect the NFC reader to the computer running the Ranger Pro software.
2. Open the Ranger Pro software.
3. Place the Ranger Pro device upside down on the NFC reader
4. Select **NFC Manager > Sensor View**. The device status and whether a fault is present is displayed.

### Sensor Status

The NFC reader displays these device status messages in the application footer.

<b>Good</b>	The sensor has been detected and is working correctly.
<b>Read Fault (Identification)</b>	The sensor identification data could not be read.
<b>Model Unrecognized</b>	The sensor identification data was successfully read but the model is not recognized.
<b>Model Unsupported</b>	The sensor identification data was successfully read but the model is not supported.
<b>Bypass (Identification)</b>	The sensor identification data was successfully read but the model has been detected as a legacy model.
<b>Read Fault (Calibration)</b>	The sensor calibration data could not be read.
<b>Bypass (Calibration)</b>	The sensor calibration data was successfully read but the model has been detected as a legacy model.
<b>Read Fault (Diagnostics)</b>	The sensor diagnostics data could not be read.
<b>Bypass (Diagnostics)</b>	The sensor diagnostics data was successfully read but the model has been detected as a legacy model.
<b>Read Fault (Temperature)</b>	The sensor detected a temperature read fault.
<b>Read Fault (Accelerometer)</b>	The sensor detected an accelerometer read fault.

## Temperature Status

<b>Good</b>	The sensor temperature has been read successfully. The status message is followed by the maximum and minimum detected temperatures.
<b>Fault</b>	The sensor temperature could not be read.

## Vibration Status

<b>Good</b>	The sensor vibration values have been read successfully. The status message is followed by the maximum RMS acceleration recorded for each axis.
<b>Fault</b>	The sensor vibration values could not be read.

## Open the Device



Before opening the device, remove it from the field and operating environment.

To prevent damage to the O-rings, turn the e-module retaining ring counter-clockwise  $\frac{1}{2}$  to one turn, and then clockwise about  $\frac{1}{4}$  turn, and repeat until you can remove the retaining ring.

If you experience difficulty removing the retaining ring, the e-module may be rotating with the retaining ring. Turn the retaining ring clockwise slightly and press down lightly on the e-module to hold it in place. Then turn the retaining ring counter-clockwise.

## Clean the Interior

To clean the interior, remove the components.

- Remove the e-module at top. Press upward lightly on the side opposite the module's contact pins.
- Remove the battery using the battery installation tool.
- To clean the interior, use a clean, dry, anti-static cloth.



## Inspect the O-rings

The Ranger Pro device uses two O-rings to seal the unit against dust and moisture.



34x1mm O-ring on the e-module



35x1mm O-ring on the case



To maintain the device's IP67 dust and water-resistant rating and prevent leaks, you must install and lubricate the O-rings properly.



To inspect the O-rings:

- Verify that the O-rings are free from dust and debris.
- To remove dust and dirt, use a clean, dry cloth.
- When you install new O-rings, coat them very lightly with silicone grease.

If they're damaged, or if you're replacing the battery, always replace the O-rings. For details and ordering information, see the **Ranger Pro Datasheet** (document 125M5237) available from [Bently.com](http://Bently.com).

## Inspect the e-module

Inspect the e-module (top of the device).

- Verify that the enclosure, battery terminal spring, and contact pins are undamaged.
- Remove the e-module from the retaining ring by pressing firmly on the side opposite the contact pins.
- Inspect the e-module battery terminal spring. Look for chemical corrosion or deposits.
- Verify that the e-module contact pins move freely when pressed against the sensor module contact pads.
- Verify the e-module housing is not cracked or degraded.

## Inspect the Sensor Module

Inspect the stainless steel sensor module (bottom of the device).

- Inspect the sensor battery terminal spring. Look for chemical corrosion or deposits.
- Verify that the sensor contact pads at the top of the case are undamaged and free of deposits.
- Verify the orange, reverse polarity protection pad is centered and positioned on the inside and at the bottom of the sensor module.

## Inspect the Battery

Inspect the battery before removing it. Look for:

- Swelling, deformation, or elongation.
- Indentations or lifting of battery terminals.
- Moisture or liquid on the battery surface.
- Chemical corrosion or deposits on the battery terminals.
- If a battery leaks, don't touch the corrosive electrolyte.

If the battery is damaged or is leaking, follow your site's hazardous materials handling procedures.

## Replace the Battery

To replace the battery, [see Install Battery on page 16](#). To dispose of used or partially-expended batteries, follow your site's or locality's hazardous materials handling procedures.

## Reassemble the Device

To reassemble the device, [see Install Battery on page 16](#).

### 6.3 Reboot the Sensor

After installing a battery, the e-module is ready to receive join keys from the network. If after several hours it fails to join the network, reboot the sensor. For details, [see Reboot the Device on page 28](#).

## 6.4 Update Device Firmware

You may on rare occasions need to update the sensor firmware. Download firmware updates from [Bently Nevada technical support](#). You can update firmware over-the-air or using the NFC reader. Each method has advantages and disadvantages.

### Supported Versions

System 119.2 and later releases support Ranger Pro devices under these conditions:

- The devices must use either version 2 or version 3 of the device firmware.
- All Windows patches and application service packs are installed.
- System 1 Ranger Pro plugin version 30XXX or later is installed.

### Before You Use a USB NFC Reader to Update Firmware

Before you use the USB NFC reader to update Ranger Pro device firmware:

- Be sure you have downloaded and added current versions of the firmware to the Ranger Pro Configuration Software.
- You must first remove all of the devices from the field. This can be time-consuming, but the reader applies the firmware immediately, without delay.

### Before You Update Firmware Over-the-air



As you upgrade the firmware, monitoring may be interrupted. When the firmware update is complete, the Ranger Pro device restarts. All nodes connected to the device are temporarily disconnected. Plan your upgrade to minimize disruption of your condition monitoring activities.

Before you update Ranger Pro devices firmware over-the-air:

- If you update firmware on a large number of devices, updates can take more than 8 hours to apply.
- Be sure you have downloaded and added current versions of the firmware to the application.
- We recommend that you update no more than 10 sensors at a time, otherwise the remaining devices are likely to time out and fail.
- In multi-hop or mesh networks, we recommend you update the outer layer of devices on the mesh first.
- If you are using Ranger Pro Repeaters, you can only update one child device on each Repeater at a time.



For complete information, refer to the network vendor's documentation.

After you upgrade the device firmware, you must apply the correct capability file (CF) to each type of Wireless Condition Monitoring Device device. [See on page 50.](#)

## Download Firmware Files

Before you use the Ranger Pro Configuration Software to update device firmware, you must first add the firmware. All other applications automatically download the firmware.

To add the firmware to the Ranger Pro Configuration Software:

1. Visit [Bently Nevada Tech Support](#) and download the firmware files to your local machine.
2. Open the Ranger Pro configuration software.
3. Select the **Firmware Manager** tab.
4. Click **Add File**. The Windows **Open** dialog box is displayed.
5. Navigate to the directory in which you saved the downloaded firmware files.
6. Select the firmware file and click **Open**.
7. If the firmware file is valid, the new firmware and its properties are displayed in **Available Firmware Upgrade Files**.
8. To remove a firmware file, select the file and click **Remove File**.

## Update Sensor Firmware Using Bently Nevada Ranger Pro ISA100 Gateway

Before you can update sensor firmware, be sure you have downloaded and added current versions of the firmware to the application.

To update firmware using the Bently Nevada Ranger Pro ISA100 gateway:

1. Verify that all Ranger Pro devices are provisioned, connected to the network, and joined to the gateway.
2. In the Bently Nevada gateway application, select **Firmware**. The **Firmware** tab is displayed.
3. Click **Upload**. The Windows **Open** dialog box is displayed.
4. Navigate to the directory where the firmware files are located.
5. Select the device firmware file. Click **Open**.
6. In the **Firmware Type** field, select **Device Application**.
7. In the **Version** field, enter the firmware version number.
8. In the **Firmware Type** field, enter **Device Application**.
9. Select the devices to which you want to apply the firmware upgrade.
10. TBD

## Update Sensor Firmware Using Yokogawa Gateway

To update firmware using the Yokogawa Field Wireless Management Console:



When the firmware upgrade is complete, you must apply a capability file (CF) to the upgraded devices.

1. Download the CF and firmware files from [Bently Nevada technical support](#).
2. Verify that all Ranger Pro devices are provisioned, connected to the network, and joined to the gateway.
3. In the Yokogawa Field Wireless Management Console, open **Monitor**.
4. Choose **Tools > Firmware Download Manager**. The **Firmware Download Manager** dialog box is displayed.
5. Select the **Sensor Firmware** tab. Ranger Pro devices are listed.
6. Select the check box of the devices you want to upgrade.
7. Select **Download Firmware**. The **Update Sensor Firmware** dialog box is displayed.
8. Do not modify **TSAP** and **Object ID** default values. Click the **Firmware file** browse button. The **Open** dialog box is displayed.
9. Navigate to the location of the firmware file. Select it and click **Open**. The **Update Sensor Firmware** dialog box is displayed.
10. Click **Start Download**. When the download is complete, the **Firmware Download Manager** dialog box is displayed and the node is highlighted Yellow.
11. In the **Sensor Firmware** tab, select the Yellow highlighted devices and click **Apply**. The firmware upgrade is applied and the sensors are restarted.
12. Apply the Capabilities File. **See XREF Needed. TBD**

## Update Sensor Firmware Using Honeywell Gateway

Before you upgrade the device firmware, obtain the correct device descriptor (DD) file required for each type of Wireless Condition Monitoring Device device from Bently Nevada [technical support](#). You only need to add a DD file to the gateway once for each device type.

To add Honeywell device descriptor (DD) file to the Honeywell OneWireless Device Manager (WDM):

1. Download the device descriptor (DD) files from [Bently Nevada technical support](#).
2. Copy the DD zip file to the computer connected to the Honeywell OneWireless Device Manager (WDM). Do not unzip the archives.
3. Open Honeywell WDM.
4. Select **Maintenance > Templates**. The **Load ISA100.11a DD / Modbus config file** dialog box is displayed.
5. Click **Load ISA100.11a DD / Modbus file**. The Windows **Open** dialog box is displayed.
6. Navigate to the Windows directory location of the DD file. Select it and click **Open**. The DD is listed in the dialog box.
7. Click **Close**.

To update firmware using a Honeywell OneWireless Device Manager:

1. Verify that all Ranger Pro devices are provisioned, connected to the network, and joined to the gateway.
2. Open Honeywell OneWireless Device Manager (WDM).
3. In the **Selection Panel**, select the device you want to upgrade.
4. In the tools ribbon, click **Upgrade** and select **Application**. The **Application Firmware Upgrade** dialog box is displayed.
5. To add a firmware file, click **Add**. The Windows **Open** dialog box is displayed.
6. Navigate to the location of the firmware file. Select it and click **Open**. The firmware is listed in **Available Firmware Files**.
7. Select the Ranger Pro device to be updated and click **Upgrade**. The firmware update is automatically applied.
8. Refresh the list of Ranger Pro devices.
  - a. Delete the upgraded device(s) from Honeywell WDM.
  - b. Allow the device to rejoin.
9. Once loaded, Honeywell applies the correct device descriptor (DD) file to each device.

## Update Sensor Firmware Using WirelessHART Gateway

Use the Ranger Pro configuration software to update devices on an Emerson WirelessHART gateway.

Before you can update sensor firmware, be sure you have downloaded and added current versions of the firmware to the application.

To update device firmware using a WirelessHART on an Emerson WirelessHART gateway:

1. Open Ranger Pro configuration software.
2. Select **Network Manager** > **Gateways** tab.
3. Select the Emerson gateway hosting the sensors you want to update.
4. Select the **Firmware** tab.
5. Select a valid firmware version and click **Upgrade**.
6. Select **Network Manager** > **Sensors** tab.
7. Update progress is displayed in the **Firmware Version** field. To cancel, right-click on **Firmware Version** and select **Cancel Firmware Upgrade**. Canceling the upgrade may take from 1-5 minutes.
8. Once complete, the Ranger Pro device automatically reboots. The version number displayed in **Firmware Version** is updated.
9. When successful, you can clear the status message. Right-click on the status and click **Clear Firmware Upgrade Status**.

## Update Sensor Firmware Using the Ranger Pro Configuration Software

When you use the Ranger Pro Configuration Software, there are two methods to update the firmware: the USB NFC reader or the over-the-air. You can only use the over-the-air method to update devices on a WirelessHART gateway.

Before you can update sensor firmware, be sure you have downloaded and added current versions of the firmware to the application.

Before you update sensor firmware using the NFC reader:

- Remove each Ranger Pro device from the field. Depending on the number of devices, this can be a manually time-consuming process.
- When you update the firmware, the update is applied immediately.

To use the USB NFC reader to individually update the e-module firmware:

1. Open the Ranger Pro Configuration Software.
2. Connect the NFC reader to the computer running the Ranger Pro Configuration Software.
3. Place the Ranger Pro device upside down on the NFC reader pad with the e-module in contact with the pad.
4. Select **NFC Manager > Firmware Manager**.
5. Select a valid firmware version and click **Upgrade**.
6. Select **Network Manager > Sensors** tab.
7. Update progress is displayed in the **Firmware Version** field. To cancel, right-click on **Firmware Version** and select **Cancel Firmware Upgrade**. The upgrade may take from 1-5 minutes.
8. When successful, you can clear the status message. Right-click on the status and click **Clear Firmware Upgrade Status**.
9. Once complete, the Ranger Pro device automatically reboots. The version number displayed in **Firmware Version** is updated.

## Troubleshooting Ranger Pro Devices

If a Ranger Pro Wireless Sensors fails, it may be due to a weak battery, environmental damage, or even a blocked wireless connection.

To identify the status of a Ranger Pro device:

1. Connect one or more NFC reader(s) to the computer running the Ranger Pro Configuration Software.
2. Place the Ranger Pro device upside down on the NFC reader pad with the e-module in contact with the pad.
3. Select **NFC Manager > NFC View**.
4. Select **Maintenance / Diagnostics**.
5. Verify the device status and whether a fault is displayed.

## Device Status Messages

Status	Description
Good	The sensor has been detected and is working correctly.
Read Fault (Identification)	The sensor identification data could not be read.
Model Unrecognized	The sensor identification data was successfully read but the model is not recognized.
Model Unsupported	The sensor identification data was successfully read but the model is not supported.
Bypass (Identification)	The sensor identification data was successfully read but the model has been detected as a legacy model.
Read Fault (Calibration)	The sensor calibration data could not be read.
Bypass (Calibration)	The sensor calibration data was successfully read but the model has been detected as a legacy model.
Read Fault (Diagnostics)	The sensor diagnostics data could not be read.
Bypass (Diagnostics)	The sensor diagnostics data was successfully read but the model has been detected as a legacy model.
Read Fault (Temperature)	The sensor detected a temperature read fault.
Read Fault (Accelerometer)	The sensor detected an accelerometer read fault.

## Temperature Status Messages

Status	Description
Good	The sensor temperature has been read successfully. The status message is followed by the maximum and minimum detected temperatures.
Fault	The sensor temperature could not be read.

## Vibration Status Messages

Status	Description
Good	The sensor vibration values have been read successfully. The status message is followed by the maximum RMS acceleration recorded for each axis.
Fault	The sensor vibration values could not be read.

## 6.5 Update Radio Firmware

Radio firmware is rarely modified. When required, the steps are similar to the steps required to update the sensor firmware.

### Update Radio Firmware Using Honeywell Gateway

With one exception, the process to upgrade a Ranger Pro device radio firmware on a Honeywell gateway is the same as upgrading the sensor firmware. In the tools ribbon, choose **Radio**. Otherwise the steps are entirely the same. For details, [see Maintenance on page 43](#).

### Update Radio Firmware Using Yokogawa Gateway

With one exception, the process to upgrade a Ranger Pro device radio firmware on a Yokogawa gateway is the same as upgrading the sensor firmware. In the **Firmware Download Manager** dialog box, select the Radio **Firmware** tab. Otherwise the steps are entirely the same. For details, [see Update Sensor Firmware Using Bently Nevada Ranger Pro ISA100 Gateway on page 49](#).

## 6.6 Harden the System

The security risk to your network when using Ranger Pro devices is like that in any distributed control system or industrial control system. You need to take all reasonable steps to properly secure these devices.

At a minimum, to secure Ranger Pro devices:

- Securely manage all device NFC readers.
- Verify that the latest firmware is installed on all NFC readers and device e-modules and sensors.
- Follow your site's standards or industry's best practices for strong passwords.
- Only install Ranger Pro software on computers dedicated to that purpose and maintain appropriate physical security of those computers.
- When you complete provisioning on a Honeywell Gateway, verify that Over-The-Air-Provisioning is disabled.