TIMKEN

TIMKEN® WIRELESS SENSOR AND MONITORING SOLUTION

USER MANUAL

CONTENTS

1: INTRODUCTION AND WARNINGS

This User Manual covers the use of the Timken® Wireless Sensor and Monitoring Solution. Please visit www.timkensensor.com for more information and resources, including the quick-start guide, instruction videos, FAQ, the Terms of Use that apply to your use of this system, safety information, and important product warnings. Please review all available information before installing and using this system.

YOUR USE OF THE TIMKEN WIRELESS SENSOR AND MONITORING SOLUTION IS SUBJECT TO THE TERMS OF USE AT WWW.TIMKENSENSOR.COM/TERMSOFUSE, WHICH YOU SHOULD REVIEW BEFORE BEGINNING INSTALLATION OR USE OF THE SYSTEM. IF YOU INSTALL OR USE THE SYSTEM, YOU ARE AGREEING TO BE BOUND BY THESE TERMS. IF YOU DO NOT AGREE TO THESE TERMS, DO NOT INSTALL OR USE THE SYSTEM AND INSTEAD RETURN THE PRODUCTS INCLUDING ALL ACCOMPANYING WRITTEN MATERIALS AND THEIR RESPECTIVE CONTAINERS WITHIN 30 DAYS OF RECEIPT TO THE PLACE YOU OBTAINED IT. ALL RETURNS ARE SUBJECT TO TIMKEN'S THEN CURRENT RETURN POLICY.

⚠WARNING
Failure to observe the following warnings could create a risk of death or serious injury.

Please review all available information and these product warnings before installing and using this system. These warnings provide important information about the suitability of the Timken Wireless Sensor and Monitoring Solution for your particular application or environment and the safe installation and use of the system.

1.1: Application and Environment

The Timken Wireless Sensor and Monitoring Solution is not for use in life- or safety-critical systems, or any other application or environment requiring unconditional and uninterrupted reliability in order to safeguard the security of people, tangible or intangible property, or environmental harm, including, but not limited to, nuclear related activities, mass transportation, air transportation navigation/communication, air traffic control systems, and life-saving or life-sustaining systems or equipment and similar medical devices.

NOT RATED FOR USE IN EXPLOSIVE ENVIRONMENTS (e.g., not rated IECEx, ATEX, NEC, CEC). NEVER use the Timken Wireless Sensor and Monitoring Solution in a location with an explosive environment, such as where gases, vapors, dusts, or fibers are or may be present in sufficient quantities to cause an explosion or fire.

The Timken Wireless Sensor and Monitoring Solution should be regarded as one of several tools and processes for monitoring the condition of equipment, and not as the sole or primary means of such monitoring. DO NOT rely solely or primarily upon the Timken Wireless Sensor and Monitoring Solution to monitor the condition of equipment.

1.2: Installation

The Timken Wireless Sensor and Monitoring Solution MUST be installed in accordance with and by persons familiar with all installation instructions, applicable laws and codes, and industry practices.

Before installing the sensor, turn off power to equipment onto which sensor is being installed, allow equipment to cool, measure surface to confirm cooling, and USE lock-out-tag-out procedures.

1.3: Sensor Batteries

DO NOT expose the sensor to excessive mechanical, thermal, or electrical loads, as this could cause the battery container to rupture.

DO NOT allow the sensor to be exposed to heat above 100º C (212º F).

Because the sensors contain non-replaceable lithium thionyl chloride batteries, they are classified as hazardous materials during transport. The sensor must be transported in accordance with applicable legal requirements. Defective sensors must not be sent by air freight; contact manufacturer or your supplier for more information on how to transport a sensor containing a damaged or defective battery. Sensors must be deactivated during transport, see User Manual for deactivation instructions.

DO NOT open the sensor and DO NOT attempt to remove or replace battery in the sensor. Battery is not replaceable. Upon end of battery life, you MUST dispose of the entire sensor in accordance with local regulations. Do not dispose of the sensor as unsorted municipal waste; take them for recycling (or, in locations where recycling is unavailable, another hazardous waste collection point). For information on your nearest recycling or hazardous waste collection point, check with your local waste authority.

1.4: General

DO NOT attempt to repair or modify the sensor or the gateway. Neither product has any parts that can be serviced by the user.

KEEP OUT OF REACH OF CHILDREN.

DO NOT use the gateway (enclosed version) without the finger guard of the power cable connector.

USE ONLY the power supply cord provided with the gateway.

2: SPECIFICATIONS

2.1: Sensor Specifications

Vibration

- Acceleration measurement on 3-axis Axial,
- Horizontal and Radial
- Dynamic range +/- 4G (configurable to 2, 4, 8 or 16)
- Frequency range 10-1000Hz
- Sampling rate 6600Hz
- Resolution 16-bit

Temperature

- Measurement range -40°F to 212°F (-40°C to +100 °C)
- Resolution 32.18°F (0.1°C)
- Accuracy +/- 32.54° F (+/- 0.3°C) (mounting dependent)
- Repeatability +/- 32.18°F (+/- 0.1°C)

Wireless communication

- 2.4GHz / Wirepas Mesh

Battery

- 3.6V lithium thionyl chloride
- Battery lifetime est. 5 years (Battery life is dependent on operating temperature and configuration)

Dimensions

- 3 13/16" total height (96.83 mm)
- 3 3/8" body height (85.73 mm)
- Mounting to 1/8-27 NPT thread
- Weight .34 lbs (152g)
- Cover material 316 ss
- Top cap material PE HD

Environment

- Operating -40°F to 185°F (-40°C to + 85 °C)
- Storage 86° F maximum (30 °C maximum)
- IP67

Certifications

- CE, FCC, ISED

Software

- Device management via the application
- Software updates
- Changing measurement interval

2.2: Gateway Specifications

Features

- Connect sensors via Wirepas mesh.
- Two connectivity options. Wireless with 2.4GHz Wi-Fi and wired Ethernet connection.

Common Specifications

- Dimensions: 3.84in x 72in. (ø95mm x 18.3mm)
- Weight: .19 lbs (85g)

Materials

- Cover material: Polycarbonate

Environment

- Operating temperature: 32° F to 155°F (0°C to +50°C)
- Storage temperature: -40° F to 85° F (-40°C to +85°C)

Technical Specifications

Power supply

- Power supply 5V DC

Hardware

- ARM Cortex-A8 1GHz Processor
- 1 GB DDR3L RAM
- 16 GB eMMC Storage

Connectivity

- Ethernet
- Wi-Fi, 2.4GHz 802.11b/g/n
- Wirepas 2.4GHz

Software (Timken Dashboard)

- Measure triaxial vibration
- Measure temperature
- Set alert thresholds
- Create and manage groups
- Detect anomalies
- Email alerts

2.3: Enclosed Gateway Specifications

Features

- Enclosure with IP66/IP67 rating for rough conditions.
- Two connectivity options. Wireless with 2.4GHz Wi-Fi and wired Ethernet connection.

Common Specifications

- Dimensions: 7 in x 5 in x 3.19 in (180 x 130 x 81mm) (excluding cable sealing clamps)
- Weight: 1.4lb (632g) without power cord
- Mounting: Wall mounting with wall mounting lugs

Materials

- Cover: Polycarbonate
- Gasket: TPE

Environment

- Operating temperature: -4°F to + 122°F (-20°C to +50°C)
- Storage temperature: -40°F to +185°F (-40°C to +85°C)
- Humidity: 20 to 90%, noncondensing pressure equalizer

Ratings

- IP rating: IP66/IP67 enclosure, IP44 integrated power cord
- Impact Resistance: IK08 (EN 62262)

Technical Specifications

Power supply

- Voltage range 85 to 264 VAC
- Frequency range 47 to 440 Hz
- Power consumption 30VA max

Gateway Hardware

- ARM Cortex-A8 1GHz Processor
- 1 GB DDR3L RAM
- 16 GB eMMC Storage
- Power supply 5V DC

Connectivity

- Ethernet
- Wi-Fi, 2.4GHz 802.11b/g/n
- Wirepas 2.4GHz

Software (Timken Dashboard)

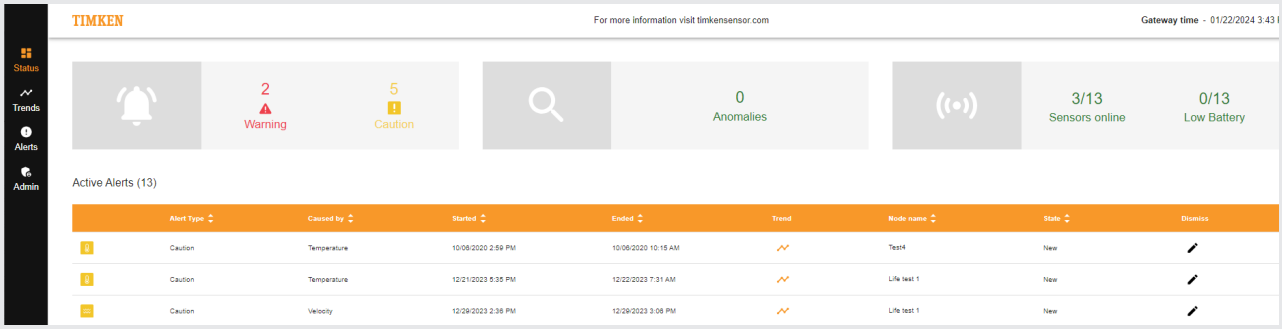
- Measure triaxial vibration
- Measure temperature
- Set alert thresholds
- Create and manage groups
- Detect anomalies
- Email alerts

3: DASHBOARD SECTIONS OVERVIEW

3.1: Status

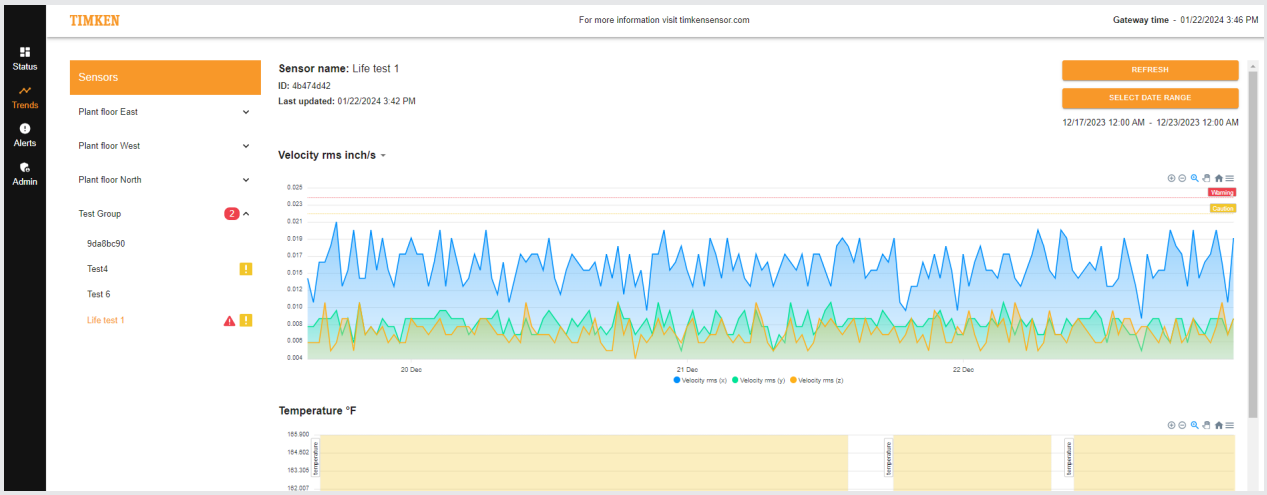
Landing page for the dashboard. Provides an overview of your system, including any alerts, warnings, anomalies, and whether any sensors are offline or low battery.

Gateway time is visible in the top right.



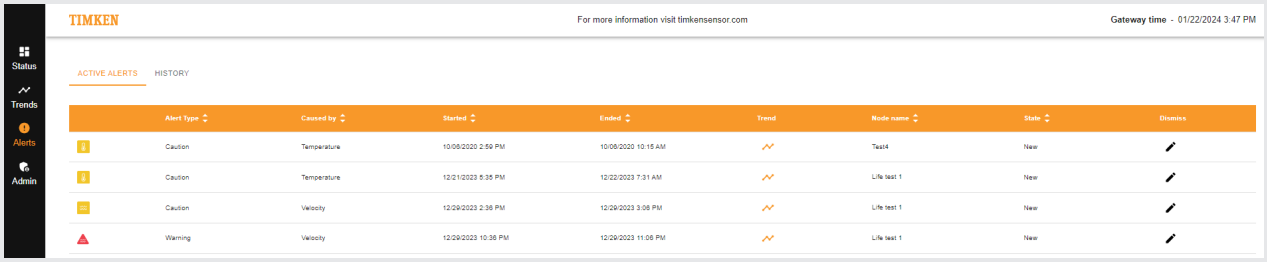
3.2: Trends

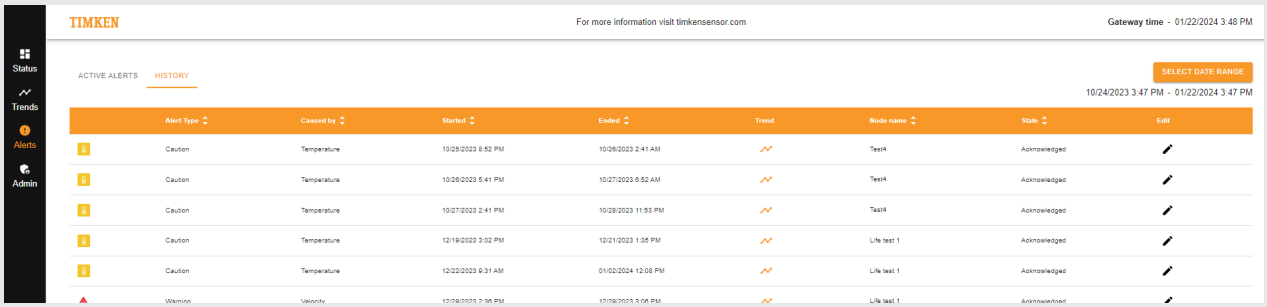
View groups of sensors, individual graphs for vibration, temperature, and battery voltage, and export data. Date range is customizable.



3.3: Alerts

List of alerts that are New or Active. Can dismiss alerts and view alert history.





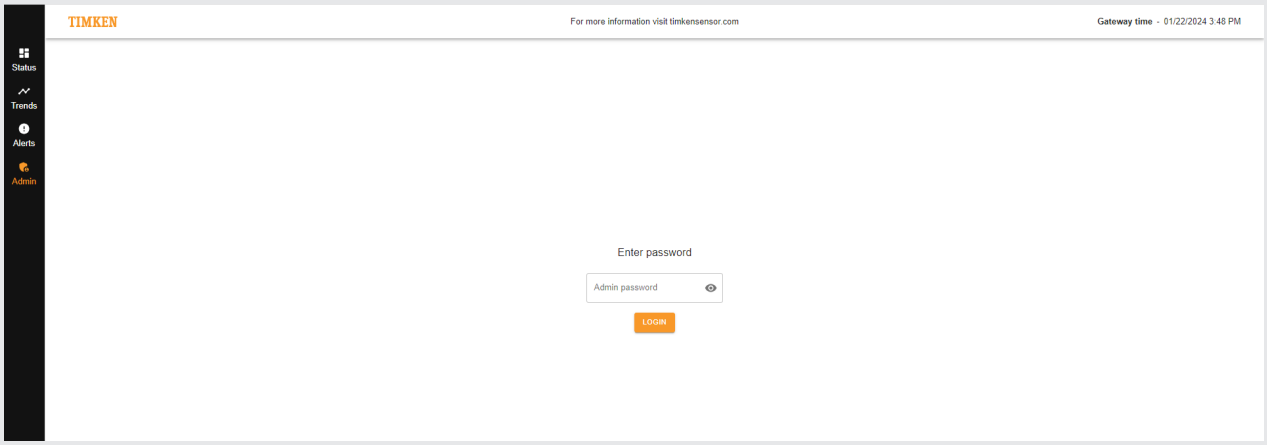
3.4: Admin

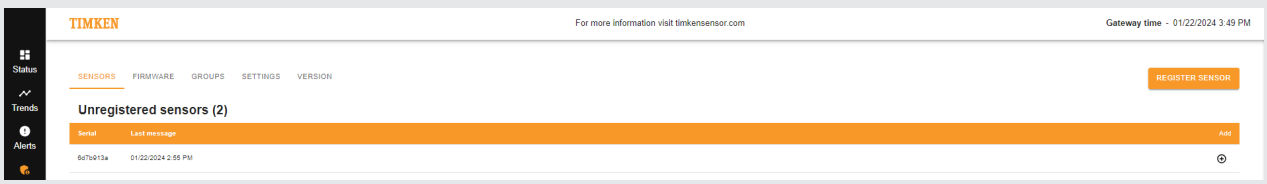
Requires password to enter (see bottom of the gateway).

Password protection allows for separation of access levels in case some users are not intended to change settings.

Configure sensors, update firmware, manage groups, configure gateway settings, and check version data.

Sub-sections include Sensors, Firmware, Groups, Settings, and Version.





4: SENSOR SETUP

4.1: Distance from the Gateway

The gateway must be kept in a place close enough to the sensors to receive data.

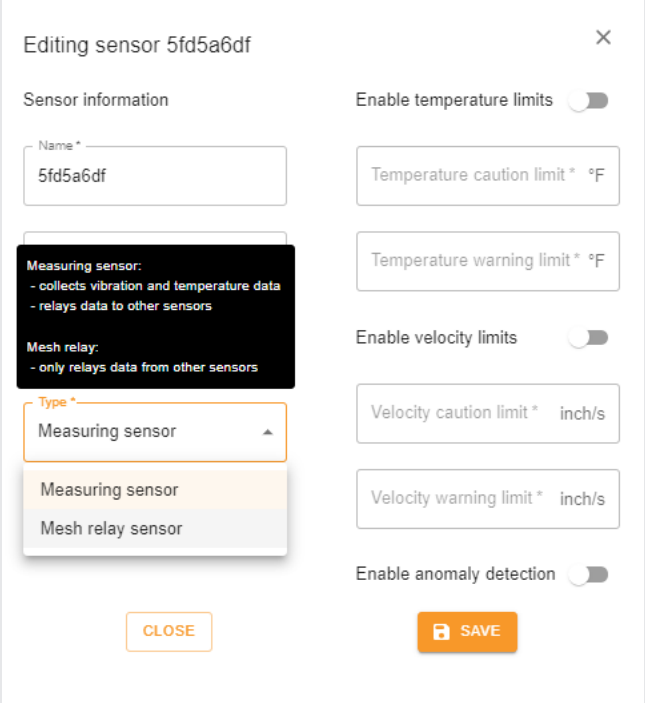
The maximum distance between the Timken® Gateway and the nodes, and in-between nodes, can vary from 50 feet to up to 150 feet, depending on the individual deployment environment. A clear line of sight between devices will help a longer distance and optimal conditions for radio transmission.

Every sensor is able to route data, even if set up as a Measuring sensor. So long as a sensor is in range of another sensor that is linked to the gateway, it can still pass data through to the gateway.

4.2: Mesh Network

If a gateway must be placed too far from the sensors to effectively receive data (whether due to power outlet location, ethernet port location, or other factors), additional sensors can be used to bridge the gap.

When registering a sensor or in the "Edit Sensor" menu, choose the "Mesh relay sensor" option under the "Type" field. Selecting this option causes the sensor to act as a data pass-through but not transmit data of its own.



Measuring sensors can relay data as well. In this way a large network of sensors can be established even if only one sensor is physically near the gateway.

Wirepas Mesh is a low-power wireless connectivity protocol. Based on mesh network architecture, all the nodes in the network are homogeneous and make all connection decisions depending on the local radio environment. Wirepas operates on 2.4GHz.

4.3: Maximum Nodes Per Gateway

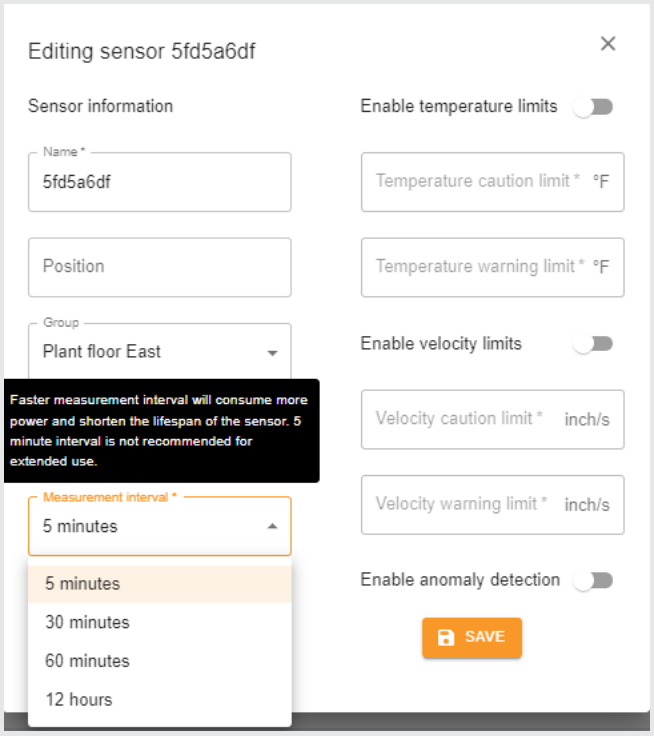
The gateway supports up to 14 nodes connected directly. The number of nodes connected within the mesh network is not limited, but there may be some slowdown if the number of nodes exceeds 50.

It is not recommended to use an additional gateway in a single deployment. Once registered to a gateway, nodes cannot transfer to another gateway.

4.4: 5-Minute Interval

When setting up sensors, the 5-minute interval can be used to more quickly see if the sensors are transmitting data to the gateway.

However, once connection has been established, a longer interval is recommended. Extended use of the 5-minute interval will significantly reduce the sensor battery life.



5: SETTING UP ALERTS

5.1: How to Set Alerts

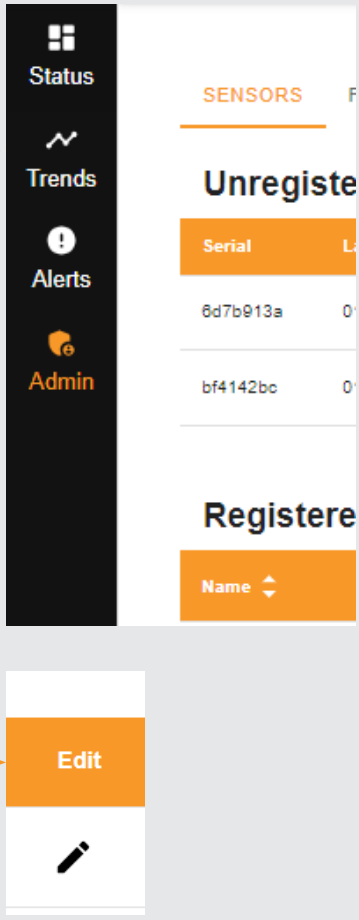
Go to the “Sensors” Subsection of the Admin Section.

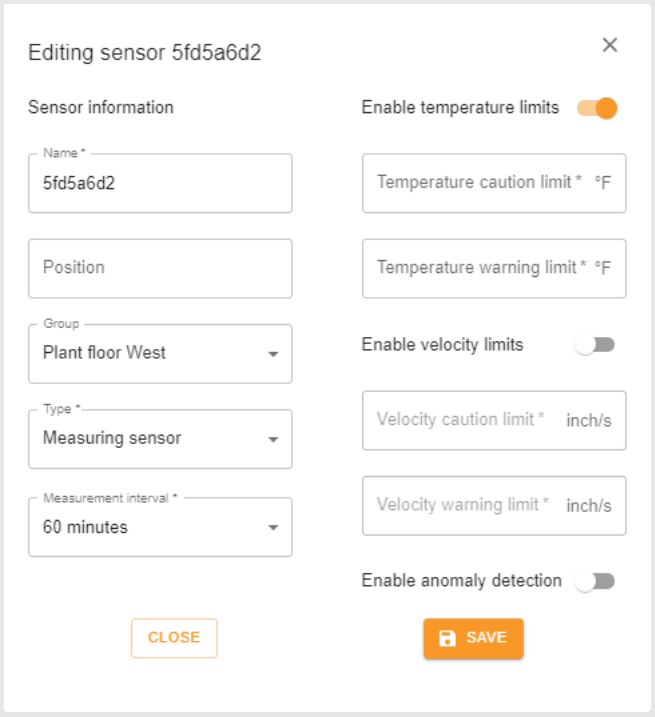
Click the Pencil icon under “Edit” next to the sensor you wish to change.

The menu then pops up with various options. In addition to changing the sensor name and assigning a group, you can enable either temperature limits, velocity limits, or both.

The button slides to the right and turns orange when successfully enabled. Next, values must be entered for “Caution limit” (yellow alert) and “Warning limit” (red alert).

Press Save when finished.





5.2: Deciding Alert Values

5.2.1: Variability Inherent in Setups

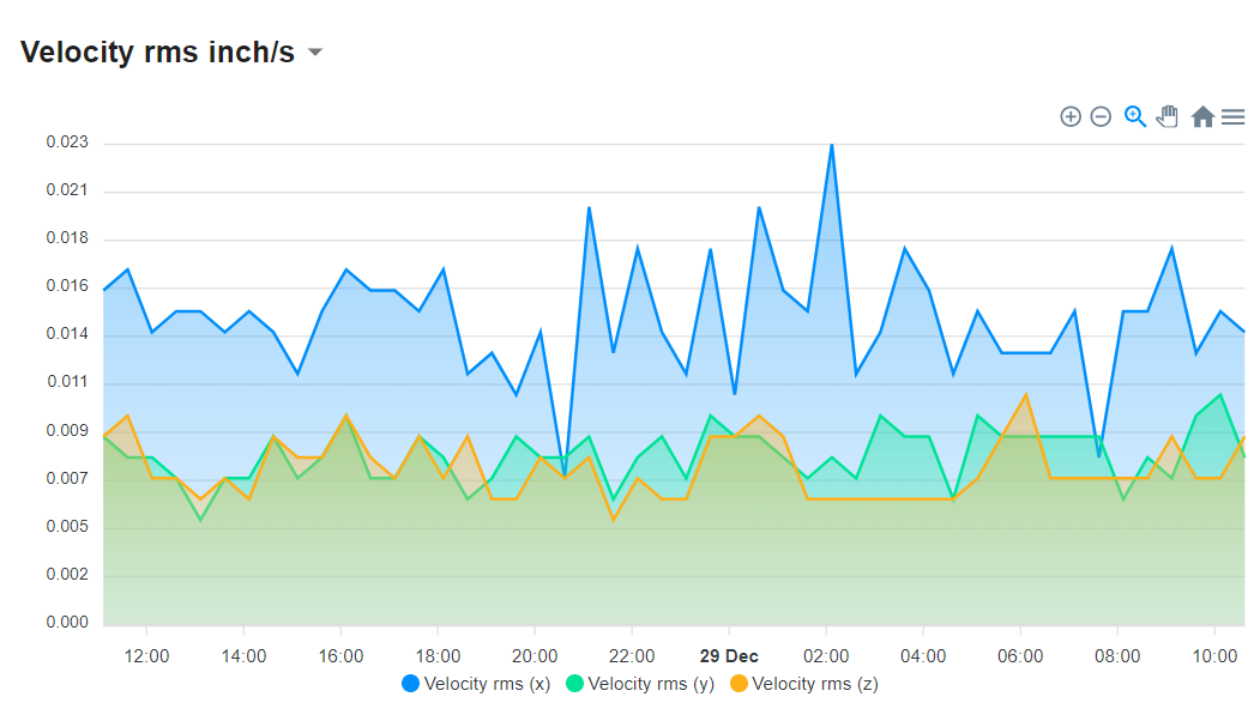
There is a vast and diverse range of applications where Timken Wireless Sensors can be used. Normal operating temperature and vibration is challenging to specify in advance. Factors such as ambient temperature, machine temperature and vibration, adapter usage, and distance of the sensor from the equipment can all impact the readings. Therefore, users must select alert levels based on their own individual situations and setups.

5.2.2: Setting Initial Values

After sensors are mounted, registered, and connected to the gateway, they will begin to collect data. It is recommended to use data gathered during normal operation to establish alert levels. Once normal levels are known, alert levels can be established to detect any changes. Exact values will vary by application and need to be monitored by the user.

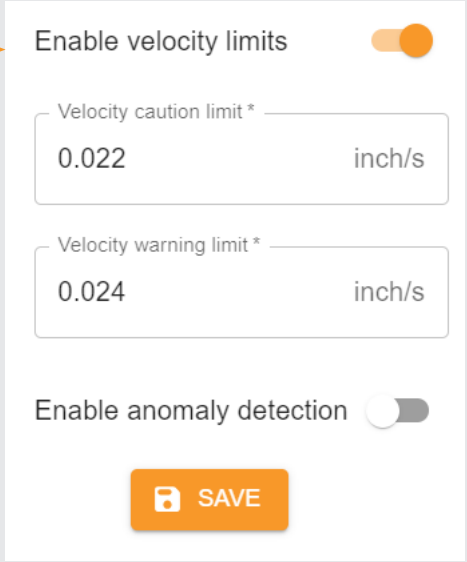
5.2.3: Example Alert Setup

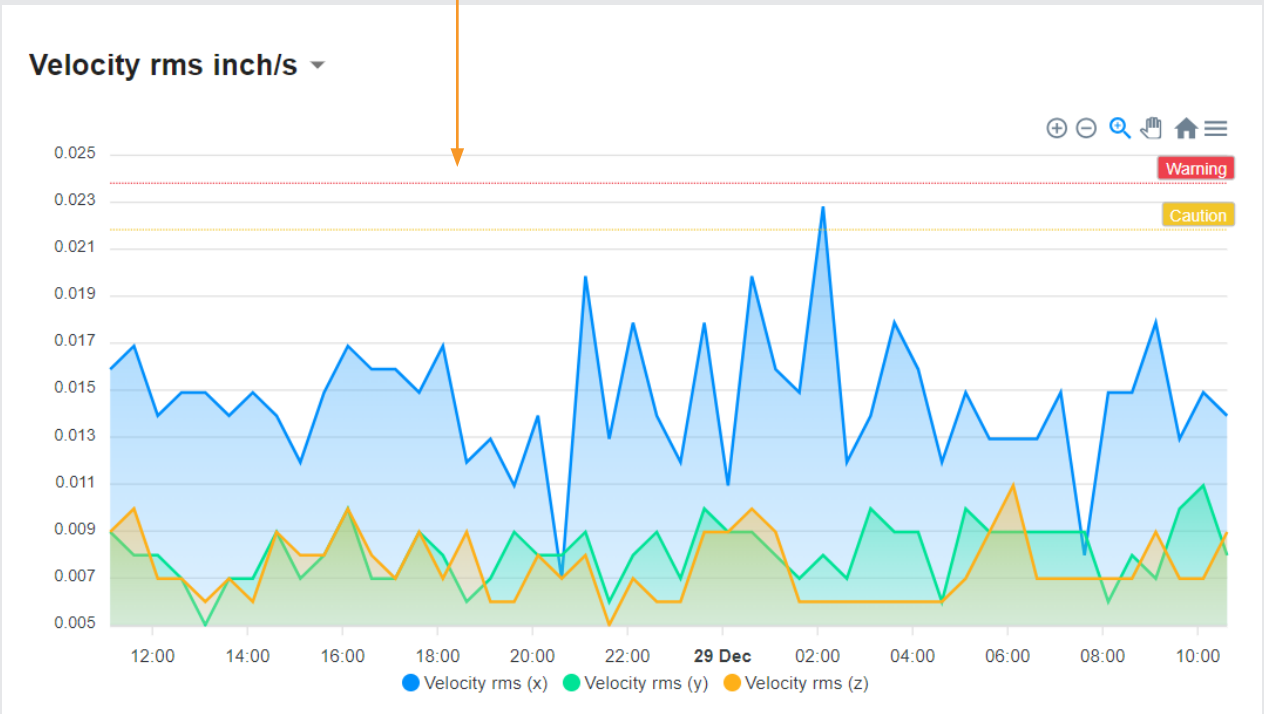
Initial data shows vibration levels up to 0.023.



To detect changes from this baseline, a user could choose to set alerts at 0.022 (yellow alert) and 0.024 (red alert).

When saved, these settings will appear on the graph.



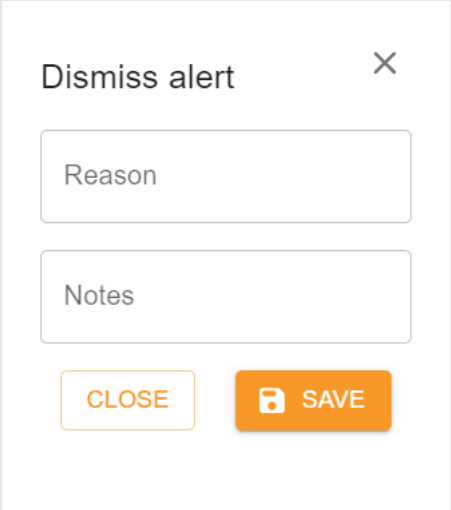


5.3: Dismissing Alerts

5.3.1: How to Dismiss an Alert

For an active alert, click the “Edit” icon to dismiss. This can be done either from the Status page or the Alerts page.

A menu will appear:



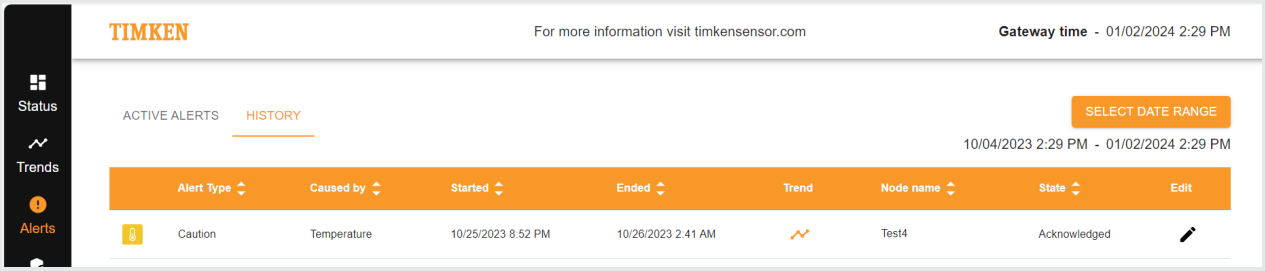
A minimum of one character must be entered into the “Reason” field to be able to save. The “Notes” field is optional. Press “Save” to complete the dismissal.

5.3.2: Effect of Dismissing an Alert

Once an alert is dismissed, a confirmation message will appear.

The alert then moves to the “History” tab visible on the Alerts page and its state is updated to “Acknowledged.”

Alerts can still be viewed and edited here even after being dismissed.



5.3.3: Alert Recurrence

Once an alert is dismissed, it will not reappear if the conditions that triggered the alert persist without going back below the threshold.

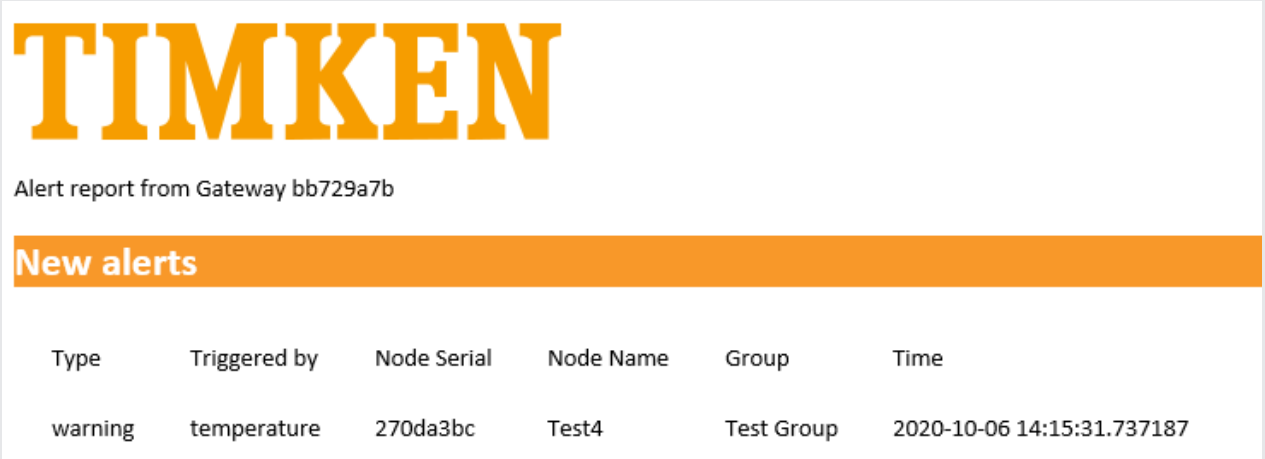
For example:

- A temperature alert is set at 140 degrees.
- The sensor measures 141 degrees, generating an alert.
- The alert is dismissed.
- Next, additional readings continue to come in.
  - If the temperature remains above 140 degrees – **no new alert**.
  - If the temperature drops below 140 degrees, and then climbs above it again – **new alert generated**.

5.4: Alert Emails

If enabled, emails will be sent either instantly when an alert is triggered or at the end of the day in a single summary email.

Emails will contain details about each warning and when it was triggered.



TIMKEN

Alert report from Gateway bb729a7b

New alerts

Type	Triggered by	Node Serial	Node Name	Group	Time
warning	temperature	270da3bc	Test4	Test Group	2020-10-06 14:15:31.737187

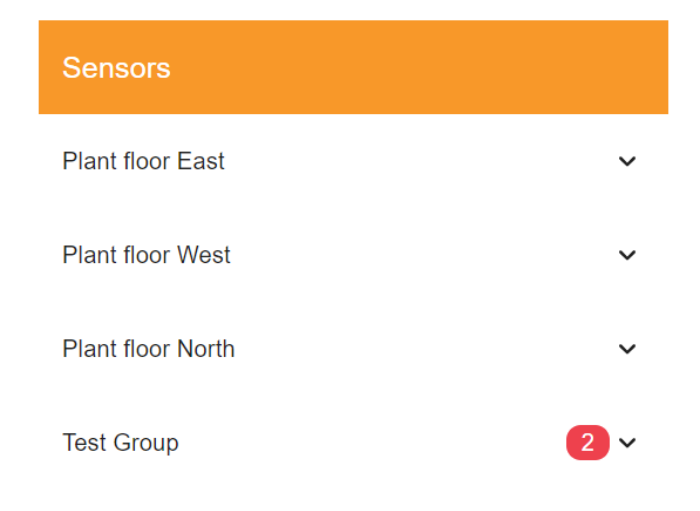
5.5: Miscellaneous Alert Information

5.5.1: Icons

In the Trends page, icons will appear next to any sensors with active alerts. Yellow for Caution, Red for Warning:

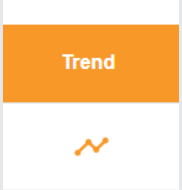
If anomaly detection is enabled (after an appropriate learning period has passed), anomalies will appear as a Blue alert icon:

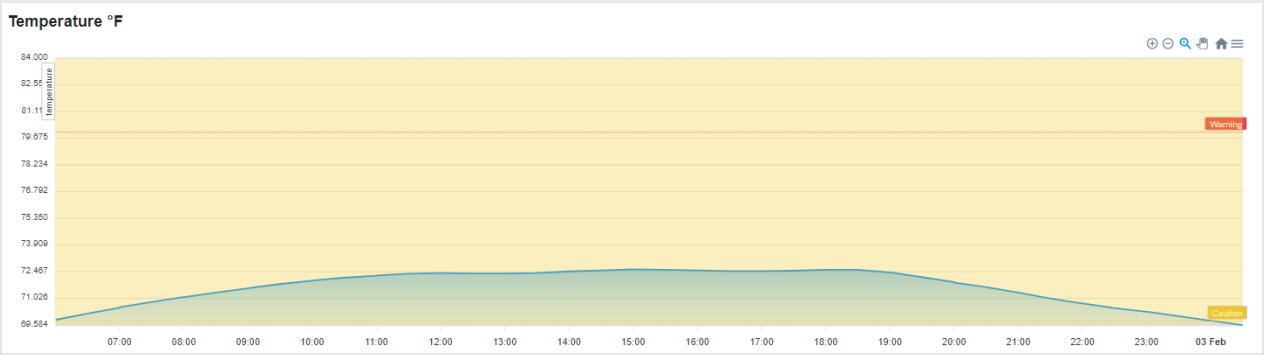
Any groups that have alerts will have the number of sensors with alerts next to the group name. Groups can be expanded to view individual sensors.



5.5.2: Graphical View

In the Alerts page, clicking the “Trend” icon on an alert will take you to a graphical view of the time when the alert was triggered.





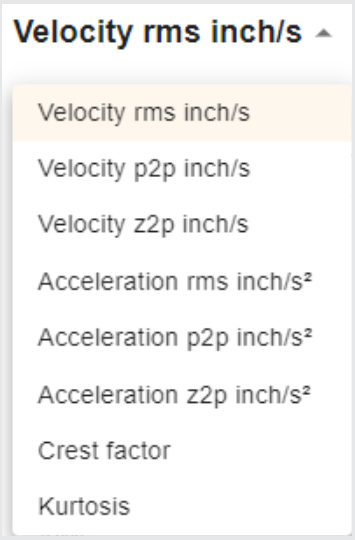
6: TRENDS SECTION OPERATION

6.1: Defaults

The Trends section defaults to showing the most recent 24-hour period.

6.1.1: Vibration Graph

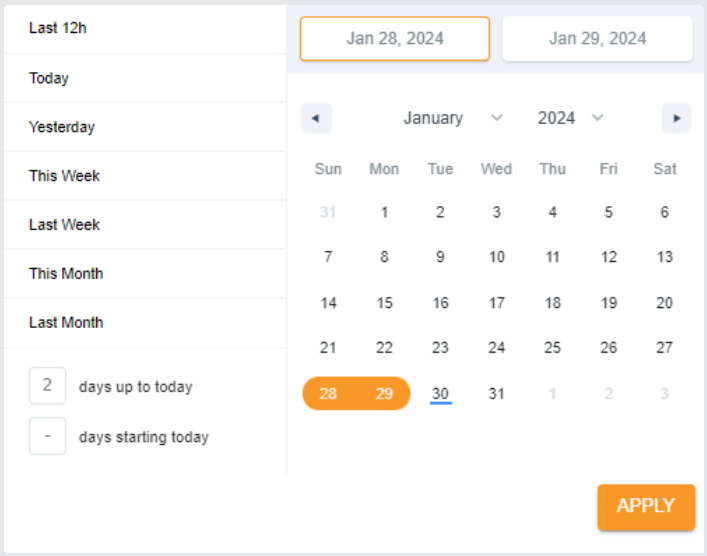
The default display for vibration data is Velocity rms inch/s. A variety of other measures are available by clicking the drop-down.



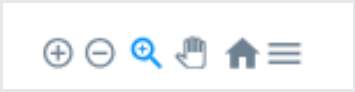
6.2: Date Range

Clicking “Select Date Range” brings up a menu to choose which dates to display.

One of the options on the left can be selected or a start and end date can be clicked manually. Press “Apply” to make the changes appear in the graphs.



6.3: Viewing Graphs



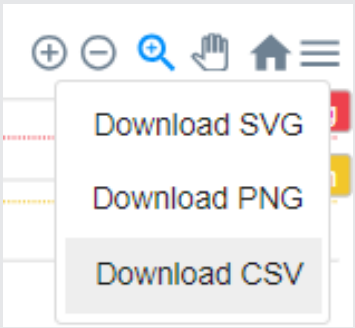
A menu of buttons above each graph allows for manipulation of the view.

- The “+” zooms in.
- The “-“ icon zooms out.
- The magnifying glass icon brings up a selection zoom that can be executed by clicking on the graph, dragging across, and releasing at the end of the desired range.
- The hand icon allows for panning across the graph by clicking and dragging.
- The home icon resets the graph to the original view.

6.4: Export Data

Clicking the last icon in the row allows you to export the data in several formats.

For a spreadsheet, select “Download CSV.”



7: ANOMALY DETECTION

7.1: Function and Purpose

Anomaly detection is a way to model vibration data during the learning period. If this learning period is taken from normal operation, anomalies will be detected when data appears outside of normal operating range. Any change from this baseline then triggers a vibration anomaly alert.

The purpose of this feature is to offer a more advanced way to detect changes from an operating baseline. It can be used in addition to or instead of manually defined alert thresholds.

7.2: Requirements – Learning Period

To be switched on, anomaly detection requires at least 500 data points. That means that for the standard sensor measurement intervals there will need to be operating data for a minimum of the following durations:

30 minutes: 10.4 days

60 minutes: 20.8 days

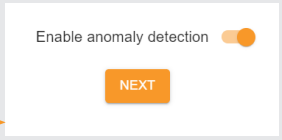
12 hours: 250 days

There is no upper limit on the number of data points used for anomaly detection. It's most important that the learning period covers everything considered normal operation to minimize false alerts.

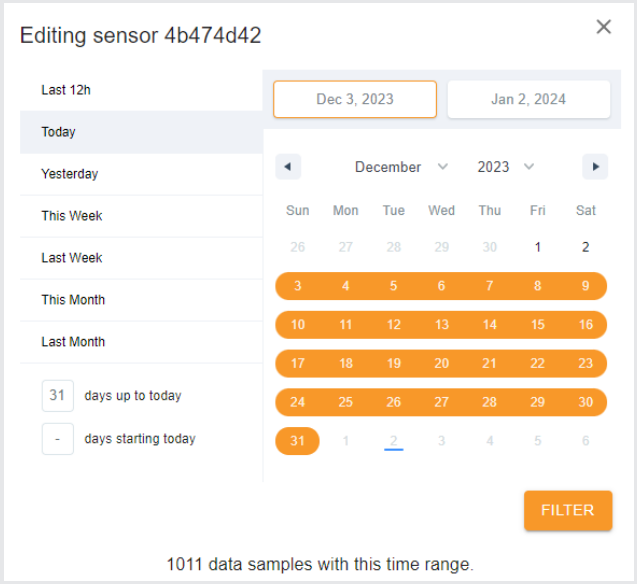
7.3: Enabling Anomaly Detection

In the Admin page, click "Edit" next to the desired sensor.

Click "Enable anomaly detection" in the bottom right, then click "Next."



Filter the date range to a time period that represents normal operation. The menu will show how many data samples are within the selected range. Remember that at least 500 data samples are required.



A visual representation of the selected data will appear. The final settings are:

7.3.1: Window Size

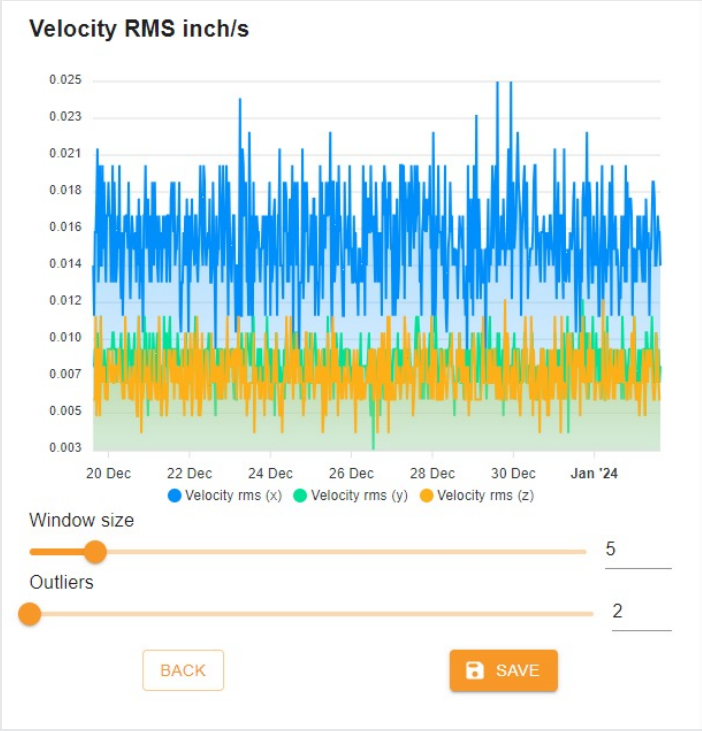
This value represents the number of sequential samples to be analyzed by the anomaly detection. If a lower value is chosen, anomalies would have to occur over a shorter period of time to qualify for an alert. Higher values will make detection more sensitive but may increase false alerts.

The minimum value is 3 and the maximum value is 20.

7.3.2: Outliers

This value represents how many data points must be considered anomalous for an alert to be triggered. Higher values will decrease the sensitivity of detection.

The minimum value is 2 and the maximum value is 15.



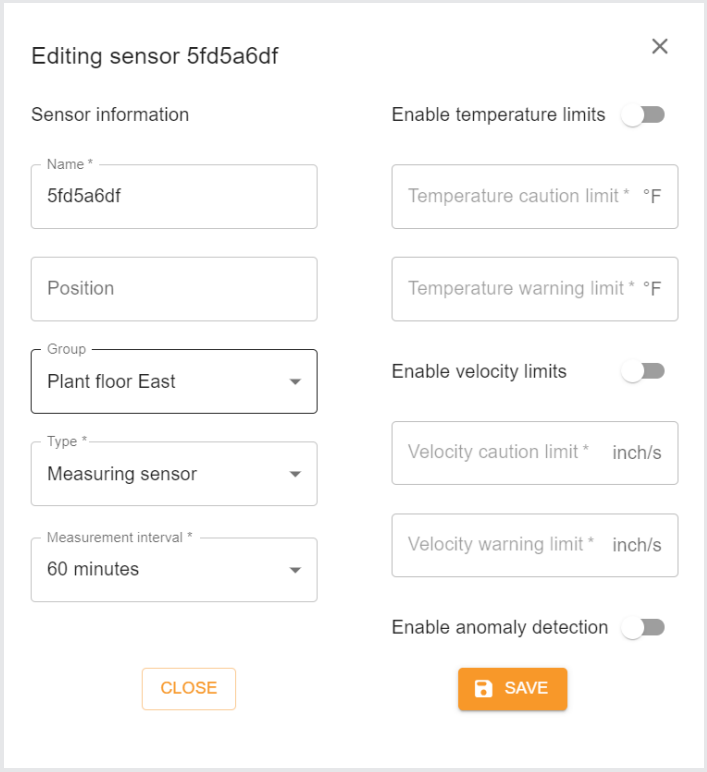
8: ADMIN FUNCTIONS

8.1: Sensors

A list of registered sensors that shows the name, serial number, date/time of the last message received from each sensor, whether it's in battery alert, and the option to edit sensor settings.

Register Sensor button in the top right is used to register new sensors into the system.

Clicking "Edit" by a sensor brings up the following menu:



Name: Name the sensor (defaults to serial number)

Position: Optional field for additional notes about the sensor's location or purpose

Group: Assign sensor to an existing group or "**—No group—**"

Type: Measuring sensor (used to collect data as well as route data from other sensors) or **Mesh relay sensor** (used to relay data from other sensors only - use to fill a gap in the Mesh network if distances between sensors and/or gateway is too great).

Measurement interval: Set the interval that data is sent from the sensor. Options are **5 minutes**, **30 minutes**, **60 minutes**, and **12 Hours**.

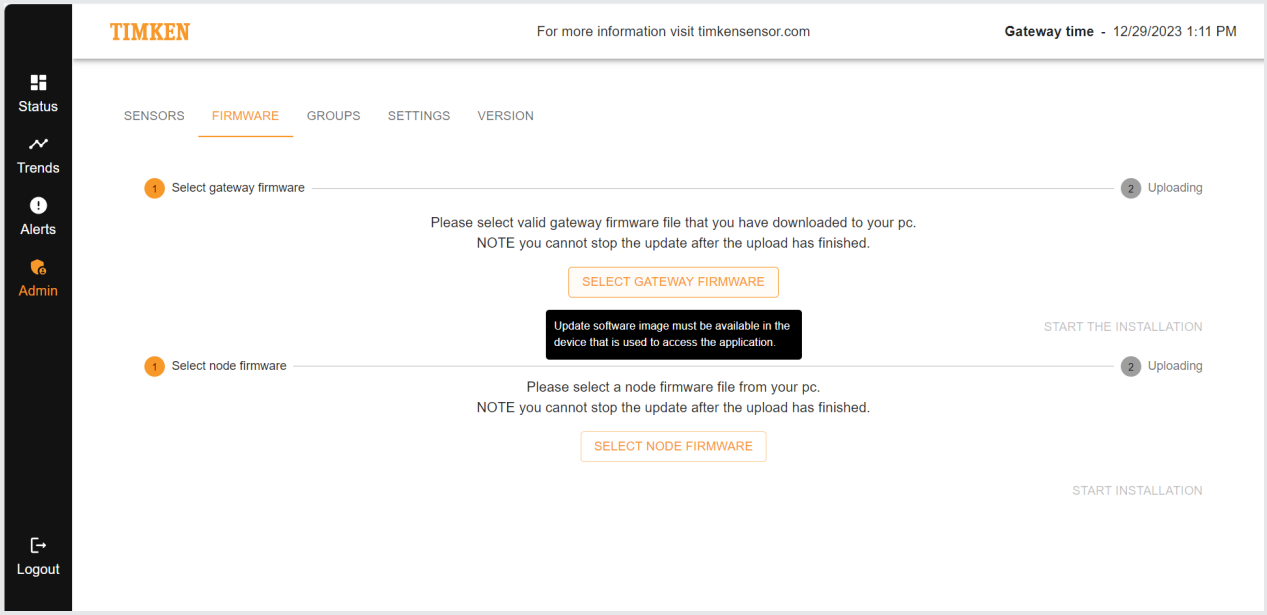
Enable temperature limits: Enable or disable temperature limits. Allows for setting values as well.

Enable velocity limits: Enable or disable vibration limits. Allows for setting values as well.

Enable anomaly detection: See Section 4 for details.

8.2: Firmware

Used for updating software. See "**Updating Dashboard Software**" for more details.

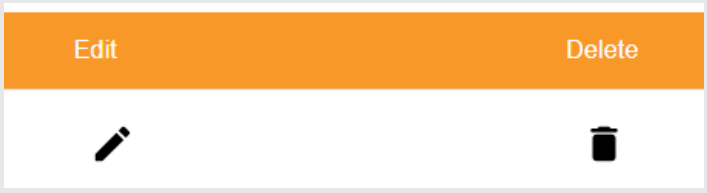


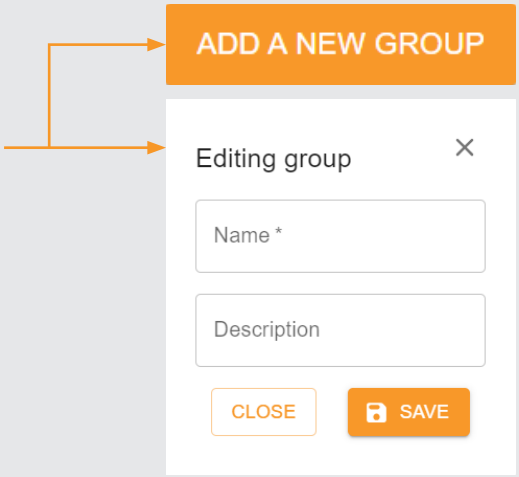
8.3: Groups

Groups can be used to make sensor management easier and clearer. Examples of groups include by areas of the plant, by type of equipment, or by expected temperature range.

"Add a New Group" opens a simple menu to name a group and enter a description.

Additionally, groups can be edited or deleted here.





Once a group is created, it will appear as an option in the Sensor settings. Sensors can be assigned to groups there.

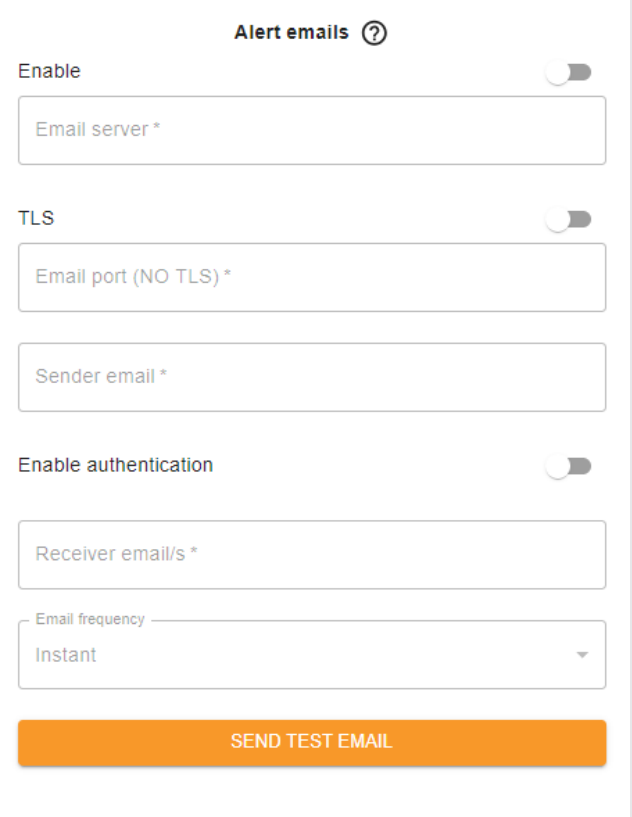
8.4: Settings

8.4.1: Alert Emails

These settings are required for email alerts to function. They will only become operational if the gateway has been connected via Ethernet to the local network.

Users must work with their IT department to ensure the proper settings.

The "Send Test Email" button sends an immediate test email to demonstrate whether the email settings are functioning properly.



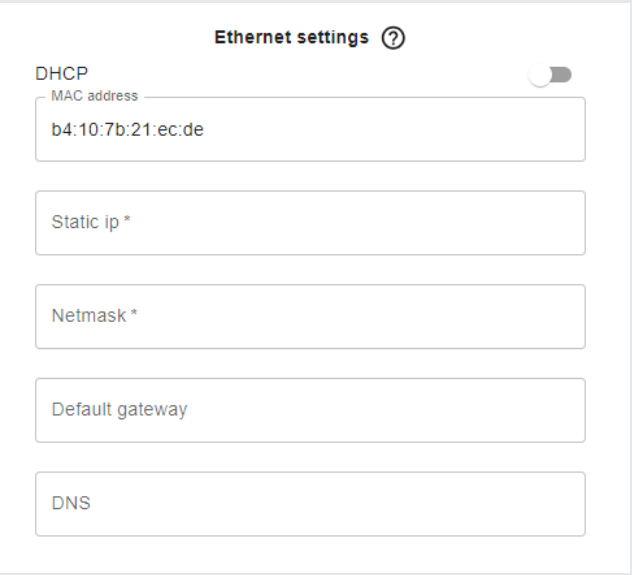
8.4.2: Ethernet Settings

There are two main connection options:

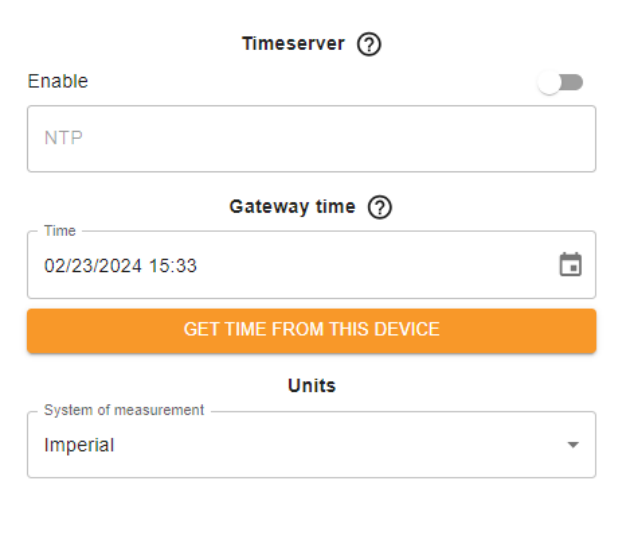
First, if the network has a DHCP server available, the gateway can receive network settings automatically by leaving the DHCP server setting enabled.

Alternatively, the DHCP-server setting can be disabled and the network settings, including a fixed IP-address, can be configured manually.

Your IT department can tell you which settings to use.



8.4.3: Time and Units



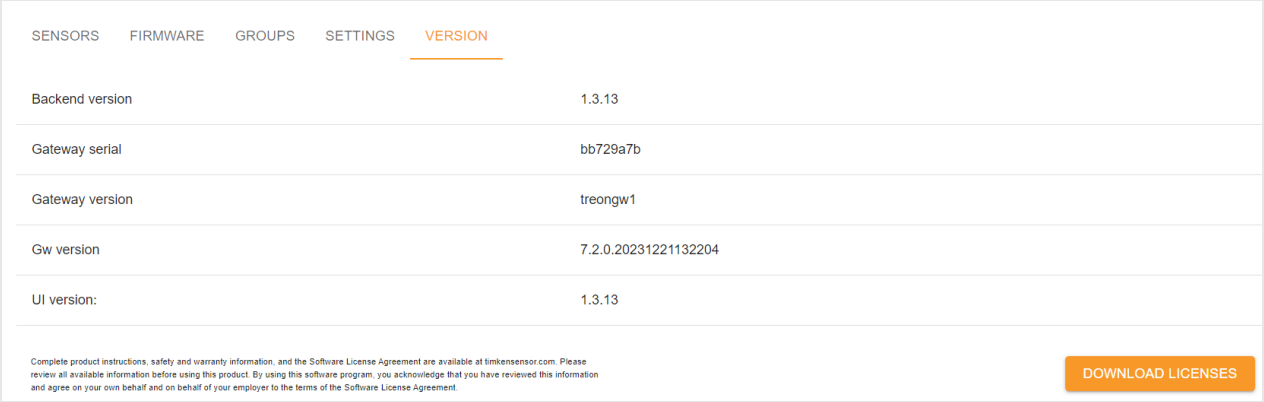
Timeserver: Usable only when gateway is connected to internal network via Ethernet. Most accurate way to keep gateway time - automatically matches the network time once established. Consult your IT department to get the appropriate Timeserver setting for your situation.

Gateway time: Set time for the gateway manually or by matching the currently linked device. Once the time is entered and saved, it will not automatically refresh again. Slight differences between gateway and actual time may arise as settings are changed and/or the gateway is rebooted.

Note: If the gateway has been powered off for a period of time or rebooted several times, the gateway time can get further away from actual time if the gateway is not using a timeserver. Refresh the gateway time again manually if this occurs.

8.5: Version

View current software versions and Gateway serial. Licenses available for download.



9: MOUNTING SENSORS

Before installing any sensors, turn off power to equipment onto which the sensor is being installed, allow equipment to cool, and use lock-out-tag-out procedures.

9.1: Default Thread

Timken Wireless Sensors come with a built-in 1/8-27 NPT bolt. They can be threaded directly into a 1/8-27 NPT hole such one used for a grease fitting.

9.2: Grease Pass Through Adapter

If the desired destination is a mounted bearing that requires lubrication, you can use a grease pass-through adapter (part TWS-A-GPT-1) to maintain the lubrication avenue while still using the sensor.

9.3: Adapter Fittings

A variety of fittings are available to help you fit Timken Wireless Sensors into your specific applications.
See **www.timkensensor.com** for a full listing.

10: GATEWAY REBOOTS AND INDICATOR LIGHTS

10.1: Reboot Process

The gateway requires 4-6 minutes to boot up for the first time upon being plugged in. The same time is required for the gateway to reboot.

A gateway reboot is required to save and implement a variety of settings changes. In the Admin Settings page, saving changes to the following settings will result in a gateway reboot.

- Alert email settings
- Email frequency
- Ethernet settings
- Timeserver enable/disable
- Gateway time
- Units (Imperial or Metric)

10.2: Indicator Lights

10.2.1: Blue

A blue light on the gateway indicates that it is still rebooting.

10.2.2: Green

A green light on the gateway indicates that it is online without any active alerts.

10.2.3: Red

A red light on the gateway indicates that it is online and there is at least one active alert.

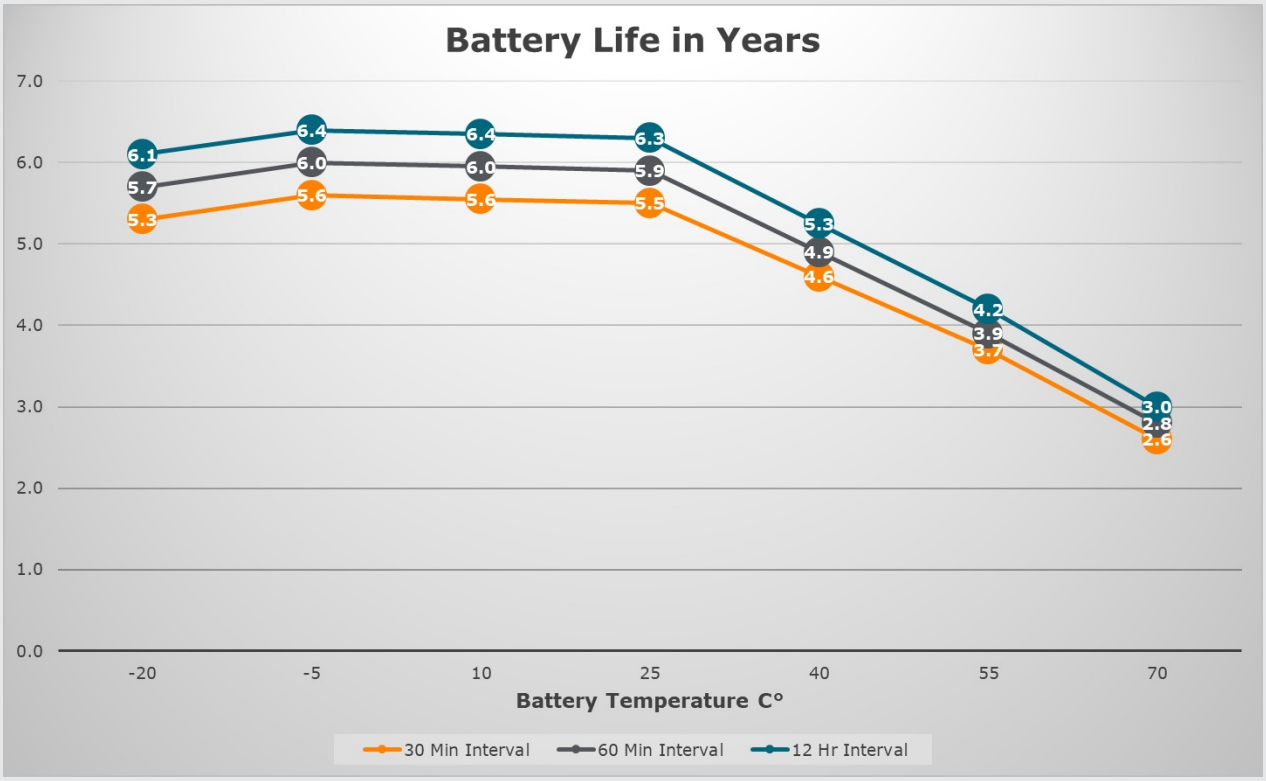
11: SENSOR ACTIVATION AND DEACTIVATION

Press and hold the button on the sensor until the indicator light turns green. The sensor will now be powered on.

Use the same procedure to turn the sensor off. As you hold the button down, the light will turn green and then change to red. Release the button to complete the deactivation.

12: SENSOR BATTERY LIFE

Sensor batteries can last for years, but they are not replaceable. Sensors must be disposed of properly at the end of their battery life. The battery life span varies based on operating temperature and conditions, including the measurement interval used. See below for further detail.



13: GATEWAY WIRELESS VS ETHERNET CAPABILITIES

13.1: Wireless

Connecting wirelessly to the gateway is quick and easy from either PCs or mobile devices. It requires no IT involvement, and the data will all remain local. This mode is recommended if IT support is either not desired or not feasible.

- The connecting device must be in Wi-Fi range of the gateway.
- Email alert functionality cannot be enabled.
  - Alerts appear via the indicator light on the gateway or by directly viewing the dashboard.
- A laptop or mobile device can only connect wirelessly to one device/network at a time. If there is no alternate internet signal to the device (cellular data, ethernet cable, etc.) then the connecting device will temporarily be 'offline' while connecting to the gateway.

13.2: Ethernet

Connecting the gateway to your internal network via ethernet opens up further capabilities. This mode is recommended if email alerts are desired or if you wish to view the dashboard from any device connected to the internal network. The gateway is also able to use the network time server to maintain the most accurate time.

- IT support is required to allow the device into the network.
- Additional support is required to enable test email and/or time server functions, depending on your company's IT policies and settings.
- Wi-Fi connection is still possible even while connected to ethernet.

14: UPDATING DASHBOARD SOFTWARE

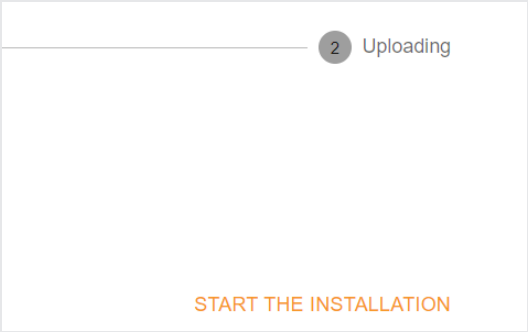
14.1: When and Why

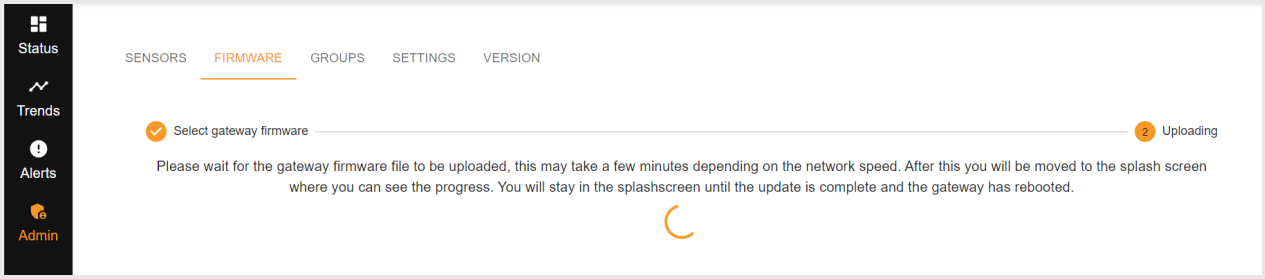
Used only in the event of a software update being released. Future updates could be released to enhance functionality, resolve issues, or roll out additional features. If this occurs, it will be announced and available through **www.timkensensor.com**.

13.2: How to Update

New software will be in the form of a .tar file. The file must be downloaded to a device that can connect to the gateway (either through the internal network or wirelessly) and then uploaded to the gateway.

Once a new version has been downloaded, click "Select Gateway Firmware" and find the file on the connected device. When selected, "Start the Installation" will be highlighted Orange – click it to begin the process.





The installation process will include rebooting the gateway. After some time, the dashboard will be upgraded to the new version. Close and reopen the internet browser, return to the Dashboard, and check that the version number has been updated.

Note – if the upgrade completes but the version still appears unchanged, press "Ctrl + Shift + R" to reload the currently open page and override the locally cached version.

TIMKEN

The Timken team applies their know-how to improve the reliability and performance of machinery in diverse markets worldwide. The company designs, makes and markets bearings, gear drives, automated lubrication systems, belts, brakes, clutches, chain, couplings, linear motion products and related industrial motion rebuild and repair services.

Stronger. By Design.

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