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Patents

The product(s) described in this manual are covered under existing and pending patents.

Where to get help

Software Registration

Phone: Toll free 888.367.3774, option 2 (U.S. and Canada)
       +63.2.702.1111 (Rest of world)

Email: wwcs.custserv@emerson.com

Web: http://www.emerson.com/machineryhealthreg

Product Support

Emerson provides a variety of ways to reach your Product Support team to get the answers you need when you need them:

Phone   Toll free 800.833.8314 (U.S. and Canada)
       +1.512.832.3774 (Latin America)
       +63.2 702.1111 (Asia Pacific, Europe, and Middle East)

Email   ap-sms@emerson.com

Web    http://www.emerson.com/en-us/contact-us

To search for documentation, visit http://www.emerson.com.
To view toll free numbers for specific countries, visit http://www.emerson.com/technicalsupport.
1 Introduction

1.1 Safety messages

Instructions in this manual may require special precautions to ensure the safety of the personnel performing the operations.

The AMS Wireless Vibration Monitor complies with Part 15 of the FCC Rules. 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.

This device must be installed to ensure a minimum separation of 20 cm from all persons.

Refer to the following safety messages before performing an operation preceded by the warning symbol:

⚠️ WARNING

Failure to follow these installation guidelines can result in death or serious injury. Only qualified personnel should install the AMS Wireless Vibration Monitor.

Explosions could result in death or serious injury:

- Before connecting a Field Communicator in an explosive environment, make sure the instruments are installed in accordance with applicable field wiring practices.
- Verify that the operating environment of the AMS Wireless Vibration Monitor is consistent with the appropriate hazardous locations certifications.

1.2 Symbols

Note
This symbol marks passages that contain important information.

⚠️ CAUTION

This symbol marks operations that can lead to malfunctions or faulty measurements, but will not damage the device.

⚠️ DANGER

This symbol indicates actions that can lead to property damage or personal injury.

The symbols on the device signify compliance to the following:

🚫 Ukraine Restriction of Hazardous Substances (RoHS)
<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Regulatory Compliance Mark Australia" /></td>
<td>Regulatory Compliance Mark Australia</td>
</tr>
<tr>
<td><img src="image" alt="China Restriction of Hazardous Substances (RoHS)" /></td>
<td>China Restriction of Hazardous Substances (RoHS)</td>
</tr>
<tr>
<td><img src="image" alt="Lithium-ion cell recyclable" /></td>
<td>Lithium-ion cell recyclable</td>
</tr>
<tr>
<td><img src="image" alt="Warning" /></td>
<td>The documentation must be completely read and understood before installing and commissioning the device. Observe all safety-related instructions in this document.</td>
</tr>
<tr>
<td><img src="image" alt="Waste Electrical and Electrical Equipment Directive" /></td>
<td>Waste Electronic and Electrical Equipment Directive</td>
</tr>
</tbody>
</table>
1.3 Considerations

General
Electrical vibration sensors, such as accelerometers, produce low-level signals proportional to their sensed vibration. With simple HART configuration, the monitor converts the low-level sensor signal to a wireless-enabled signal.

Commissioning
The monitor can be commissioned before or after installation. You can commission it on the bench before installation to ensure proper operation and to be familiar with its functions.
Make sure the instruments are installed in accordance with applicable field wiring practices.
The AMS Wireless Vibration Monitor is powered whenever the battery is installed.

Installation
When choosing an installation location and position, provide ample access to the monitor. The device should be mounted vertically, perpendicular to the shaft and on the bearing case. Horizontal mounting is also an option. For more information, see Installation.

Battery
The AMS Wireless Vibration Monitor uses an off-the-shelf Tadiran TL-4920/VE battery.
The battery comes with the device but it is not connected when the device is shipped. You need to connect the battery before configuring and installing the device.

Environmental
The monitor operates within specifications for ambient temperatures between –40°F and 185°F (–40°C and 85°C).
Verify that the operating environment of the monitor is consistent with the appropriate hazardous location certifications.

1.4 Return of materials
You may need to ship the device to an Emerson Product Service Center for return or replacement in case of warranty issues. Before shipping, contact Emerson Product Support to obtain a Return Materials Authorization (RMA) number and receive additional instructions.

Emerson Product Support contact information:
Phone  
Toll free 800.833.8314 (U.S. and Canada)
+1.512.832.3774 (Latin America)
+63.2 702.1111 (Asia Pacific, Europe, and Middle East)

Email  
ap-sms@emerson.com

Web  
http://www.emerson.com/en-us/contact-us
**Note**
If the monitor has been exposed to hazardous substances, a Material Safety Data Sheet (MSDS) must be included with the returned materials. An MSDS is required by law to be available to people exposed to specific hazardous substances.

**Shipping considerations for wireless products (Lithium Batteries)**

- The unit was shipped to you with the battery inside but disconnected. Connect the battery for proper operation.

- Primary lithium batteries are regulated in transportation by the U.S. Department of Transportation, and are also covered by IATA (International Air Transport Association), ICAO (International Civil Aviation Organization), and ADR (European Ground Transportation of Dangerous Goods).

- It is the responsibility of the shipper to ensure compliance with these or any other local requirements. Please consult current regulations and requirements before shipping.
1.5 Overview

The manual

This User Guide applies to the AMS Wireless Vibration Monitor, a triaxial vibration measurement device designed for use on a WirelessHART network.

Use this manual to install, operate, and maintain the device.

The monitor

The AMS Wireless Vibration Monitor is an installation-ready solution that monitors vibration and temperature in rotating equipment in hard-to-reach locations.

The AMS Wireless Vibration Monitor also provides a variety of monitor and sensor configurations. It has built-in radio and four integral sensors:

• X and Y MEMS

• Z MEMS High Sensitivity, High Bandwidth (Vibration & PeakVue)

• Temperature sensor

The Z accelerometer has the highest bandwidth and is considered the primary sensor. The temperature sensor is designed to measure the temperature near the mounting point (that is, the machine surface).

Other features include:

• Support for up to 13 device variables with up to three user-configurable alerts for each process variable. Any device variable can be configured as any process variable (PV, SV, TV, QV).

• Support for storage of Waveform/Spectrum directly in AMS Machine Works

• Wireless output with >99% data reliability, delivering rich HART data, protected by industry leading security (when operated as part of a well-formed network)

The device uses an off-the-shelf battery contained in the device which is easily removable for device installation and replacement.
Parts of the monitor

A. Chassis
B. HART Terminals
C. Orientation hole
D. Mounting screw
A. Cover  
B. Battery clamp  
C. Battery  
D. Battery pull tab  
E. Base O-ring
**Device revision information**

<table>
<thead>
<tr>
<th>Revision</th>
<th>Current level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universal</td>
<td>7</td>
<td>This is the HART version the monitor supports.</td>
</tr>
<tr>
<td>Field device¹</td>
<td>1</td>
<td>This is the major revision of the monitor and corresponds with a major interface release. When using AMS Device Manager, this revision can be found on the screen title.</td>
</tr>
<tr>
<td>Software</td>
<td>56</td>
<td>This is the current software version. The software may be occasionally modified to refine functionality. When major functionality is added, the device revision increases.</td>
</tr>
<tr>
<td>Hardware</td>
<td>2</td>
<td>This is the hardware revision.</td>
</tr>
<tr>
<td>DD</td>
<td>1</td>
<td>This is the Device Descriptor (DD) revision. The device descriptor is primarily used for configuring devices in the field.</td>
</tr>
</tbody>
</table>

¹ *If you have an older device revision, a factory upgrade may be possible in some cases. Contact Product Support for more information.*

You can also view the revision information in AMS Device Manager and Trex Communicator.

**Figure 1-1: Revision numbers in AMS Device Manager**

![Revision numbers in AMS Device Manager](image)
### 1.6 Device variables

The device supports the following measurements.

<table>
<thead>
<tr>
<th>Device variable index</th>
<th>Device variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Z-Velocity</td>
</tr>
<tr>
<td>1</td>
<td>Z-Peakvue</td>
</tr>
<tr>
<td>2</td>
<td>Machine Temperature</td>
</tr>
<tr>
<td>3</td>
<td>Supply Voltage</td>
</tr>
<tr>
<td>4</td>
<td>X-Velocity (Triax Mode license required)</td>
</tr>
<tr>
<td>5</td>
<td>Y-Velocity (Triax Mode license required)</td>
</tr>
<tr>
<td>6</td>
<td>IB1 (Velocity) (Advanced Diagnostics license required)</td>
</tr>
<tr>
<td>7</td>
<td>IB2 (Velocity) (Advanced Diagnostics license required)</td>
</tr>
<tr>
<td>8</td>
<td>IB3 (Acceleration) (Advanced Diagnostics license required)</td>
</tr>
<tr>
<td>9</td>
<td>IB4 (Acceleration) (Advanced Diagnostics license required)</td>
</tr>
<tr>
<td>10</td>
<td>Speed Estimate (Advanced Diagnostics license and valid speed required)</td>
</tr>
<tr>
<td>11</td>
<td>Mechanical Condition (Advanced Diagnostics license and valid speed required)</td>
</tr>
<tr>
<td>12</td>
<td>Lubrication Condition (Advanced Diagnostics license and valid speed required)</td>
</tr>
</tbody>
</table>
1.7 Variable mappings

Any of the device variables can be configured as a process variable. The process variables and their default values are as follows.

**Table 1-1: Process Variables**

<table>
<thead>
<tr>
<th>Process Variable</th>
<th>Default</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV</td>
<td>Z-axis Overall</td>
</tr>
<tr>
<td>SV</td>
<td>X-axis Overall</td>
</tr>
<tr>
<td>TV</td>
<td>Y-axis Overall</td>
</tr>
<tr>
<td>QV</td>
<td>Z-axis PeakVue</td>
</tr>
</tbody>
</table>

**Table 1-2: Device Variables**

<table>
<thead>
<tr>
<th>Device Variables</th>
<th>Process Variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>X-axis Overall</td>
<td>PV</td>
</tr>
<tr>
<td>Y-axis Overall</td>
<td>SV</td>
</tr>
<tr>
<td>Z-axis Overall</td>
<td>TV</td>
</tr>
<tr>
<td>Z-axis PeakVue</td>
<td>QV</td>
</tr>
<tr>
<td>Velocity Parameter 1</td>
<td></td>
</tr>
<tr>
<td>Velocity Parameter 2</td>
<td></td>
</tr>
<tr>
<td>Acceleration Parameter 1</td>
<td></td>
</tr>
<tr>
<td>Acceleration Parameter 2</td>
<td></td>
</tr>
<tr>
<td>Bearing/Mechanical Severity</td>
<td></td>
</tr>
<tr>
<td>Lubrication Severity</td>
<td></td>
</tr>
<tr>
<td>Calculated Speed</td>
<td></td>
</tr>
<tr>
<td>Skin Temperature</td>
<td></td>
</tr>
<tr>
<td>Supply Voltage</td>
<td></td>
</tr>
</tbody>
</table>
2  Configuration

2.1  Setup overview

Unless the AMS Wireless Vibration Monitor is purchased pre-configured from the factory, it needs to be configured prior to installation at the facility or measurement location. There are three possible setups to configure the device:

1. Connect the device to a field communicator, and then configure the device using the field communicator.

   **Note**
   This setup is recommended if you are in a hazardous area.

2. Connect the device to a computer through a HART modem, and then configure the device using AMS Device Manager.

   **Note**
   The HART modem is purchased separately.

3. Connect the device to a computer through a wireless gateway and then configure the device using AMS Device Manager.
2.2 Pre-configuration

The AMS Wireless Vibration Monitor is shipped with the battery disconnected from the device to comply with safety requirements. You need to connect the battery before you can configure the device. Remove the battery after configuration to avoid depleting it.

Procedure

1. Use your hands to unscrew and remove the blue cover. This exposes the HART ports.

   Use an Allen wrench or a small screwdriver and put it through the Orientation hole to use as leverage while loosening the cover.

   **CAUTION**

   Exercise caution when using your bare hands to remove the cover.

2. Remove the battery with the pull tab.
3. Locate the battery connector and plug it into the socket on the device as shown.
4. Replace the battery. Tuck the wires against the battery and lock them into place.
5. Mount the cover and then tighten it.

**Note**
To avoid depleting the battery, disconnect it when the device is not in use. If you have configured the device and network but are not ready to commission it, remove the battery to extend its operating life. Reconnect the battery when you are ready to install the device.

### 2.3 Configuration overview

Configure the device to control the following operations:
- How measurement results are reported and how often are they reported
- How and when alerts are generated
- Set the upper and lower limits of the alerts
- Set the units of measurement for the parameters
- Set the primary variable, secondary variable, tertiary variable, and quarternary variable

You can change these configurations from AMS Device Manager or from a field communicator such as Trex Communicator.

To view the default values, see Configuration defaults.

**Note**
The specific user interface for performing the configuration varies depending on the host used.
Procedure

1. **Connect to a computer or field communicator.**
   You need to connect to a wired connection to set the wireless credentials.
   For more information, see [Connect to a wired HART interface](#).

2. **Set the wireless network credentials (Network ID and Join Key) using wired connection.**
   The monitor has a default Network ID and Join Key. You can change the network credentials in the gateway that you used for configuration. All devices should join the network once the battery is connected.
   For more information, see [Set the wireless network configuration](#).
   After the device has joined the network, you can complete the rest of the configuration steps over a wireless connection.

3. **(Optional) Name the device (Tag and Device Description).**
   By default, the tag is VXAABBCC, where AABBCC: is the unique device ID. The device joins the network and operates correctly even if no changes are made, but it is recommended to name the device something meaningful for the specific application.

4. **Specify the units (English or metric) that will be used for each parameter.**
   By default, units are set to English.

5. **Specify which measurements (velocity, temperature, etc.) correspond to the process variables PV, SV, TV, and QV. Specify the units (English or metric) for each parameter.**
   By default, PV corresponds to Z-axis overall, SV is X-axis overall, TV is Y-axis overall, and QV is Z-axis PeakVue.

6. **Specify alert levels.**
   Determine the thresholds at which measurement alerts will display and determine the behavior of device alerts. See the alert limits in [Device variable alert limits](#).

7. **Specify the update rate.**
   The default update rate is once every 60 minutes. A faster update rate is not recommended as it significantly reduces battery life.

8. **Configure trending of parameters.**
   You can trend parameters in multiple locations such as in a plant historian, in AMS Machine Works, and in a DCS control system.
2.3.1 Connect to a wired HART interface

You need to initially connect the device to a wired HART interface to define the credentials that allow it to communicate on a wireless network. You can also define other device configurations such as sensor type and alert thresholds at this time.

**Notes**

Use the wired HART interface only for configuration. Dynamic variables (such as measured vibration parameters) are not updated when communicating on the wired interface.

**Procedure**

1. Locate the terminals for the communication port on the opposite side of the device.
2. Connect a configuration device to the terminals such as a computer running AMS Device Manager with a HART™ modem or an AMS Trex Communicator.
3. Configure the device.
   - To configure the device using AMS Device Manager, see Configuration with AMS Device Manager.
   - To configure the device using AMS Trex Communicator, see Configure with Trex Communicator.

Press **Send** to send configuration changes to the monitor.

2.3.2 Set the wireless network configuration

This enables the monitor to communicate with the Emerson Wireless Gateway and with other systems. This is the wireless equivalent of connecting wires from a transmitter to a control system input.

**Procedure**

1. From the Emerson Wireless Gateway, click **System Settings → Network → Network Settings** to obtain the Network ID and Join Key.
2. Using a field communicator or AMS Device Manager with a wired modem, enter the Network ID and Join Key so that they match the Network ID and Join Key from the Emerson Wireless Gateway.

**Note**
If the Network ID and Join Key are not identical to the gateway settings, the AMS Wireless Vibration Monitor will not communicate with the network.

### 2.4 Configuration with AMS Device Manager

#### 2.4.1 Configure wireless network credentials

**Prerequisites**
Before performing operations in AMS Device Manager, first scan the AMS Wireless Vibration Monitor with a wired HART modem. Right-click the HART Modem icon in Device Explorer and select *Scan All Devices*.

**Note**
Configuring the wireless network is only applicable using a wired HART modem and cannot be done using WirelessHART devices.

**Procedure**

1. In AMS Device Manager, right-click AMS Wireless Vibration Monitor and then select *Methods → Join Network*.

2. Enter the network ID for the wireless network in the Join Device to Network screen and click *Next*.
   
   You can obtain the network ID from the Emerson Wireless Gateway web server. Click *Setup → Network → Settings*.

3. Enter the Join Key in the screens that follow, and click *Next*.

4. Select the *Accept new join key* option, and click *Next*.

5. Click *Finish* when done.
2.4.2 **Main navigation**

The main navigation page provides quick links to the Overview, Configure, and Service Tools menus, as well as to other context menus available for the device.

In the Device Explorer view, select the wireless network where the transmitter is connected and right-click the transmitter to display the context menus.

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**Figure 2-1: AMS Wireless Vibration Monitor Main Navigation**

![Diagram of AMS Wireless Vibration Monitor Main Navigation](image-url)
2.4.3 Overview menu

The Overview menu provides a glimpse of the status of the AMS Wireless Vibration Monitor, including the status of the connection to the wireless network, and a summary of the primary variables, machine temperature, battery voltage, and update rate.

From this menu, you can access the Configure menu and the Service Tools.

You can also access these shortcuts:

- Device Information
- Perform Acquisition
- Join Device to Network
2.4.4 Configure menu

Use this menu to configure sensors, variable mappings, units and alert limits.

There are two options to configure the device. It is advisable to use Guided Setup.

**Important**

To be able to edit configuration settings, select *Current* in the Time drop-down menu at the bottom of the screen.

**Guided setup**

This option lets you configure device settings in a guided step-by-step process. Click each of the buttons under Initial Setup to complete the guided setup.

Click **Configure Variable Mapping** to display or specify which measurements are reported as the Primary, Secondary, Tertiary, and Quaternary variables.

Click **Configure Device Variable Units** to configure the units for device variables.

Click **Configure Alert Limits** to define the lower range and upper range values and alert limits for Advisory, Maintenance, and Failure for each of the process variables. You can also configure alert reporting from here.

Click **Configure Acquisition Settings** to set the acquisition settings.

Click **Join Device to Network** to enter network identifiers and join keys that will enable the device to join a wireless network.

Click **Configure Update Rate** to set how often the device acquires and reports new measurements (update rate) and to specify the number of times the transmitter skips data acquisitions between updates to the gateway.
Manual setup

In this option, you have to define the settings in several tabs as shown below.

**Wireless tab**

![Wireless tab screenshot]

Click **Join Device to Network** to enter network identifiers and join keys that will enable the monitor to join a wireless network.

Click **Configure Update Rate** to set how often the device acquires and reports new measurements (update rate) and to specify the number of times the monitor skips data acquisitions between updates to the gateway.

Click **Apply Default Burst Configuration** to reset the burst configuration to default values.

**Note**
The burst messages are not individually controllable via the DD.
Click **Configure Acquisition Settings** to configure the parameters for the specific sensor.

Click **Refresh Acquisition Time** to reset the parameters to default values.
Click **Configure Acquisition Settings** to configure the parameters for the specific sensor.

Click **Refresh Acquisition Time** to reset the parameters to default values.

When configured with speed (which requires the Advanced Diagnostics License), the optimal and minimum values are displayed.
Click **Configure Acquisition Settings** to configure the parameters for the specific sensor.

Click **Refresh Acquisition Time** to reset the parameters to default values.

When configured with speed (which requires the Advanced Diagnostics License), the optimal and minimum values are displayed.
**Interval Bands tab**

This tab shows the measurement ranges for the Z PeakVue, Z Velocity, and X-Y Velocity and effectively bound FMin and FMax for the selected source.

The device enforces these ranges and forces them to the bounded values. This was designed to never allow bad configuration.

<table>
<thead>
<tr>
<th>Source</th>
<th>FMin</th>
<th>FMax</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB1 Velocity</td>
<td>2 Hz</td>
<td>65 Hz</td>
</tr>
<tr>
<td>IB2 Velocity</td>
<td>65 Hz</td>
<td>300 Hz</td>
</tr>
<tr>
<td>IB3 Accel</td>
<td>10 Hz</td>
<td>500 Hz</td>
</tr>
<tr>
<td>IB4 Accel</td>
<td>500 Hz</td>
<td>1000 Hz</td>
</tr>
</tbody>
</table>

**Measurement Ranges**

<table>
<thead>
<tr>
<th>Source</th>
<th>HP / FMin</th>
<th>FMax</th>
<th>LDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z PeakVue</td>
<td>1000 Hz</td>
<td>1000 Hz</td>
<td>1400 LDR</td>
</tr>
<tr>
<td>Z Velocity</td>
<td>2 Hz</td>
<td>1000 Hz</td>
<td>400 LDR</td>
</tr>
</tbody>
</table>
General tab

- **Write Protect**—Allow or block an application from modifying the device parameters.
- **SW Configuration**—Allow or block software applications to modify the device parameters.
- **Configure Device Variable Units**—Specify the units of measurement for acceleration, velocity, and temperature.
- **Localization**—Set the country and timezone where the device is located.
**Mapping tab**

Use this menu to set the PV, SV, TV, and QV.
Device Information tab

This window shows relevant device information such as the serial number, device identifier, and revision numbers.

Identification—displays the device tag, long tag, device type, serial number, device identifier, date, and device description.

Revision Numbers—displays the universal, field device, software, hardware, and DD revision numbers.
License tab

Change License—This option lets you upgrade the device license. Downgrading is not allowed. When the device is fully licensed, this option is not visible to the user.

Installed Features

The device has 2 license options. Triax Mode and Advanced Diagnostic.

- **Triax Mode**—Enabling this mode allows the device to collect vibration data in all axis (X, Y, and Z).

- **Advanced Diagnostic**—Enabling this mode lets you edit acquisition parameters, acquire four additional vibration parameters, acquire spectra and waveform, access advanced prescriptive analytics.
Alert setup

Use this menu to configure the alert limits of the device variables. Each tab lets you configure the units of each variable or set it back to the default values. All alerts are configured from highest value to lowest value. Depending on the alert type, this may mean the fail or the advise follows the range upper.
2.4.5 Service Tools

Alerts

This menu displays alert conditions. These include hardware and software malfunctions or parameters with values beyond specifications. Only active alerts are visible.
Variables

This tab lets you see the graphical gauge for each device variable.

Click **Mapped Variables** to display graphical gauges of the PV, SV, TV, and QV.

Click the tabs for each parameter to view graphical gauges for each of the parameters.
Spectra

This tab allows you to retrieve spectral data from the device. It is only visible if the Advanced Diagnostics license is enabled.
This tab shows the status and details of the device joining a network.

**Maintenance tab**

Use this tab to manage the device maintenance and log settings.

![Software Interface screenshot](image)

Click **Routine Maintenance** to view device statistics and restore the device to default settings.

**Log** to display events such as measurements, HART transmissions, and wake actions.

Click **Log Configuration** to configure event logging options. Data from event logs are useful during a debug process.

Click **Device Statistics** to display statistics related to radio transmission operation such as communication interval between data requests.

Click **Reset/Restore** to reset the device or to restore factory default settings.

### 2.5 Configure with Trex Communicator

You can configure the monitor using a field communicator such as the AMS Trex Communicator. For instructions on using the AMS Trex, refer to the AMS Trex Device Communicator User Guide.

2.6 Configuration options

2.6.1 Measurement parameter units

The table below shows the measurement parameters and units that can be configured for each parameter.

Table 2-1: Measurement parameter units

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acceleration</td>
<td>m/s</td>
</tr>
<tr>
<td>Velocity</td>
<td>m/s, mm/s, in/s</td>
</tr>
<tr>
<td>Temperature</td>
<td>°C, °F</td>
</tr>
<tr>
<td>Speed</td>
<td>rpm</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>V</td>
</tr>
</tbody>
</table>

2.6.2 Configuration defaults

Table 2-2: Configuration Values

<table>
<thead>
<tr>
<th>Configuration option</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network ID</td>
<td>1234</td>
</tr>
<tr>
<td>Join Key</td>
<td>12340000 00000000 00000000 00000000</td>
</tr>
<tr>
<td>Message</td>
<td>WIRELESS VIBRATION TRANSMITTER</td>
</tr>
<tr>
<td>Description</td>
<td>ASSET NAME</td>
</tr>
<tr>
<td>Default Long Tag Format</td>
<td>VX WWYYYYYYYYY</td>
</tr>
<tr>
<td>Default Short Tag Format</td>
<td>VXAABBCC</td>
</tr>
<tr>
<td>Update Rate</td>
<td>60 minutes</td>
</tr>
<tr>
<td>Mounting Method</td>
<td>Not Set</td>
</tr>
<tr>
<td>Motor Type</td>
<td>Not Set</td>
</tr>
<tr>
<td>Line Frequency</td>
<td>Not Set</td>
</tr>
<tr>
<td>VFD</td>
<td>Not Set</td>
</tr>
<tr>
<td>Machine Noise Threshold</td>
<td>0.05 in/sec</td>
</tr>
<tr>
<td>Nameplate Speed RPM</td>
<td>0 rpm</td>
</tr>
<tr>
<td>Driver/Driven Ratio</td>
<td>1</td>
</tr>
<tr>
<td>X_YLOR</td>
<td>1600 lines</td>
</tr>
<tr>
<td>X_YFMIN</td>
<td>2 Hz</td>
</tr>
</tbody>
</table>
Table 2-2: Configuration Values (continued)

<table>
<thead>
<tr>
<th>Configuration option</th>
<th>Default value</th>
</tr>
</thead>
<tbody>
<tr>
<td>X_YFMAX</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>Z LOR</td>
<td>1600 lines</td>
</tr>
<tr>
<td>Z FMIN</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>Z FMAX</td>
<td>1000 Hz</td>
</tr>
<tr>
<td>Z Peakvue LOR</td>
<td>Z velocity spectrum</td>
</tr>
<tr>
<td>Z Peakvue HP Filter</td>
<td>2</td>
</tr>
<tr>
<td>Z Peakvue FMAX</td>
<td>65</td>
</tr>
<tr>
<td>Velocity Band 1 Source</td>
<td>Z velocity spectrum</td>
</tr>
<tr>
<td>Velocity Band 1 Start</td>
<td>2</td>
</tr>
<tr>
<td>Velocity Band 1 Stop</td>
<td>65</td>
</tr>
<tr>
<td>Velocity Band 2 Source</td>
<td>Z velocity spectrum</td>
</tr>
<tr>
<td>Velocity Band 2 Start</td>
<td>65</td>
</tr>
<tr>
<td>Velocity Band 2 Stop</td>
<td>300</td>
</tr>
<tr>
<td>Acceleration Band 1 Source</td>
<td>Z acceleration spectrum</td>
</tr>
<tr>
<td>Acceleration Band 1 Start</td>
<td>10</td>
</tr>
<tr>
<td>Acceleration Band 1 Stop</td>
<td>500</td>
</tr>
<tr>
<td>Acceleration Band 2 Source</td>
<td>Z acceleration spectrum</td>
</tr>
<tr>
<td>Acceleration Band 2 Start</td>
<td>500</td>
</tr>
<tr>
<td>Acceleration Band 2 Stop</td>
<td>1000</td>
</tr>
</tbody>
</table>

2.6.3 Publish mode

The device publishes all device variables and status in three bursts. In cases where a third party host or other control system configures the burst configuration in a custom mode, the DD allows the user to reset the burst configuration to the default burst mode.

However, it is strongly recommended that the device bursting not be manipulated as it has been optimized to provide all device variables and status bytes, hence allowing any potential data from the device to be cached in the gateway, minimizing opportunity for errant communication from a 3rd party host or other control system to wake the device due to burst misconfiguration.

2.6.4 Update rate

The default update rate is 60 minutes. This is the maximum (fastest) recommended update rate. You can change this at commissioning or at any time through AMS Device Manager, the AMS Trex Communicator, or the Smart Wireless gateway web server.

The update rate can be set from 1 minute to 60 minutes (with 1-second resolution) and from 1 hour to 24 hours (with 1-hour resolution, always rounding to the next hour).
When the update rate is greater than 1 hour, the device will publish the last measurement every hour (meeting the HART requirement to at least publish data once / hour) and will publish the new data set on the update rate.

Reducing the update rate minimizes power consumption and extends the life of the battery.

**Note**
If the device is configured to publish at the fastest allowable update rate (once per minute), the battery is expected to last only about 2-3 months.

### 2.6.5 Alert levels

The AMS Wireless Vibration Monitor sets HART status bits to indicate when measured values exceed the configured thresholds. Measured values have six levels: Saturated, Sensor, Range, Advisory, Maintenance, and Failed.

The level at which these thresholds should be set depends on the type of equipment being monitored and on your specific process.

Check the alert thresholds in Device variable alert limits.

One rule of thumb for vibration is to examine the current level at which the equipment is operating. Assuming the equipment is in good working condition, set the Advisory level at 2x the current value (or at a minimum of 0.05 in/s RMS, whichever is greater), set the Maintenance level at 4x the current value, and set the Failed level at 8x the current value. For example, if the current value for Overall Velocity is 0.1 in/s, set the Advisory threshold at 0.2 in/s, the Maintenance threshold at 0.4 in/s and the Failed threshold at 0.8 in/s. While this type of vibration program is not recommended, it can provide a starting point when no other information is available.

A good rule of thumb for establishing the PeakVue alert levels is to use the rule of 10's. This applies for most rolling element bearing equipment with a turning speed between 900 and 4000 CPM. Using this approach, the Advisory alert would be set at 10 g's, the Maintenance alert at 20 g's, and the Failed alert at 40 g's. In general, PeakVue alert levels can then be interpreted as follows:

- 10 g's | Indication of Abnormal Situation
- 20 g's | Serious Abnormal Situation - Maintenance Plan Required
- 40 g's | Critical Abnormal Situation - Implement Maintenance Plan

For more information on PeakVue, see PeakVue.

**Notes**
When any measured process parameter (Velocity, PeakVue, or Temperature) exceeds the configured Advisory, Maintenance, or Failed threshold, this causes an alert indication that you can view from AMS Device Manager (or in another graphical host). This indicator itself does not set a status bit.

### 2.6.6 Trend parameters

You can trend parameters in multiple locations such as in a plant historian or in AMS Machine Works. The method for configuring this functionality is contained in the
associated software and the details of all the possibilities are beyond the scope of this manual. This manual only indicates some of the general capabilities and version requirements.

You can trend values in essentially any host that accepts Modbus or OPC inputs. Configure OPC tags and Modbus registers for wireless devices in the Smart Wireless Gateway web interface. Refer to the Smart Wireless Gateway User Manual for additional information. The settings in the gateway and the host must be consistent and entered in both locations (for example, Modbus register definitions).

Also, with AMS Machine Works and AMS Wireless Vibration Monitor devices (that are licensed for the Advanced Diagnostics application), you can trend Energy Band parameters and collect spectrum and waveform information.
3 Installation

3.1 Device handling

Before beginning the installation process:
Install the Emerson Wireless Gateway and ensure it functions properly before you activate the AMS Wireless Vibration Monitor or any other wireless devices. Power up wireless devices in order of proximity from the Emerson Wireless Gateway, beginning with the closest. This will result in a simpler and faster network installation.

Note
The device requires a standard 1/4–28-inch mounting location.

⚠️ CAUTION
Do not drop, hammer, or impact the device housing before, during, or after installation.

⚠️ CAUTION
When installing the device in hazardous locations, ensure that the device is grounded to the machine case.

⚠️ CAUTION
If the equipment is used in a manner not specified by the manufacturer or contrary to the instructions in this manual, the protection provided by the equipment may be impaired.

3.2 Mounting tools and supplies

Mounting tools
- Drill
- Spot face or end mill tool

The spot face tool attaches to a standard electric drill and provides a machined surface that is at least 1.1 times greater than the diameter of the sensor. The spot face tool also drills a pilot hole that can then be tapped for a stud mounted sensor.

You can purchase the spot face tool from Emerson (MHM P/N 88101), or you can substitute a spot face tool with similar characteristics as required. Contact your local sales representative for assistance.
Attachment tools and supplies

- 1/4-28" taps and tap handle
- 9/16" open-end wrench
- 1/8" hex Allen key
- 3/16" ball-end hex wrench
- Wire brush
- Plant-approved cleaner/degreaser
- Plant-approved semi-permanent thread locker (e.g. Loctite)

For epoxy mount, you also need the following:

- 2-part epoxy
- A212 Mounting Pads

(Optional) Grinder – to create a sufficiently flat mounting surface

For motor fin mount, you also need the following:

- Motor Fin Mount Probe
- Epoxy

3.3 Mounting mechanisms

The device may be mounted using any of the mechanisms listed below. Stud mounting is preferred. The mounts are listed according to our recommendation. Temporary mounting should be a last resort.

- Stud mounting (preferred)
• Epoxy mounting (alternative)
• Triaxial quick connection
• Motor fin mounting
• Temporary mounting

3.3.1 Stud mounting (preferred)

Prerequisites
The mounting location must provide a flat surface of at least 1.1 in (27.94mm) in diameter and a case thickness exceeding 0.4 in. (10.2 mm). If this is not possible, use the epoxy mount method instead.

Stud mount provides increased reliability, improved frequency response, and increased signal sensitivity.

⚠️ CAUTION

Do not exceed the specified torque when tightening a stud-mounted device. Over-tightening the device will damage the sensing element and void the manufacturer’s warranty.

Procedure
1. Prepare the spot face or end mill tool by setting the drill bit depth to a minimum of 0.325 in. (8.255 mm).
2. Using a wire brush and plant-approved cleaner, clean and degrease the surface area.
3. Keeping the spot face and end mill tool perpendicular to the machine surface, drill into the mounting location until the surface is smooth to the touch with no noticeable irregularities. This may require the spot face tool to remove as much as 0.04 in. (1.016 mm) or more from the surface.

Note
If the spot face is not uniform on all sides, it indicates that the spot face tool is not perpendicular to the mounting surface, and the resulting surface will not allow the sensor to be mounted properly.

4. Using 1/4-28 in. tap set, tap a pilot hole to a minimum depth of 0.25 in. (6.35 mm).

3.3.2 Epoxy mounting (alternative)

If it is not practical to drill into the machine casing, then the epoxy mount method is acceptable.

⚠️ CAUTION

When installing in a hazardous location, all efforts must be made to ensure that the device is grounded to the machine case.
Procedure
1. If the equipment surface has a radius of curvature that is less than 4 in. (100 mm), grind a flat surface approximately 0.5 in. (12.7 mm) in diameter.
2. Using a wire brush and plant-approved cleaner, clean and degrease the surface area.
3. Using a two-part epoxy (such as Emerson P/N A92106), spray the activator onto the mounting surface. Place a light coat of epoxy on the surface of the mounting pad and hold firmly against the machine spot face surface for one minute.

Note
If the adhesive does not set within 1 minute, it indicates that too much epoxy is applied or that the mounting surface is not prepared properly. Repeat steps 2–3.

4. Ensure that the mounting pad / base of the device is grounded to the machine case. Use a two-part conductive epoxy (such as Loctite Ablestik 2902) and make a bead that bridges the mounting pad to the machine case.
5. Use a multimeter to check conductivity between the mounting pad and machine surface.

3.3.3 Triaxial quick connection
Use this mount in scenarios where there is a need to remove the monitor from the machine but you also need a more permanent type of installation. This mounting mechanism has two components: the receptacle that attaches to the device and the base that attaches to the machine. The base itself comes in two options: epoxy mounted, or stud mounted.

Procedure
1. Find the right location for the base. Make sure that the base notch is oriented with either the X or the Y axis of the device.
2. Install the device on the receptacle and orientate the whole assembly together.
3. Install the base on the machine using either Stud mounting (preferred) or Epoxy mounting (alternative).
4. Align the notch on the receptacle with the notch on the base and give it a ¼ turn. It will lock in the same place every single time.

3.3.4 Motor fin mounting

Procedure
1. Prepare cooling fins on motor for mounting by scraping or grinding any paint or debris between cooling fins.
2. Clean mounting area with a spray degreaser that will not leave a thin film lubricating residue.
3. Mix adhesive.
4. Apply adhesive to the sides and the bottom of the probe portion of the motor fin mount probe/pad (the area is roughened to enhance the bonding area).
5. Place the motor fin mount probe/pad between the motor fins at the location desired.
   • Correct motor fin mount selection is important. The probe must fit in between the motor fins, and the bottom of the probe must contact the motor casing.
   • For motors that have a space greater than \( \frac{1}{2} \)” between each fin, motor fin mount probe pads with a thickness of \( \frac{1}{2} \)” are available and will reduce the amount of adhesive needed.

6. Firmly press the motor fin mount probe/pad into place, ensuring the bottom of the motor fin mount probe/pad is touching the motor casing (this contact area is where the vibration is transferred from the motor to the sensor).
   • The tip of the motor fin mount probe/pad should be as flat against the motor casing as possible.
   • The motor fin mount probe/pad should not be resting on the top of the fins – if it does, then the bottom of the probe may not be in direct contact with the motor casing.

7. Use a spatula to redirect any epoxy that has been displaced from the mounting area when pushing the fin mount probe/pad into place.

8. Fill in any remaining voids with the adhesive to ensure the motor fin mount will be fixed in place.

9. Allow full cure for the adhesive prior to installing sensor.

### 3.3.5 Temporary mounting

Temporary mounting may be required to perform field testing. This allows for testing the location and orientation of each sensor to get the best possible coverage. A magnetic mount is the best solution in this case. Once the optimum location is determined, the device shall be permanently mounted using one of the methods outlined above.

⚠️ **CAUTION**

The recommended magnets have a pull force of 40lb-60lb and are very strong. Handle with care when working with multiple units or near metal structures.

**Procedure**

1. Prepare the surface. Use a rag or wire brush to remove any loose debris, grease, dirt, or rust.
2. Attach the device on the magnetic base with a \( \frac{1}{4} \)”-28 threaded hole.
3. Position the magnetic base on a ferrous surface, making sure that the device is properly oriented.
4. Check to see that the device is properly and firmly attached. Wriggle the device with your hand. It should not wobble or rotate.
3.4 Mount the device

Prerequisites
Prepare the surface according to your mounting method. The mounting location is the machine surface when using stud mount and the mounting pad when using epoxy mount. The mounting location should be prepared according to best practices.

Procedure
1. To stud mount the device (recommended), prepare the machine surface using a spot face tool. Then drill and tap a ¼-28" hole 0.25" (6.35mm) deep. Alternately, a mounting pad with ¼-28" thread can be glued in place using epoxy.
2. With the cover still on the device, use your hand to loosely screw the device into the threaded hole. Do not tighten.
3. Using your hand, loosely screw device into the mounting location.
4. Remove the cover and battery.
5. Set the device in the proper orientation. Insert a small screwdriver through the guide hole in the base of the unit (shown below) and use this to hold the device in the desired orientation.

Make sure that your planes are in the right direction. The Z plane should be vertical. The orientation of the X and Y axis depends on how you configured your device. To make sure that your X and Y axis stay where they are, use an allen wrench or a small screwdriver while you torque down the device to make sure that everything stays in the correct position. You can also hold the device while you torque it down.
6. While maintaining the device orientation, use a 3/16" ball driver to tighten the captive screw in the center of the base (shown above) to 2-5 ft-lb.

The mounting screw must be tightened firmly but carefully to prevent stripping out the mounting thread, typically 1/8 turn past finger tight for steel and slightly less for aluminum or brass. For high-frequency applications above 7kHz and all PeakVue
measurements, a good quality silicon grease (Dow #4) should be used as a coupling agent on the mounting ring on the bottom of the device. Only a small amount is needed.

7. Insert and connect the battery.
8. Mount the cover and then tighten it. Tighten the cover all the way down until the bottom of the cover touches the base.

Ensure that the base does not turn while tightening the cover. Turning of the base causes misalignment of the measuring directions.

Always ensure a proper seal when screwing the cover. The cover should be tightened all the way down to the base to keep the device watertight and free from the elements.

3.5 Change the battery

The battery that comes with the device is replaceable. The battery may last without need of replacement or recharge for a minimum of 3 years up to 5 years, if used at room temperature while collecting and reporting with default collection parameters.

Note
While the device is approved for battery replacement in hazardous locations, always check with your local Safety Officer before replacing the battery in a hazardous location.

Procedure
1. Using an allen wrench, hold the metal base.
2. Unscrew the device cover and then remove it.
3. Release the holding latch, and then carefully pull the battery tab to take the battery out of the compartment.
4. Use your finger to release the bottom latch on the battery connect by lifting the tab and then gently pull it until the connector is released.
5. Plug the battery wire into the connector and position the wire so that it is held by the battery clamp.
6. Place the battery into the compartment.
7. Snap the battery clamp back into place to secure the battery and wire.
8. Mount the cover and then tighten it. Tighten the cover all the way down until the bottom of the cover touches the base.

Ensure that the base does not turn while tightening the cover. Turning of the base causes misalignment of the measuring directions.

Always ensure a proper seal when screwing the cover. The cover should be tightened all the way down to the base to keep the device watertight and free from the elements.
4 Operation

4.1 Verify the device is operational

You can verify the device operates properly using the following methods:

- Field Communicator
- Emerson Wireless Gateway web interface

4.2 Verify operation with Emerson Wireless Gateway

If the device is configured with the Network ID and Join Key, and sufficient time for network polling has passed, the monitor will be connected to the network.

**Note**
The time to join a new device to the network is dependent upon the number of devices being joined and the number of devices in the current network. For one device joining an existing network with multiple devices, it may take up to five minutes. It may take up to 60 minutes for multiple new devices to join the existing network.

**Procedure**

1. From the Emerson Wireless Gateway Home page, navigate to the Devices page.

   The Devices page shows if the device has joined the network and if it is communicating properly. It also displays the transmitter tag name, PV, SV, TV, QV, time of last update. A checkmark in a green box means that the device is working properly. A red indicator means there is a problem with either the device or its communication path.

   **Note**
   It is normal for the AMS Wireless Vibration Monitor to have a red “X”, on the screen until the sensor is installed and configured.
2. On the Devices page, click + beside a tag name to display more information about the device.

3. Verify the Network ID and Join Key in the device match those found on the Emerson Wireless Gateway:
   a. From the Emerson Wireless Gateway, click **System Settings** → **Network** → **Network Settings**.
   b. Verify **Show join key** has a check mark.

   **Note**
   The most common cause of incorrect operation is that the Network ID or Join Key are not set correctly in the device.

4.3 Verify operation with AMS Trex Communicator

You can verify the status of the AMS Wireless Vibration Monitor and configure it using an AMS Trex Communicator. For instructions on using the AMS Trex unit, see the User Guide.

**Note**

**Table 4-1: Field Communicator menu**

<table>
<thead>
<tr>
<th>Menu</th>
<th>Submenu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Guided Setup</td>
<td>Configure Variable Mapping</td>
</tr>
<tr>
<td></td>
<td>Configure Device Variable Units</td>
</tr>
<tr>
<td></td>
<td>Configure Alert Limits</td>
</tr>
<tr>
<td></td>
<td>Configure Acquisition Settings</td>
</tr>
<tr>
<td></td>
<td>Join Device to Network</td>
</tr>
<tr>
<td></td>
<td>Configure Update Rate</td>
</tr>
<tr>
<td>Manual Setup</td>
<td>Wireless</td>
</tr>
<tr>
<td></td>
<td>Machine</td>
</tr>
<tr>
<td></td>
<td>Z Axis</td>
</tr>
<tr>
<td></td>
<td>X-Y Axis</td>
</tr>
<tr>
<td></td>
<td>Interval Bands</td>
</tr>
<tr>
<td></td>
<td>General</td>
</tr>
<tr>
<td></td>
<td>Mapping</td>
</tr>
<tr>
<td></td>
<td>Device Information</td>
</tr>
<tr>
<td></td>
<td>License</td>
</tr>
</tbody>
</table>
### Table 4-1: Field Communicator menu (continued)

<table>
<thead>
<tr>
<th>Menu</th>
<th>Submenu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alert Setup</td>
<td>Z Axis</td>
</tr>
<tr>
<td></td>
<td>X-Y Axis</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
</tr>
<tr>
<td></td>
<td>Battery</td>
</tr>
<tr>
<td></td>
<td>IB1-2 (Velocity)</td>
</tr>
<tr>
<td></td>
<td>IB3-4 (Accel)</td>
</tr>
<tr>
<td></td>
<td>Machine Conditions (PVP)</td>
</tr>
</tbody>
</table>

**Note**
Disconnect the leads when you are finished configuring or troubleshooting. The AMS Wireless Vibration Monitor does not publish any new vibration data to the gateway while connected to an AMS Trex Device Communicator or HART modem. It can take up to three minutes for the leads connection to time out; after which, the AMS Wireless Vibration Monitor resumes reporting new readings to the gateway.

### 4.4 Check device status

You can check the device status from the AMS Device Manager or the AMS Trex Communicator.

The images below show the status of the device and what it means.

![Device Status Images]

The device status is dependent upon individual device variable evaluation, system activity, and operating parameters.

The out-of-the-box overall status should always be Good.

The highest level severity is always be asserted, even if there are underlying lower level alerts.
4.5 Device variable ranges

The device variables have the following ranges:

1. **Saturated** – Indicates the saturation point of the transducer. In this device, this level is not settable by the end user. When this range is violated, the device variable status is Bad. This is referred to as “Upper Saturated” and “Lower Saturated”.

2. **Sensor** – Indicates the sensor point of the transducer. In this device, this level is not settable by the end user. When this range is violated, the device variable status is Degraded. This is referred to as “Upper Sensor” and “Lower Sensor”.

3. **Range** – Indicates the user-defined process range. This is referred to as “Upper Range” and “Lower Range”.

4. **Fail** – The user-defined fail level(s)

5. **Maint** – The user-defined maintenance levels.

6. **Advise** – The user-defined fail levels.

4.6 Device operating limits

**Table 4-2: Operational ranges**

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Range</th>
<th>Frequency Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibration Overall X</td>
<td>16 g's</td>
<td>1 KHz</td>
</tr>
<tr>
<td>Vibration Overall Y</td>
<td>16 g's</td>
<td>1 KHz</td>
</tr>
<tr>
<td>Vibration Overall Z</td>
<td>80 g's</td>
<td>20 KHz</td>
</tr>
<tr>
<td>PeakVue Z</td>
<td>80 g's</td>
<td>20 KHz</td>
</tr>
<tr>
<td>Temperature</td>
<td>-40°C to 85°C</td>
<td>N/A</td>
</tr>
</tbody>
</table>

4.7 Clean the device

Use a soft towel or paper towel to wipe any excess grime.

If necessary, use a cloth dampened with a mixture of water and mild detergent (similar to cleaning household dishes).

Do not use solvents to clean the device.
Overall Velocity, PeakVue, and temperature

5.1 Overall Velocity

The Overall Velocity measurement provides a summation of the low-frequency vibration energy, which indicates fault conditions such as imbalance, misalignment, looseness, and late-stage bearing problems.

The AMS Wireless Vibration Monitor uses (lower-frequency) Overall Velocity in conjunction with (higher-frequency) PeakVue to provide a holistic solution across all frequencies while optimizing the usage of the limited power and bandwidth available in a wireless device. The majority of developing fault conditions manifest in one or both of these key parameters.

The difference between the standard vibration waveform and the associated PeakVue waveform is shown in Figure 5-1 and Figure 5-2. Overall Vibration indicates energy from shaft rotation, expressed in units of RMS velocity per the ISO 10816 standard. PeakVue, on the other hand, filters out the rotational energy to focus on impacting. Impacting is expressed in units of Peak acceleration. This indicates key mechanical problems such as rolling element bearing faults, gear defects, and under-lubrication.

Figure 5-1: Velocity waveform
While PeakVue is very useful for providing an early indication of impact-related faults in rolling-element bearings, there are many general applications where a lower-frequency measurement is more appropriate. Also, virtually all vibration analysts are very familiar with the Overall Velocity measurement and use it as part of their existing vibration programs. While it may not be possible to obtain a measurement result comparable to the PeakVue value reported by the AMS Wireless Vibration Monitor with a non-Emerson unit, the Overall Velocity measurement is common throughout the industry and should be easy to correlate with results from handheld instruments.

There are, however, a number of different methods for measuring and reporting Overall Velocity, so ensure that the measurement conditions are similar when trying to duplicate the value reported by the AMS Wireless Vibration Monitor with a handheld. The AMS Wireless Vibration Monitor uses ISO 10816, which defines a measurement bandwidth of 2 Hz to 1 kHz. The ISO 10816 general fault levels at various turning speeds are shown in Figure 5-3.
Figure 5-3: General fault levels

Overall Velocity Alert Levels

Depending on the type of machine being monitored, the values shown in this graph should be multiplied by the service factors given in Table 5-1.

Table 5-1: Service factor multiplier

<table>
<thead>
<tr>
<th>Machinery type</th>
<th>Service factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-stage Centrifugal Pump, Electric Motors, Fans</td>
<td>1.0</td>
</tr>
<tr>
<td>Non-critical Chemical Processing Equipment</td>
<td>1.0</td>
</tr>
<tr>
<td>Turbine, Turbine Generator, Centrifugal Compressor</td>
<td>1.6</td>
</tr>
<tr>
<td>Miscellaneous Equipment</td>
<td>2.0</td>
</tr>
</tbody>
</table>

Figure 5-3 shows the Overall Velocity thresholds for root-mean-square (RMS) velocity in units of inches per second. Particularly, in digital acquisition systems, it is customary to measure and calculate with RMS quantities. While it is accepted practice in the industry to convert between RMS and peak values using the 1.4142 conversion factor, it is not technically correct to do so except for a pure sinusoidal waveform. For this reason, the AMS Wireless Vibration Monitor measures, calculates, and reports Overall Velocity in RMS, and it is necessary to multiply by 1.4142 to get the corresponding peak levels if this is the preferred format.

Table 5-2: Default velocity levels in AMS Wireless Vibration Monitor

<table>
<thead>
<tr>
<th>Alert level</th>
<th>Velocity (in RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advise</td>
<td>0.14 in/s</td>
</tr>
</tbody>
</table>
### Table 5-2: Default velocity levels in AMS Wireless Vibration Monitor (continued)

<table>
<thead>
<tr>
<th>Alert level</th>
<th>Velocity (in RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintenance</td>
<td>0.35 in/s</td>
</tr>
<tr>
<td>Failed</td>
<td>1.0 in/s</td>
</tr>
</tbody>
</table>

## 5.2 PeakVue

PeakVue™ is a patented Emerson technology that is very useful for isolating high-frequency phenomena associated with developing faults, especially in rolling-element bearings.

The premise for PeakVue is that the high-frequency components are not readily detected with more conventional measurements such as Overall Velocity, low-frequency energy (LFE), or digital overall. This is because the low-frequency measurements either average the energy or provide an energy summation over a relatively large frequency band, and the relative amount of energy that is typically contributed by the high-frequency components is quite small. As a result, even large ’spikes’ are difficult to detect with classic techniques.

The difference in the vibration waveform and the associated measurement for overall vibration versus PeakVue is shown in Figure 5-5 and Figure 5-6. The overall vibration is well below the established advisory and maintenance alert levels indicating that the machine is running well. In contrast, the PeakVue graph shows that the values have increased from zero, and that they are already crossing the advisory alert level and approaching the maintenance alert level. This early warning about impending defects is key to maintaining good machine health.

The PeakVue algorithm isolates the peak energy of interest to provide early indications of developing bearing faults such as inner and outer race defects, ball defects, and lubrication problems. Any type of “impacting” fault, where metal is contacting metal, is readily visible with PeakVue long before there is any significant increase in Overall Vibration. PeakVue is especially useful for monitoring rolling-element bearings.

Figure 5-4 shows an example of a typical formula for calculating the advisory alert level for PeakVue.

**Figure 5-4: PeakVue advisory levels**

![Recommended PPTime Waveform Alert Limits](image)
These are the equations that govern this curve:

\[ g' = \left( \frac{RPM}{900} \right)^{0.1} \times 6 \text{ for } RPM < 900 , \]

\[ g' = 6 , \text{ for } 900 \leq RPM \leq 4000 , \]

\[ g' = \left( \frac{RPM}{4000} \right)^{0.4} \times 10 \text{ for } 4000 < RPM \leq 10000 , \]

\[ g' = 10 , \text{ for } RPM > 10000 . \]

These, however, are generic limits. They are provided as a starting point and these values (for a 3600 RPM machine) are used as the default alert thresholds by the vibration transmitter.

These levels were devised for periodic data collection with a portable vibration analyzer and are set relatively low. For frequent automated monitoring, such as that offered by the AMS Wireless Vibration Monitor, the levels can be increased for most balance of plant equipment running between 900 and 4000 RPM. You can use the "rule of tens" as a simple but effective approach to monitoring PeakVue on most rolling element bearing machines. Using this guideline, we can assume the following:

<table>
<thead>
<tr>
<th>Level</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Machine is in good condition</td>
</tr>
<tr>
<td>10</td>
<td>Some problem is developing on the machine</td>
</tr>
<tr>
<td>20</td>
<td>The problem has become serious</td>
</tr>
<tr>
<td>40</td>
<td>Problem is critical</td>
</tr>
</tbody>
</table>

**Note**

The appropriate alerts for a given machine will be a function of its design, service, and turning speed.

Utilizing the embedded PeakVue technology, the AMS Wireless Vibration Monitor identified developing problems at a couple of test sites during early field trials. In both cases, the problem was not visible with conventional low-frequency analysis. The following examples provide sample data from one of the sites. Notice in the example that the velocity measurement is indicating less than 0.1 in/s. The PeakVue trend, however, indicates high-frequency vibration that is regularly in excess of 6 g's.
The defective bearing was removed and Figure 5-7 shows the developing problem that was the source of the impacting. After replacing the bearing, the PeakVue vibration is significantly reduced, as shown in Figure 5-8, indicating that the problem has been resolved.
Figure 5-7: Defective bearing
5.3 Temperature

The levels at which to set temperature alerts depend on a number of factors including the specific process, the operating environment, and the characteristics of the equipment being monitored. This section provides some generic guidelines, given some knowledge of the variables involved, for setting the thresholds for your specific AMS Wireless Vibration Monitor installation. However, the generic methodologies described here are no substitute for first-hand knowledge of your plant. If, for example, you know that you have problems when a temperature exceeds a particular value, then set your thresholds accordingly rather than following these generic guidelines.

In general, the best way to detect a developing fault related to temperature is to look for an increase in temperature, relative to ambient, over time. This implies that, for reliable alerting, the thresholds should change as ambient temperature changes. In practice, this can be difficult to do because it requires the operator to constantly monitor the ambient temperature and adjust the alert levels accordingly. It is customary, therefore, to pick an “average” ambient temperature (that is generally seasonal for outdoor installations) and choose fixed thresholds based on this average. Also, there are issues with this methodology (such that it does not work well) in areas with large variations in ambient temperature.

You can select thresholds based on some absolute temperature limit. In practice, this is much easier to maintain but is not as effective at detecting early failures as relative monitoring.
5.3.1 Relative temperature monitoring

The recommended generic guidelines for setting the thresholds based on the relative change are:

\[ T_{\text{Advise}} = 10^\circ C \text{ increase} \]
\[ T_{\text{Maintenance}} = 15^\circ C \text{ increase} \]
\[ T_{\text{Failed}} = 20^\circ C \text{ increase} \]

Assuming that the ambient temperature is 25°C, when operating at steady-state, you have determined that the normal temperature at this point on your equipment is 55°C. Your "baseline" relative difference is 30°C. Using these guidelines, you should choose the Advise, Maintenance, and Failed levels for a difference of 40°C, 45°C, and 50°C, respectively. Assuming the ambient temperature is constant at 25°C, this means the thresholds become 65°C, 70°C, and 75°C for Advise, Maintenance, and Failed, respectively. Then, as the ambient temperature changes, the thresholds should be changed accordingly (e.g., a 5°C increase in ambient temperature raises the alert thresholds by 5°C).

5.3.2 Absolute temperature monitoring

For monitoring a driven component (such as a pump or fan), there are no generic rules to determine the default levels without some prior knowledge of the steady-state baseline (good) value. In general, the Advise level should be set about 10°C to 20°C above this baseline, with the Maintenance level about 10°C above Advise and the Failed level about 10°C above Maintenance.

There are equations that define the suggested generic thresholds for monitoring motor (driver) temperature. These are based on characteristics of the motor as well as knowledge of the ambient temperature.

The first step is to determine the estimated winding temperature, which is dependent on the following variables:

- Insulation type
- Motor type
- Ambient temperature
- Altitude

The estimated winding temperature, \( T_w \), is the rise in temperature, \( T_{\text{rise}} \), for the appropriate type of motor adjusted for high ambient temperature (\( T_a \)) effects.

\[ T_{\text{rise}} = \]

\[ 65^\circ C + \text{serv\_fact\_temp}; \text{ for class A insulation} \]
\[ 85^\circ C + \text{serv\_fact\_temp}; \text{ for class B insulation} \]
\[ 110^\circ C + \text{serv\_fact\_temp}; \text{ for class F insulation} \]
\[ 130^\circ C + \text{serv\_fact\_temp}; \text{ for class H insulation} \]
\[ 150^\circ C + \text{serv\_fact\_temp}; \text{ for class N insulation} \]

where \( \text{serv\_fact\_temp} = \)
• 5 for service factor of 1.15 or greater
• -5 for either open or totally enclosed fan cooled (TEFC) motors, and service factor of 1.0
• 0 for either totally enclosed non-ventilated (TENV) motors or motors with encapsulated windings, and service factor of 1.0

If elevation > 3300 ft (1000m), then:

\[ T_{\text{rise}} = T_{\text{rise}} \left[ 1 - \frac{\text{altitude (units of ft)} - 3300}{33,000} \right] \]

If \( T_a \) is less than or equal to 40°C (or unknown), then:

\[ T_w = T_{\text{rise}} + 40°C \]

If \( T_a > 40°C \), then:

\[ T_w = T_{\text{rise}} + 40°C - (T_a - 40°C) \]

If \( T_a \) is unavailable, assume that \( T_a \) is less than 40°C.

Next, calculate the generic alert thresholds based on the estimated winding temperature, \( T_w \).

\[ T_{f_{\text{fault}}} = \text{Fault level alarm temperature (°C) of the motor skin (frame)} \]
\[ T_{f_{\text{maintenance}}} = \text{Maintenance level alarm temperature (°C) of the motor skin} \]
\[ T_{f_{\text{advisory}}} = \text{Advisory level alarm temperature (°C) of the motor skin} \]

**Alarm levels**

For open drip proof (ODP) motors:

\[ T_{f_{\text{fault}}} = 35.5366 \times \ln(T_w) - 91.1571 \]

For totally enclosed motors:

\[ T_{f_{\text{fault}}} = 37.2028 \times \ln(T_w) - 102.8868 \]

For all motors:

\[ T_{f_{\text{maintenance}}} = T_{f_{\text{fault}}} - 10°C \]
\[ T_{f_{\text{advisory}}} = T_{f_{\text{fault}}} - 20°C \]

**Error indication and steady-state determination**

• Do not use any data readings collected within 30 seconds of motor start up.
• Steady-state is said to have been reached when, over any 5-minute time interval, the maximum variation in temperature is less than 2°F.
A Specifications and reference data

A.1 Functional specifications

<table>
<thead>
<tr>
<th>Input</th>
<th>Three internal MEMS accelerometers oriented in the X-Y-Z direction. The Z accelerometer has the greatest bandwidth and is considered the primary sensor. The device also has a temperature sensor designed to read the temperature near the mounting point.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>Wireless-enabled, linear with temperature or input.</td>
</tr>
<tr>
<td>Humidity limits</td>
<td>0–95% relative humidity</td>
</tr>
<tr>
<td>Transmit rate</td>
<td>User-selectable, 60 seconds to 24 hours.</td>
</tr>
</tbody>
</table>
| Measurement | Measurement Parameters
The device is capable of measuring and reporting machine health measurement parameters and generating alerts based on overall vibration in each axis as well as peak impact measurements in the primary axis and temperature readings. |
|            | Measurement precision
Measurement precision refers to the variability of the same measurement in a fixed operating environment under steady-state conditions. For vibration, this value is obtained with statistical measurements with 1 g-peak (9.81 m/s²) input excitation at a frequency of 100 Hz. For temperature, this value is obtained with statistical measurements at room temperature. |
|            | • Vibration: 0.2 dB
• Temperature: +/- 2°C |
| Amplitude Range | Primary axis: +/- 80 g/s
Secondary axis: +/- 16g/s |
| Measurement Accuracy | +/- 3 dB from 2 Hz to 10 kHz primary axis, +/- 3 dB from 2 Hz to 1 kHz secondary axis |
| Dynamic signal range | Target: 80dB |
A.2 Physical specifications

Battery

Table A-1: Tadiran Lithium Batteries Model TL-4920/VE

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal capacity @ 3 mA, to 2 V</td>
<td>8.5 Ah</td>
</tr>
<tr>
<td>Rated voltage</td>
<td>3.6 V</td>
</tr>
<tr>
<td>Maximum recommended continuous current</td>
<td>75 mA</td>
</tr>
<tr>
<td>Maximum 1 sec. pulse capability</td>
<td>200 mA</td>
</tr>
<tr>
<td>Weight</td>
<td>49.5 g (1.746 oz)</td>
</tr>
<tr>
<td>Volume</td>
<td>26 cc</td>
</tr>
<tr>
<td>Operating temperature range</td>
<td>-55 ºC to +85 ºC</td>
</tr>
<tr>
<td>U.L. Component Recognition, MH 12193</td>
<td></td>
</tr>
</tbody>
</table>

Field Communicator connections

- HART ports
- Clips attached to the HART ports

Mounting

Mounting tools and supplies depend on the mounting mechanism. For more information, see Mounting tools and supplies.

Mounting screw thread is 1/4 - 28

Weight

0.697 lb (315 g)

Enclosure ratings

Housing is NEMA 4X and IP66

A.3 Performance specifications

Temperature Limits

The device is rated for operation in the range from -40 to +85C.

Table A-2: Temperature limits

<table>
<thead>
<tr>
<th>Device</th>
<th>Operating limit</th>
<th>Storage limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMS Wireless Vibration Monitor</td>
<td>-40 to +85C</td>
<td>-55 to +85C</td>
</tr>
</tbody>
</table>

Note

Prolonged storage above +75 C degrades battery life
### A.4 Radio specifications

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency Band</td>
<td>2.4GHz - 2.4835GHz</td>
</tr>
<tr>
<td>Output Power</td>
<td>+8dBm</td>
</tr>
<tr>
<td>Receiver Sensitivity</td>
<td>-93dBm</td>
</tr>
<tr>
<td>Range</td>
<td>100m (outdoor +25°C, 50% RH)</td>
</tr>
</tbody>
</table>

### A.5 Device variable alert limits

This table shows the alert limits of the device variables.

**Table A-3: X Overall**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Unit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>X Overall</td>
<td>Saturated</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>X Overall</td>
<td>Sensor</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>X Overall</td>
<td>Range</td>
<td>5</td>
<td>0</td>
<td>in/s</td>
<td>Can be set by the user up to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>the sensor range</td>
</tr>
<tr>
<td>X Overall</td>
<td>Fail</td>
<td>1</td>
<td>Not Applicable</td>
<td></td>
<td>in/s</td>
</tr>
<tr>
<td>X Overall</td>
<td>Maint</td>
<td>0.35</td>
<td>Not Applicable</td>
<td></td>
<td>in/s</td>
</tr>
<tr>
<td>X Overall</td>
<td>Advise</td>
<td>0.14</td>
<td>Not Applicable</td>
<td></td>
<td>in/s</td>
</tr>
</tbody>
</table>

**Table A-4: Y Overall**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Unit</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y Overall</td>
<td>Saturated</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>Y Overall</td>
<td>Sensor</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>Y Overall</td>
<td>Range</td>
<td>5</td>
<td>0</td>
<td>in/s</td>
<td>Can be set by the user up to</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>the sensor range</td>
</tr>
<tr>
<td>Y Overall</td>
<td>Fail</td>
<td>1</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>Y Overall</td>
<td>Maint</td>
<td>0.35</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>Y Overall</td>
<td>Advise</td>
<td>0.14</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
</tbody>
</table>

**Table A-5: Z Overall**

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z Overall</td>
<td>Saturated</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
</tbody>
</table>
### Table A-5: Z Overall (continued)

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z Overall</td>
<td>Sensor</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>Z Overall</td>
<td>Range</td>
<td>5</td>
<td>0</td>
<td>in/s</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>Z Overall</td>
<td>Fail</td>
<td>1</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>Z Overall</td>
<td>Maint</td>
<td>0.35</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>Z Overall</td>
<td>Advise</td>
<td>0.14</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
</tbody>
</table>

### Table A-6: Z Peakvue

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z Peakvue</td>
<td>Error</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>250</td>
<td>Read-only</td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Unused</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>250</td>
<td>Read-only</td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Saturated</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Sensor</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Range</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Fail</td>
<td>40</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Maint</td>
<td>20</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>Z Peakvue</td>
<td>Advise</td>
<td>10</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
</tbody>
</table>

### Table A-7: IB1 Velocity

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB1 Velocity</td>
<td>Unused</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>250</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB1 Velocity</td>
<td>Saturated</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB1 Velocity</td>
<td>Sensor</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>IB1 Velocity</td>
<td>Range</td>
<td>5</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>IB1 Velocity</td>
<td>Fail</td>
<td>0.6</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>IB1 Velocity</td>
<td>Maint</td>
<td>0.21</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>IB1 Velocity</td>
<td>Advise</td>
<td>0.084</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
</tbody>
</table>
### Table A-8: IB2 Velocity

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB2 Velocity</td>
<td>Saturated</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB2 Velocity</td>
<td>Sensor</td>
<td>70</td>
<td>0</td>
<td>in/s</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB2 Velocity</td>
<td>Range</td>
<td>5</td>
<td>0</td>
<td>in/s</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>IB2 Velocity</td>
<td>Fail</td>
<td>0.3</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>IB2 Velocity</td>
<td>Maint</td>
<td>0.105</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
<tr>
<td>IB2 Velocity</td>
<td>Advise</td>
<td>0.042</td>
<td>0</td>
<td>in/s</td>
<td></td>
</tr>
</tbody>
</table>

### Table A-9: IB3 Accel

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB3 Accel</td>
<td>Saturated</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB3 Accel</td>
<td>Sensor</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB3 Accel</td>
<td>Range</td>
<td>50</td>
<td>0</td>
<td>g</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>IB3 Accel</td>
<td>Fail</td>
<td>10</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>IB3 Accel</td>
<td>Maint</td>
<td>7</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>IB3 Accel</td>
<td>4</td>
<td>0</td>
<td>g</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table A-10: IB4 Accel

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>IB4 Accel</td>
<td>Saturated</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB4 Accel</td>
<td>Sensor</td>
<td>100</td>
<td>0</td>
<td>g</td>
<td>Read-only</td>
</tr>
<tr>
<td>IB4 Accel</td>
<td>Range</td>
<td>50</td>
<td>0</td>
<td>g</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>IB4 Accel</td>
<td>Fail</td>
<td>15</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>IB4 Accel</td>
<td>Maint</td>
<td>10</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
<tr>
<td>IB4 Accel</td>
<td>Advise</td>
<td>6</td>
<td>0</td>
<td>g</td>
<td></td>
</tr>
</tbody>
</table>

### Table A-11: Machine Temperature

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Temperature</td>
<td>Saturated</td>
<td>95</td>
<td>-50</td>
<td>°C</td>
<td>Read-only</td>
</tr>
</tbody>
</table>
### Table A-11: Machine Temperature (continued)

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Machine Temperature</td>
<td>Sensor</td>
<td>95</td>
<td>-50</td>
<td>°C</td>
<td>Read-only</td>
</tr>
<tr>
<td>Machine Temperature</td>
<td>Range</td>
<td>95</td>
<td>-50</td>
<td>°C</td>
<td>Can be set by the user up to the sensor range</td>
</tr>
<tr>
<td>Machine Temp</td>
<td>Fail</td>
<td>75</td>
<td>-40</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Machine Temperature</td>
<td>Maint</td>
<td>70</td>
<td>-35</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>Machine Temperature</td>
<td>Advise</td>
<td>65</td>
<td>-30</td>
<td>°C</td>
<td></td>
</tr>
</tbody>
</table>

### Table A-12: Supply Voltage

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supply Voltage</td>
<td>Saturated</td>
<td>3.75</td>
<td>0</td>
<td>V</td>
<td>Read-only</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>Sensor</td>
<td>3.75</td>
<td>0</td>
<td>V</td>
<td>Read-only</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>Range</td>
<td>3.7</td>
<td>2.3</td>
<td>V</td>
<td>Read-only</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>Fail</td>
<td>Not Applicable</td>
<td>2.7</td>
<td>V</td>
<td>Read-only</td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>Maint</td>
<td>Not Applicable</td>
<td>2.85</td>
<td>V</td>
<td></td>
</tr>
<tr>
<td>Supply Voltage</td>
<td>Advise</td>
<td>Not Applicable</td>
<td>3</td>
<td>V</td>
<td></td>
</tr>
</tbody>
</table>

### Table A-13: Speed

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Saturated</td>
<td>10000</td>
<td>0</td>
<td>rpm</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
<tr>
<td>Speed</td>
<td>Sensor</td>
<td>10000</td>
<td>0</td>
<td>rpm</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
<tr>
<td>Speed</td>
<td>Range</td>
<td>3000</td>
<td>0</td>
<td>rpm</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
</tbody>
</table>
### Table A-13: Speed (continued)

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed</td>
<td>Fail</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>rpm</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
<tr>
<td>Speed</td>
<td>Maint</td>
<td>Not Applicable</td>
<td>Not Applicable</td>
<td>rpm</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
<tr>
<td>Speed</td>
<td>Advise</td>
<td>2000</td>
<td>1600</td>
<td>rpm</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
<tr>
<td>Mechanical Condition</td>
<td>Saturated</td>
<td>1000</td>
<td>0</td>
<td>None</td>
<td>Limits calculated by device and not user settable.</td>
</tr>
</tbody>
</table>

### Table A-14: Mechanical Condition

<table>
<thead>
<tr>
<th>Axis</th>
<th>Severity</th>
<th>Upper Limit</th>
<th>Lower Limit</th>
<th>Units</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical Condition</td>
<td>Sensor</td>
<td>1000</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Mechanical Condition</td>
<td>Range</td>
<td>100</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Mechanical Condition</td>
<td>Fail</td>
<td>70</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Mechanical Condition</td>
<td>Maint</td>
<td>40</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Mechanical Condition</td>
<td>Advise</td>
<td>10</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Axis</td>
<td>Severity</td>
<td>Upper Limit</td>
<td>Lower Limit</td>
<td>Units</td>
<td>Notes</td>
</tr>
<tr>
<td>-------------------</td>
<td>----------</td>
<td>-------------</td>
<td>-------------</td>
<td>-------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Lubrication</td>
<td>Saturated</td>
<td>1000</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Condition</td>
<td>Sensor</td>
<td>1000</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Lubrication</td>
<td>Range</td>
<td>100</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Condition</td>
<td>Fail</td>
<td>70</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Lubrication</td>
<td>Maint</td>
<td>40</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
<tr>
<td>Condition</td>
<td>Advise</td>
<td>10</td>
<td>0</td>
<td>None</td>
<td>Limits constant in the device and not user-settable.</td>
</tr>
</tbody>
</table>
B  Product certifications

Note
For specific device certifications, always refer to the product nameplate and markings on
the device.

B.1  Approved manufacturing locations

Emerson
835 Innovation Drive
Knoxville, TN 37932 USA
T: +1 865-675-2400

Benchmark Electronics (Thailand) Plc.
109 moo.4, Chaimongkol, Muang, Nakorn Ratchasima
Thailand 30000
T: +66 44-233-800

B.2  Wireless certifications

Telecommunications compliance
All wireless devices require certification to ensure that they adhere to regulations
regarding the use of the RF spectrum. Nearly every country requires this type of product
certification. Emerson works with governmental agencies around the world to supply fully
compliant products and remove the risk of violating country directives or laws governing
wireless device usage.

Emerson complies with the Radio and Equipment Directive.

FCC approvals
This equipment has been tested and found to comply with the limits for a Class B digital
device, pursuant to part 15 of the FCC rules. These limits are designed to provide
reasonable protection against harmful interference in a residential installation. This
equipment generates, uses and can radiate radio frequency energy and, if not installed
and used in accordance with the instructions, may cause harmful interference to radio
communications. However, there is no guarantee that interference will not occur in a
particular installation. If this equipment does cause harmful interference to a radio or
television reception, which can be determined by turning the equipment off and on, the
user is encouraged to try to correct the interference by one or more of the following
measures:

• Reorient or relocate the receiving antenna.
• Increase the separation between the equipment and receiver.
• Connect the equipment into an outlet on a circuit different from that to which the
  receiver is connected.
• Consult the dealer or an experienced radio/TV technician for help.
• This device must be installed to ensure a minimum antenna separation distance of 20cm from all persons.

⚠️ CAUTION

Changes or modification not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

ISED approvals
This device 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 two conditions:

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

Cet appareil contient des émetteurs / récepteurs exemptés de licence qui sont conformes aux RSS exempts de licence d’Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:

1. Cet appareil ne doit pas provoquer d’interférences.
2. Cet appareil doit accepter toute interférence, y compris les interférences pouvant entraîner un fonctionnement indésirable de l’appareil.

Radio approvals

Table B-1: Radio Approvals

<table>
<thead>
<tr>
<th>Country</th>
<th>ANATEL</th>
<th>Pending</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Canada</td>
<td>IC: 3434A-A9530M1</td>
<td></td>
</tr>
<tr>
<td>Ecuador</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hong Kong</td>
<td></td>
<td>Pending</td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td>Pending</td>
</tr>
<tr>
<td>Mexico</td>
<td></td>
<td>Pending</td>
</tr>
<tr>
<td>Philippines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table B-1: Radio Approvals (continued)

<table>
<thead>
<tr>
<th>Country</th>
<th>Approval Body</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serbia</td>
<td></td>
<td>Pending</td>
</tr>
<tr>
<td>Singapore</td>
<td></td>
<td>Pending</td>
</tr>
<tr>
<td>South Africa</td>
<td></td>
<td>Pending</td>
</tr>
<tr>
<td>US</td>
<td></td>
<td>NL5-A9530M1 Model: A9530V1, A9530V3</td>
</tr>
</tbody>
</table>

**Note**
The table above does not include all countries for which certificates have been issued. For a complete list, please contact your local Emerson Sales Representative.

**B.3 Ordinary location certification (CSA)**

As standard, the transmitter has been examined and tested to determine that the design meets basic electrical, mechanical, and fire protection requirements by CSA, a nationally recognized testing laboratory (NRTL) as accredited by the Federal Occupational Safety and Health Administration (OSHA).

**Electromagnetic Compatibility (EMC) (2014/30/EU)**

All Models: EN 61326-1

**Canadian Standards Association (CSA)**

CAN/CSA-C22.2 No. 61010-1-04 - Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use, Part 1: General Requirements

ISA S82.02.01 2nd (IEC 61010-1 Mod) - Safety Standards for Electrical and Electronic Test, Measuring, Controlling and Related Equipment - General Requirements

UL 61010-1 2nd - Safety Requirements for Electrical Equipment for Measurements, Control, and Laboratory Use, Part 1: General Requirements

**B.4 CE mark**

The device has been tested and complies with all relevant directives required for CE marking.
<table>
<thead>
<tr>
<th>Country</th>
<th>Restriction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulgaria</td>
<td>General authorization required for outdoor use and public service.</td>
</tr>
<tr>
<td>Italy</td>
<td>If used outside of own premises, general authorization is required.</td>
</tr>
<tr>
<td>Norway</td>
<td>May be restricted in the geographical area within a radius of 10 km from the center of Ny-Alesund.</td>
</tr>
<tr>
<td>Romania</td>
<td>Use on a secondary basis. Individual license is required.</td>
</tr>
</tbody>
</table>
B.5 Hazardous locations certifications

Model No.: A9530

Product Name: Wireless Vibration Monitor

The AMS Wireless Vibration Monitor carries certificates for operation in hazardous locations.

Table B-2: Hazardous locations certifications

<table>
<thead>
<tr>
<th>Certification Type</th>
<th>Conditions</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSA C/US Certificate</td>
<td>Class I Division 1 Groups A, B, C, D</td>
<td>-40°C ≤ Ta ≤ +85°C</td>
</tr>
<tr>
<td>CSA20CA80026524</td>
<td>Class I Zone 0 AEx / Ex ia IIC T4 Ga</td>
<td>Type 4X Enclosure</td>
</tr>
<tr>
<td>IECEx Certificate IECEx CSA 20.0002X</td>
<td>Ex ia IIC T4 Ga</td>
<td>Ta: -40°C to +85°C</td>
</tr>
<tr>
<td>ATEX Certificate CSANe 20ATEX2042X</td>
<td>II 1 Ex ia IIC T4 Ga</td>
<td>-40°C ≤ Ta ≤ +85°C</td>
</tr>
<tr>
<td></td>
<td>IP66</td>
<td></td>
</tr>
</tbody>
</table>

Other approvals

For a complete list of approvals, see the product page at http://www.emerson.com/AMSVibrationMonitor.

Conditions for Safe Use

1. Shall be powered only by C-sized lithium primary cell type TL-4920/VE manufactured by Tadiran or Emerson Part Number A0702PPU.

2. HART Terminal Entity Parameters:
   - Uo = 5.84V, Io = 116mA, Po = 169mW, Co = 0.1µF, Lo = 5mH;
   - Ui = 5.27V, Ii = 5mA, Pi = 6.6mW, Ci = 13 µF, Li = 0.022mH

3. The device may be configured using the HART terminals only by 375, 475, or TREX field communicators.

4. Under certain extreme circumstances, the non-metallic parts incorporated in the enclosure of this equipment may generate an ignition-capable level of electrostatic discharge. Therefore, the equipment shall not be installed in a location where the external conditions are conductive to the build-up of electrostatic charge on such surfaces. In addition, the equipment shall only be cleaned with a damp cloth.

5. The device shall be installed on an earthed metal frame.

Note

Battery may be replaced in hazardous locations. Only replace battery with Tadiran Part Number TL-4920/VE or Emerson Part Number A0702PPU.
**Note**
The markings that appear on the monitor housing determine whether a device is suitable for operation in a specific hazardous location. This further requires that the monitor is operated in accordance with the installation drawings provided with the unit.

**Conditions d'utilisation sûre:**

1. Ne doit être alimenté que par une cellule primaire au lithium de taille C de type TL-4920/VE fabriquée par Tadiran ou Emerson Part Number A0702PPU.

2. Paramètres d'entité de terminal HART:
   - $U_o = 5.84 \text{ V}$, $I_o = 116 \text{ mA}$, $P_o = 169 \text{ mW}$, $C_o = 0.1 \mu\text{F}$, $L_o = 5 \text{ mH}$;
   - $U_i = 5.27 \text{ V}$, $I_i = 5 \text{ mA}$, $P_i = 6.6 \text{ mW}$, $C_i = 13 \mu\text{F}$, $L_i = 0.022 \text{ mH}$

3. L’appareil ne peut être configuré à l’aide des terminaux HART que par des communicateurs de terrain 375, 475 ou TREX.

4. Dans certaines circonstances extrêmes, les pièces non métalliques incorporées dans le boîtier de cet équipement peuvent générer un niveau de décharge électrostatique capable d’allumage. Par conséquent, l’équipement ne doit pas être installé dans un endroit où les conditions externes conduisent à l’accumulation de charges électrostatiques sur de telles surfaces. De plus, l’équipement ne doit être nettoyé qu’avec un chiffon humide.

5. L’appareil doit être installé sur un cadre métallique mis à la terre.

**Warnings:**

1. Care should be taken to protect this device from impact or abrasion if located in a zone 0 environment.

2. Substitution of components may impair intrinsic safety.

3. The battery may present a potential electrostatic ignition hazard. Use Caution when replacing the battery.

**Avertissements:**

1. Des précautions doivent être prises pour le protéger des chocs ou de l’abrasion s’il est situé dans un environnement de zone 0.

2. La substitution de composants peut compromettre la sécurité intrinsèque.

3. La batterie peut présenter un risque potentiel d’allumage électrostatique. Soyez prudent lors du remplacement de la batterie.

**List of Standards:**

**IEC:**
- IEC 60079-0 7th Edition, December 2017

**ATEX:**
- EN IEC 60079-0:2018
- EN 60079-11:2012
**North America:**

CAN/CSA C22.2 No. 61010-1-12
UL Std. No. 61010-1 3rd Ed.
CAN/CSA C22.2 No. 60079-0 7th Ed.: 2019
UL 60079-0 7th Ed.: 2019
CAN/CSA C22.2 No. 60079-11 6th Ed.: 2014
UL 60079-11: 6th Ed.: 2013
CAN/CSA-C22.2 No. 60529 Ed. 2.2: 2016
ANSI/IEC 60529-2004 (R2011)
CAN/CSA-C22.2 No. 94.2-2007 (R2012)
UL 50E 2015

### B.6 Waste Electrical and Electronic Equipment

Marking for the Waste of Electrical and Electronic Equipment in accordance with Article II (2) of Directive 2012/19/EU (WEEE). The European Directive 2012/19/EU requires marking:

- That applies to electrical and electronic equipment falling under Annex 1 Category 9 of Directive 2012/19/EU.

- That serves to clearly identify the producer of the equipment and that the equipment has been put on the market after 13 August 2005.

- That the crossed out wheeled bin alerts the end-user to dispose this equipment via the special recycling procedure for electrical and electronic equipment that is applicable in the country of use.

- The shown marking is attached to the product and identifies the product to fall within the scope of this directive.
C Third-party licenses

C.1 Dust SmartMeshSDK C Library

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