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1. General Safety

1.1 Receiving Inspection

Visually inspect the device for obvious shipping damage. If you detect shipping damage, file a claim with the carrier and submit a copy to Bently Nevada. Include all model numbers and serial numbers with the claim.

1.2 Handling and Storing Considerations

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

Devices

The Ranger Pro Wireless Condition Monitoring Device is shipped in a foam-filled package, and may be shipped with test data. **DO NOT DISCARD THIS TEST DATA!**
1.3 Personal Safety Warnings

Labels and markings are provided on the monitor 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.

Potential Electrostatic Charging Hazard

![WARNING]

**ELECTROSTATIC CHARGING HAZARD**

RISK OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

Potential for electrostatic charging hazard.

Do not separate when energized.

Remove power before service.

Connect grounding before power.

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.

- Do not discharge static electricity onto the circuit board. Avoid tools or procedures that would subject the circuit board to static damage. Some possible causes of static damage include ungrounded soldering irons, nonconductive plastics, and similar materials.
- Use a suitable grounding strap before handling or performing maintenance on a printed circuit board.
- Transport and store circuit boards in electrically conductive bags or foil.
- Use extra caution during dry weather. Relative humidity less than 30% tends to multiply the accumulation of static charges on any surface.

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

- Potential of electrostatic discharge on plastic components, or
- Removal or placement of an energized connection.
Hazardous Environment for Transducers

Read and understand manual before operating!
Lire et comprendre le manual avant d'utiliser!

WARNING

HAZARDOUS ENVIRONMENT

Risk of explosive atmosphere.

Adapters, isolation valves, or sealing rings that are not compatible with process gasses will corrode and fail. This failure may result in gas leaks, fire, explosion, or projectiles.

Prevent corrosion and failure by verifying that all components are compatible as described in the installation procedures.

Do not connect or disconnect while circuit is live unless area is known to be nonhazardous.

Specific conditions of use:

For Division 2 / Zone 2 installations the equipment shall be supplied from Class 2 limited energy source compliant with requirements of CSA C22.2 No 61010-1:2012 and UL61010-1: 2012
Lithium Batteries

**WARNING**

**USE ONLY ONE OF THE FOLLOWING BATTERIES**

Xeno Energy XL-205F, Tadiran TL-5930, Tadiran SL-2780. Don’t use a device with a damaged e-module, O-rings, sensor module, or battery. Using a damaged battery may further damage the device, cause it to fail, or in hazardous locations cause other unintended consequences.

The Ranger Pro wireless sensor uses 3.6V lithium-thionyl chloride D-cell 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.
- 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 network vendor’s application to monitor battery performance and replace batteries as needed.
1.4 Safe Disposal

Replacing Device and Failure Analysis

Visit Bently.com to returning parts under warranty and request 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 material. Refer to local or regional waste removal administration to collect 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 at the end of its useful life. 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 for recycling information.
2. BN Wireless Gateway Hardware

2.1 Intended Use

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

2.2 Compliance Information

FCC ID: XFU-121M64A
IC ID: 8349A-121M64A

2.3 Description

The Ranger Pro ISA100.11a wireless sensor measures temperature, acceleration, and velocity.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature</td>
<td>A sensor embedded in the device base measures contact temperature.</td>
</tr>
<tr>
<td>Acceleration Overall</td>
<td>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.</td>
</tr>
<tr>
<td>Velocity Overall</td>
<td>Calculated from the acceleration waveform and the overall value is calculated over a 2.5 second duration.</td>
</tr>
</tbody>
</table>

There are three versions of the device:

<table>
<thead>
<tr>
<th>Version</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ranger Pro 70M303 tri-axial sensor</td>
<td>Detects velocity and acceleration in three axis (X, Y, and Z) and measures surface temperature.</td>
</tr>
<tr>
<td>Ranger Pro 70M301 uniaxial sensor</td>
<td>Detects velocity and acceleration in one-axis (vertical, or Z) only and measures surface temperature.</td>
</tr>
<tr>
<td>Ranger Pro 70M300 repeater</td>
<td>Enables you to extend the range between sensors and network access points.</td>
</tr>
</tbody>
</table>

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 access point, you can use the Ranger Pro 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 Datasheet (document 125M5237).
- 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, either the Identiv uTrust 3700 F Contactless NFC reader or the Sony RC-S380/S NFC reader.
- Ranger Pro configuration software (121M7997, available from Bently Nevada technical support).
- Spot facing tool, if required. (Not provided by Bently Nevada.)
- Torque wrench with ¼ inch drive, capable of tightening devices in the 5–7 Nm (44 to 62 in lb) range. (Not provided by Bently Nevada.)
Ranger Pro Components

The Ranger Pro device is composed of six 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.
- Battery (replaceable D-sized 3.6V lithium-thionyl chloride).
- Battery retaining ring.
- Two O-ring seals (35x1mm on sensor body and 34x1mm on e-module).

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).

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 these compatible ISA100.11a wireless networks and gateways. Additional licenses may be required to activate these gateways.

<table>
<thead>
<tr>
<th>Manufacturer</th>
<th>Gateway Manager</th>
<th>Access Point</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yokogawa</td>
<td>YFGW410 (R2.01.04 or equivalent)</td>
<td>YFGW510 (R1.07.01 or equivalent)</td>
</tr>
<tr>
<td>Honeywell‡</td>
<td>WDM (R310.2~4 or later)</td>
<td>FDAP (OW 230 or later) CISCO 1552S</td>
</tr>
</tbody>
</table>

‡ 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.
Setup Overview

The Ranger Pro Wireless Condition Monitoring Device operates on the ISA100.11a wireless network protocol. 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. Network Design

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

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 gateway devices
- Proximity to gateway devices
- Gateway 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 is configured as a sensor 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 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 devices routed through Ranger Pro Repeaters. Avoid connecting more than eight devices through a single Ranger Pro Repeater, or more than five devices through a sensor with router enabled. Since Ranger Pro 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. Your existing network infrastructure may determine the number of devices you can connect to access points or the maximum number of hops permitted. A star topology is recommended, 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 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

Installing and configuring ISA100.11a wireless networks is beyond the scope of this user guide. For details, refer to your vendor’s wireless network documentation.

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 sensor. (When connecting to an access point, the range is about 50% greater.)

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

3. Pinpoint the locations of any existing access points and gateways.
   - If you’re installing sensors in extremely congested plant areas or in areas with insufficient wireless connectivity, consider installing additional ISA100.11a gateways and access points.
   - Add locations where you need to install additional access points and gateways.
   - When placing ISA100.11a access points and gateways, consider the location of line power and suitable connections to the existing plant network.

Place access points in locations where as many sensors as possible can connect directly to each access point. We recommend that you don’t exceed 40 devices per access point.
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, access points or Ranger Pro repeaters.
   - Avoid connecting more than five devices through a single Ranger Pro sensor, or more than eight devices through a single Ranger Pro Repeater.

5. To extend the range of the wireless network or to reach devices beyond the range of an access point, 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 an access point, although we recommend a maximum of three hops.

7. If your installation is complex or likely to require additional 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. Use only approved battery types described in the Ranger Pro Datasheet (document 125M5237) available from Bently.com.

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.)

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 details and 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.
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 ¼ 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 Devices

Ranger Pro devices detect single or tri-axial acceleration using a piezoelectric ceramic sensing element in the sensor base. The sensor derives velocity from the acceleration signal. The Ranger Pro devices 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.

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
You can configure Ranger Pro devices two ways:

| ISA Manager Mode (Over the air Configuration) | Configure one or many sensors over the network using Ranger Pro Configuration Software and ISA device manager to configure Ranger Pro devices wirelessly |
| 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 View | View, modify and update sensor configurations in real-time. Most often used to change device configuration on a single device. |
| Preset View | View, modify, save, and apply saved settings to multiple sensors over the network. Most often used with customer defined configuration templates. |

**Set up ISA100 Gateways**

To manage ISA100 Gateways:

1. Open the Ranger Pro configuration application.
2. Select ISA100 Manager > Gateway View. Existing ISA100 gateways are displayed.

To add a gateway:

1. In Gateway View, click Add. The Add Gateway dialog box is displayed.
2. Enter the Gateway Address and Gateway Port and optionally, other information as needed. Select Online.
3. Click Add Gateway. The ISA100 Gateway is displayed in the list of gateways. The gateway immediately begins to acquire a list of all devices on the network. The number of devices discovered and configured is displayed.

To view available devices on the gateway:

1. In Gateway View, select a gateway from the list.
2. Double-click on the gateway name. The Sensor View pane is displayed.
To view provisioned Ranger Pro devices on ISA100 Gateways:

1. Select **ISA100 Manager > Sensor View**.
2. All provisioned Ranger Pro devices and their status is displayed.
Configure Sensors Over the Network

To configure sensors over the network:

1. Open the Ranger Pro configuration application.
2. Select ISA100 Manager > Sensor View. Current devices are displayed.
3. Select a sensor device. Verify that the sensor status in the application footer is Ready. The sensor configuration is displayed in Configuration Manager > Live View.
4. Modify configuration options as needed. When complete, click Apply. Pending changes are displayed in orange. Completed changes are displayed in green.

To save sensor configuration settings:

1. Open the Ranger Pro configuration application.
2. Select ISA100 Manager > Sensor View. Current devices are displayed.
3. Select an updated sensor. The configuration is displayed in Configuration Manager > Preset View.
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 ISA100 Manager > Sensor View. Current devices are displayed.
3. Select Configuration Manager > Preset View. 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 a file name.
6. Click Open. The Preset View pane is updated with the saved preset configuration data.
7. In the ISA100 Manager > Sensor View pane, select the Ranger Pro sensors to which you want to apply the preset configuration. Press CTRL or SHIFT to select the sensors you want.
8. In ISA100 Manager > Sensor View, click Apply. The preset configuration is applied to the selected sensors. When the change is complete, the sensor status changes to green.
Configure Sensors Using a NFC Reader

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. 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. Connect the NFC reader to the computer running the Ranger Pro software.
2. Place the Ranger Pro device upside down on the NFC reader pad.
3. Access the Ranger Pro software.
4. Select **NFC Manager Mode > Sensor View**. All sensors are displayed with their current status.
5. Select a sensor device. Verify that the sensor status in the application footer is **Ready**. The individual sensor’s configuration is displayed in **Configuration Manager > Live View**.
6. In **Live View**, modify configuration options as needed. Alternately, a user may use Preset View and download a custom configuration template.
7. Shorter vibration and temperature periods reduce battery life.
8. Click **Apply**. Pending changes are displayed in orange. Completed changes are displayed in green. 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).

### 4.3 Provision Devices

Before installing Ranger Pro devices, you must prepare each device to join your ISA100.11a network. Depending on your network infrastructure, you can provision multiple sensors over-the-air or individually using the Ranger Pro USB device NFC reader. When you provision the device, you provide it with the correct UTC adjustment (if needed), a network ID, and the network join key. Depending on the number of Ranger Pro devices and their current sleep state, provisioning can take up to several hours.

Ranger Pro devices must be in an unprovisioned state to join the network. If you’re using a Yokogawa or Honeywell gateway, you must provision devices over the air.
**Provision Using the Yokogawa Gateway**

To provision Ranger Pro devices on a Yokogawa 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 Gateway**

To provision Ranger Pro devices on a Honeywell gateway:

1. Open Honeywell OneWireless Device Manager (WDM).
2. Select an appropriate access point on which Ranger Pro devices have been installed.
3. Expand the **Property Panel**.
4. Select **ISA100 Over the Air Provision**.
5. Click **Enable for 60 Minutes**. Wait for the unprovisioned devices to display in the **Property Panel**. This may take five to ten minutes.
6. Select the un-provisioned devices and click **Accept**.
7. 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.

If over-the-air provisioning fails, you may be required to use the NFC reader and Ranger Pro software to reboot or un provision the device.
Provision Using the Configuration Software

To provision a 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.

To provision sensors, you need:
- Ranger Pro configuration software (available from Bently Nevada technical support).
- Ranger Pro sensors with batteries installed
- ISA100.11a network ID
- ISA100.11a security join key
- ISA100.11a device tag

To provision sensors using Ranger Pro configuration software and a NFC reader:
1. Open the Ranger Pro configuration application.
2. 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.
3. Place the Ranger Pro device upside down on the NFC reader pad.
4. Select NFC Manager > NFC View.
5. If needed, select the NFC Reader in the application footer. Verify that the status is Connected.
6. Enter UTC Adjustments (if needed), Network ID, and Join Key.
7. Click Provision.

4.4 Unprovision Sensors

If you remove a sensor from the network, or if you need to disable it for any reason, you can unprovision it.

Unprovision Using the Yokogawa Gateway

To unprovision Ranger Pro devices using the Yokogawa Field Wireless Management Console:
1. Open Monitor. Select Tools > OTA Provisioning Manager. The OTA Provisioning Manager dialog box is displayed.
2. Click the check box of one or more devices that you want to unprovision.
3. Click Reset Provisioning Information and then click Apply. The device is un-joined from the channel and reset to its original mode.

Unprovision Using the Honeywell Gateway

To unprovision Ranger Pro devices using the the Honeywell OneWireless device gateway:
1. Open Honeywell OneWireless 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. Place the Ranger Pro device upside down on the NFC reader’s pad.
4. Select NFC Manager > NFC View.
5. Expand Sensor Provisioning.
6. If needed, select the NFC Reader in the application footer. Verify that the status is Connected.
7. Click Unprovision.

The Ranger Pro sensor is unprovisioned, disconnects from the network, and is ready to join the same or new ISA network.
4.5 Reboot the Device

Once you insert a battery into a device, an unprovisioned e-module is ready to receive a join key from the network. If it fails to receive a join key, it enters an increasingly long sleep cycle. It periodically wakes from sleep mode to attempt to join the network.

Table 4 - 1: Device progressive sleep cycle

<table>
<thead>
<tr>
<th>Interval after battery in inserted or sensor is disconnected from a network:</th>
<th>Sensor tries to connect every:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 to 20 minutes</td>
<td>2 min</td>
</tr>
<tr>
<td>&gt;20 min to 120 min</td>
<td>5 min</td>
</tr>
<tr>
<td>&gt;120 min to 10 hours</td>
<td>15 min</td>
</tr>
<tr>
<td>&gt;10 hours to 48 hours</td>
<td>30 min</td>
</tr>
<tr>
<td>&gt;48 hours</td>
<td>60 min</td>
</tr>
</tbody>
</table>

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

To reboot a single device:

1. Connect the NFC reader to the computer running the Ranger Pro software.
2. Access the Ranger Pro software.
3. Place the Ranger Pro device upside down on the NFC reader pad.
4. Select NFC Manager > NFC View.
5. If needed, select the NFC Reader in the application footer. Verify that the status is Connected.
6. Verify that the Ranger Pro device status is Ready.
8. Click Reboot. The device is restarted.

4.6 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.

You also need:

- Spot facing tool 40 mm (1 ½ 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

**WARNING**

**ELECTROSTATIC CHARGING HAZARD**
RISK OF PERSONAL INJURY OR EQUIPMENT DAMAGE.

Potential electrostatic charging hazard.

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

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 13.

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.
   - 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 15.]
- 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.
- Yokagawa YFGW410 device manager: verify that the operation status is “published, not published or session timeout”.

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, $F_{\text{min}}$ and $F_{\text{max}}$ settings.

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

Dynamic Data

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

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

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.

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.

**CAUTION**

**EQUIPMENT DAMAGE**

Don't use a device with a damaged e-module, O-rings, sensor module, or battery. Using a damaged device may further damage the device, cause it to fail, or in hazardous locations cause other unintended consequences.

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

**Temperature Status**

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>The sensor temperature has been read successfully. The status message is followed by the maximum and minimum detected temperatures.</td>
</tr>
<tr>
<td>Fault</td>
<td>The sensor temperature could not be read.</td>
</tr>
</tbody>
</table>

**Vibration Status**

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>The sensor vibration values have been read successfully. The status message is followed by the maximum RMS acceleration recorded for each axis.</td>
</tr>
<tr>
<td>Fault</td>
<td>The sensor vibration values could not be read.</td>
</tr>
</tbody>
</table>
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 ½ to one turn, and then clockwise about ¼ 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 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 O-rings

The Ranger Pro device uses two O-rings to seal the unit against dust and moisture. The O-rings maintain the device's IP67 dust and water-resistant rating.

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.

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 17. To dispose of used or partially-expended batteries, follow your site’s or locality’s hazardous materials handling procedures.

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.

Preparing to Upgrade Sensor 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 over-the-air:

- Refer to your network vendor’s infrastructure software.
- If you have a large number of devices, updates can take many hours to apply.

To update multiple Ranger Pro devices firmware over-the-air:

Consult with the ISA device manufacturer guidelines for further details.

- 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.
Upgrade Sensor Firmware Using Yokogawa Gateway

After you upgrade the device firmware, you must apply the correct capability file (CF) to each type of Wireless Condition Monitoring Device device.

To update firmware using the Yokogawa Field Wireless Management Console:

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.

Apply capabilities file

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

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.

<table>
<thead>
<tr>
<th>Ranger Pro Device</th>
<th>Yokogawa Model</th>
<th>Capability File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>70M300 Repeater</td>
<td>GE/70M300</td>
<td>BHGE-RP-70M300 v6.1.CFF</td>
</tr>
<tr>
<td>70M301 Single Axis</td>
<td>GE/70M301</td>
<td>BHGE-RP-70M301 v6.1.CFF</td>
</tr>
<tr>
<td>70M303 Tri–Axis</td>
<td>GE/70M303</td>
<td>BHGE-RP-70M303 v6.1.CFF</td>
</tr>
</tbody>
</table>

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**:

<table>
<thead>
<tr>
<th>OID Concentrator Value</th>
<th>70M300 Repeater</th>
<th>70M301 Single Axis</th>
<th>70M303 Tri–Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Update policy</td>
<td>Periodic</td>
<td>Periodic</td>
<td>Periodic</td>
</tr>
<tr>
<td>Publication period</td>
<td>0 (zero)</td>
<td>150</td>
<td>150</td>
</tr>
<tr>
<td>Stale limit</td>
<td>Default</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Retry mode</td>
<td>Normal</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>OID Parameter</th>
<th>70M300 Repeater</th>
<th>70M301 Single Axis</th>
<th>70M303 Tri–Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>UAPMO Diag_Status</td>
<td>To prevent session timeout, select the <strong>UAPMO Diag_Status</strong> parameter (if displayed) and click the &quot;&lt;&quot; button. The parameter is moved to the list of <strong>Available Parameters</strong>.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Al_01 – Al_08</td>
<td>Not available</td>
<td>Al_01 – Al_05: available</td>
<td>Al_01 – Al_08: available</td>
</tr>
<tr>
<td>AI_01 – AI_08</td>
<td>Available</td>
<td>Al_06 – AI_08: unavailable</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>OID Concentrator Value</th>
<th>70M300 Repeater</th>
<th>70M301 Single Axis</th>
<th>70M303 Tri–Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Update policy</td>
<td>Default</td>
<td>Periodic</td>
<td>Periodic</td>
</tr>
<tr>
<td>Publication period</td>
<td>Default</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Stale limit</td>
<td>Default</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Retry mode</td>
<td>Default</td>
<td>Normal</td>
<td>Normal</td>
</tr>
</tbody>
</table>
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:

<table>
<thead>
<tr>
<th>Configuration Status</th>
<th>70M300 Repeater</th>
<th>70M301 Single Axis</th>
<th>70M303 Tri-Axis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not Published</td>
<td>Published</td>
<td>Published</td>
<td></td>
</tr>
</tbody>
</table>

   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.
Upgrade 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. 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 the NFC reader

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.
- Using the NFC reader is quick and the firmware update is applied immediately.

To individually update the e-module firmware:

1. Connect the NFC reader to the computer running the Ranger Pro configuration software.
2. Access the Ranger Pro 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 > NFC View**.
5. If needed, select the NFC Reader in the application footer. Verify that the status is **Connected**.
6. Expand **Sensor Maintenance > Firmware Upgrade**.
7. Click **Open Upgrade File**. The Windows **Open** dialog box is displayed.
8. Navigate to the Windows directory location and select the new firmware.
9. Click **Open**.
10. Once the firmware is loaded, click **Upgrade**. The upgrade may take from 1-5 minutes. A message is displayed confirming upgrade results.
11. Once complete, the Ranger Pro device automatically reboots. The version number displayed in **Sensor Information > E-Module > Firmware Version** is refreshed and 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.
5. Verify the device status and whether a fault is displayed.

### Device Status Messages

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

### Temperature Status Messages

<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>The sensor temperature has been read successfully. The status message is followed by the maximum and minimum detected temperatures.</td>
</tr>
<tr>
<td>Fault</td>
<td>The sensor temperature could not be read.</td>
</tr>
</tbody>
</table>

### Vibration Status Messages
<table>
<thead>
<tr>
<th>Status</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>The sensor vibration values have been read successfully. The status message is followed by the maximum RMS acceleration recorded for each axis.</td>
</tr>
<tr>
<td>Fault</td>
<td>The sensor vibration values could not be read.</td>
</tr>
</tbody>
</table>

### 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 37*.

**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 *Upgrade Sensor Firmware Using Yokogawa Gateway on page 43*. 
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.