QI2500 Wireless Vibration Sensor — User Manual

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1. Introduction

The **QI2500 Wireless Vibration Sensor** is a compact, battery-powered device for monitoring machine health through vibration and temperature data. It periodically measures vibration in three axes, processes key parameters, and stores the data.

When the sensor detects a parameter has exceeded a threshold, the light located on top of the sensor will begin blinking. The data trends of key parameters can be viewed by connecting to the sensor using a mobile device or PC with WiFi.

The QI2500 helps maintenance personnel identify early signs of imbalance, misalignment, looseness, bearing wear, and other mechanical issues — enabling predictive maintenance and minimizing unplanned downtime.

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2. The Sensor

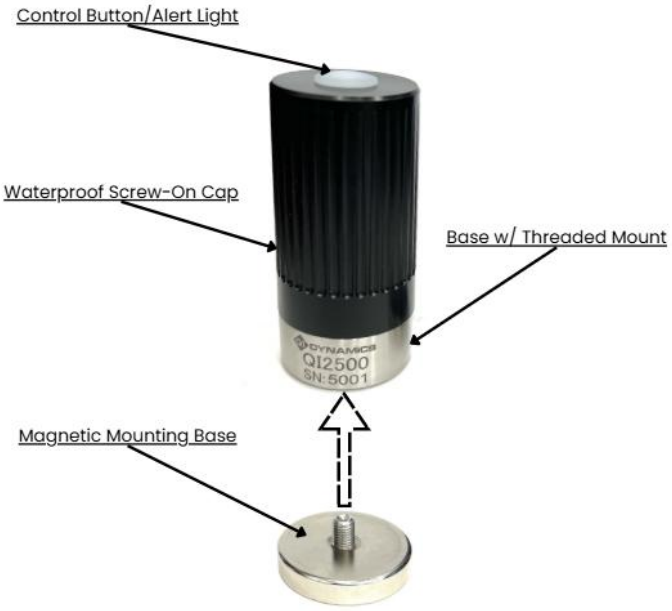

Figure A

Figure B

Figure C

- Control Button – Used to select sensor modes
- Alert Light – Flashes to communicate alerts and functions
- Waterproof Screw-On Cap
- Base w/ Threaded Mount
- Magnetic Mounting Base (flat base included – curved base sold separately)
- CR123A Battery

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3. Features

- Triaxial vibration measurement w/ MEMS accelerometer
- On-board data storage for up to 10,000 data sets
- Built-in temperature monitoring (-4 ° to 140 ° F / -20 ° to 60 ° C)
- IP68 Waterproofing
- Food-grade, stainless steel construction
- Non-invasive magnetic mounting
- Automatic alert light
- Customizable data collection intervals
- Programmable thresholds with colored condition indicators
- Parameter trend graphs
- Browser-based setup interface — no app required
- Low-power design with up to 2-year battery life
- Sensor battery monitor with low-power alert
- Built-in Wi-Fi access point — no facility Wi-Fi or IT integration required
- Advanced diagnostics
- Quick setup and mobility

4. Modes & Alerts

The following modes are accessible using the control button:

- On (single press) – Sensor will gather data periodically
- Setup (double press) – Connect to sensor to adjust sensor settings and view data graphs
- Hibernate (triple press) – Turn sensor off completely

Hint: When selecting a mode, do not press the Control Button too quickly

Sensor conditions are given via the alert light and include:

- On/Collecting Data – Blue blink
- Setup Mode – Solid green
- Hibernation – Solid yellow followed by flashing yellow
- Yellow Alert – Yellow blink
- Red Alert – Red blink

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5. Required Materials

Installation requires:

- **QI2500 Wireless Vibration Sensor W/ Magnetic Mount**
- **Mobile device** for setting thresholds and viewing/downloading trend data

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6. Installation Overview

1. Connect to sensor using a mobile device
2. Setup sensor and establish desired vibration/temperature thresholds
3. Mount sensor to desired machine and allow time to take initial measurements
4. View gathered data to establish an asset baseline – adjust thresholds if necessary
5. Periodically monitor the sensor for alerts or changing data trends
6. If sensor blinks yellow or red, use mobile device to view the data and diagnose the fault
7. Use of advanced settings may be necessary when diagnosing machine faults

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7. Basic Connection & Setup

This section covers the basics of sensor setup. This information can also be found in the included Quick Start Guide or Quick Start Video.

7.1 Sensor Setup

Activating Sensor

- Press the Control Button once to turn on sensor (blue light will flash signaling power-on)

Note: The control button is used to transfer between several sensor modes. When pressing the control button to switch modes, press in one second intervals. Pushing the button too quickly or slowly will prevent proper mode changes.

Entering Set-Up Mode

- Double press the Control Button to enter Setup Mode
    - Solid green light indicates sensor is in Set-Up mode and is ready to connect to mobile device

Note: If there is no setup activity for five minutes the Sensor will automatically disconnect from Setup Mode and resume normal operation.

Connecting to Mobile Device

- Open mobile device's Wi-Fi settings and select the network **QI2500-AP (sensor serial #)**
    - Network Password: **123456789**
- Open a browser and type **192.168.4.1** in the address bar
- Once entered, the Sensor's Home Page will open in browser

Note: Each time the Sensor is put into Setup Mode, the mobile device or PC will need to be reconnected to the Sensor's Wi-Fi. Only set up one Sensor at a time. All Sensor use the same password and address.

Hint: With the Sensor's Home Page showing, an icon for the page can be added to your device's home screen. This makes it so that after connecting to the Sensor's Wi-Fi the icon can be clicked instead of opening a web browser and typing the IP address each time.

For iOS (Safari):

1. After connecting to the Home Page, tap the Share icon (square with an upward arrow)
2. Scroll down and tap Add to Home Screen
3. Tap Add

For Android (Chrome):

1. After connecting to the Home Page, tap the three-dot menu
2. Tap Add to Home Screen
3. Tap Add

A QI2500 icon will be added to your device's home screen. Tap on the icon after connecting to the Sensor's Wi-Fi.

Customizing Sensor Settings

Each sensor comes with default settings grounded in ISO guidelines. While default settings will work for most applications, custom settings can be set at any time using the Sensor Setup Page. This section gives an overview of the basic settings necessary for operation.

The Advanced Settings section of the Setup page and Graph Page are not necessary during initial setup. Advanced Settings enable users to diagnose specific issues and work best after several data points have been gathered. Details on using Advanced Settings can be found in the section titled *Advanced Settings*.

- Beginning on the Home Page, click the Setup button to open the Setup page

Timing Settings

Timing settings govern how often the sensor takes readings and flashes its LED. Using the Setup page, you may customize the following settings:

- Data period – Number of seconds, minutes, or hours between readings
- LED blink – Number of seconds between blinks during alert conditions (longer times result in longer battery life)
- 32KHz Sample divider – Controls how fast the sensor samples the vibration (default of 4 is best for most applications) A higher divider results in a lower sample rate. The effective sample rate and the time it will take to collect all 4096 sample shows bellow the Sample divider value. The Sample divider can be set from 1 to 64 resulting in sample rates of 32,000 Hz to 500 Hz respectively.

Display Settings

With in the Display section the Temperature units can be set to display in degrees Celsius or degrees Fahrenheit.

Velocity Thresholds Settings

Velocity Thresholds determine at what points the Sensor will issue alerts for excessive vibration. Based on the size of the machine being monitored, set the velocity thresholds using this ISO-provided chart:

- Velocity Threshold Yellow – Caution (indicates early wear)
- Velocity Threshold Red – Critical (indicates advanced wear)

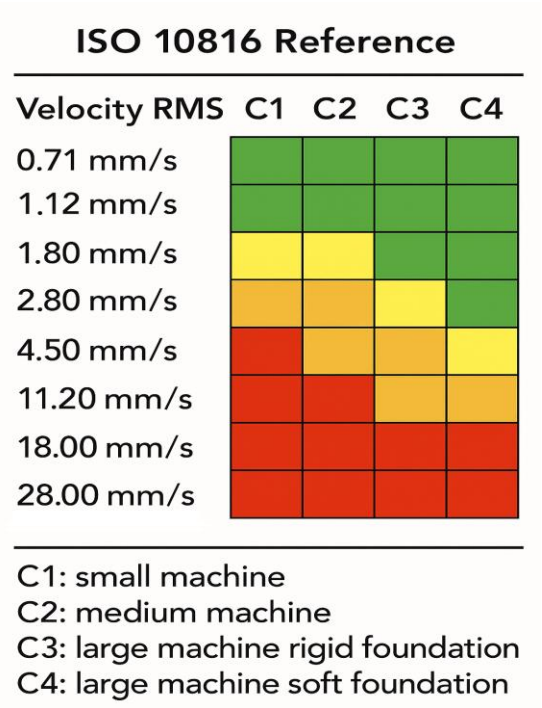
Temperature Threshold Settings

Temperature Thresholds determine when the Sensor will issue alerts for elevated temperatures. Based on knowledge of the machine, set the desired temperature thresholds:

- Temperature Threshold Yellow – Caution (above normal temperature)
- Temperature Threshold Red – Critical (high temperature)

Saving Settings

1. Click Save All to save settings to Sensor
2. Click Disconnect on the Home Page or press the Control Button once to leave Setup Mode (light will no longer be green)
3. Press the Control Button three times to power off Sensor (prevents accidental readings during mounting – solid yellow light followed by several blinks indicates Sensor is off)
4. Sensor is ready to be mounted to a machine and begin monitoring



Mounting Sensor to Machine

- Select the proper magnetic mount (curved or flat) based on desired mounting area
- Ensure that magnetic mount is securely attached to the bottom of the Sensor (see Fig. A)
- Attach the Sensor to the machine as close to the bearings as possible. Sensor should be firmly fixed to the machine surface. Any wobbling of the sensor against the surface will result in inaccurate readings.
- Press and release Control Button once (blue blink indicates that the sensor is on and recording data)
- The Sensor is active and can be left to record data. Check the Sensor as often as desired for alerts. When vibration or temperature exceed the established thresholds, the sensor will begin to blink yellow or red.

7.2 Accessing Sensor Data

Data trends emerge over time and give insights into machine performance. Trends and machine data can be viewed by connecting to the Sensor. A trend will begin to emerge after the Sensor records readings. Please allow at least five readings for best data results. Data can be viewed in response to an alert light or for general machine check-ups. The following section explains how to access Sensor data and graphs.

- Data and graphs can only be accessed in Setup Mode. Connect to the Sensor as described in *Connecting to Mobile Device* and navigate to the Sensor Home Page.

Loading Graphs

From the Home Page, click the Graph Data button to open Graph Page (data graphs will appear)

- View graphs to see data trends and recent readings
- Click on individual graph points for exact measurements
- The last 200 data sets collected while the machine was running are shown. The Sensor uses the value of Running threshold (m/s^2) from Setup to determine whether to store the data for graphing. Even if the memory for the 10,000 data sets is full, the Sensor will continue to record these data sets for graphing.
- Using data trends make decisions for machine replacement or maintenance
- If desired, stored data can be cleared using the Clear Graph Data button at the bottom of the Graph Page (clicking this button deletes ALL stored data but keeps Sensor settings intact). If moving the Sensor to a new machine, clearing the data and establishing new thresholds will be essential to avoid false alerts.

Downloading Data

Click on the Download Data button to download the full stored data set from the Sensor to the device. The downloaded data will be in comma-separated values (CSV) format. The downloaded data set includes all data sets collected by the Sensor, not just the data from when the Sensor detected that the machine is running. This is useful for determining a machine's duty cycle. After the data is downloaded, it can be viewed or shared. Refer to information on your device about how to download, view and share files. All the data collected (running and not running) is stored for downloading. Once 10,000 data sets are collected, collecting data for downloading will cease. To store new data, the old data must be cleared by clicking the Clear Graph Data button.

Hint: Once the data is downloaded it can be useful to email or transfer the data to a PC for storage or to be analyzed and graphed in Excel.

Export PNG

A picture of the graphs in PNG format can be created by clicking on the Export PNG button. After creating the PNG file, most browsers open the PNG file in a separate tab. After viewing or saving the PNG file you must close the tab or switch back to the previous tab to continue interfacing with the Sensor.

Hint: With the PNG file showing, touch and hold the image to share the image (text, email, etc.) or to save the image to photos.

When finished viewing data, click the Home button to get back to the Home Page or press the Control Button once to leave Setup Mode (Sensor will resume gathering data normally).

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8. Additional Setup Information

Below is additional information about the settings involved during basic setup:

8.1 Timing Settings

Sample Divider: Controls how fast the sensor records vibrations and the frequencies used to diagnose issues.

- **Default Divider (4)** – Captures a wide range of frequencies. Best for general monitoring and diagnosis.

- **Higher Divider (> 4)** – Monitors lower frequencies to diagnose issues like imbalance, misalignment, looseness, or structural resonance.
- **Lower Divider (< 4)** – Monitors higher frequencies to diagnose issues like bearing wear, gear-mesh faults, or frictional impacts.

Valid Sample Dividers are 1 to 64 resulting in sample frequencies of 32,000 Hz to 500 Hz respectively and sample times of 0.128 seconds to 8.192 seconds respectively.

8.2 Threshold Settings

Class Explanation

ISO 10816 standards distinguish four classes of assets based on size and mounting type. Larger assets have higher vibration thresholds than smaller assets.

- **C1 – Small Machines:** Small, rigidly mounted motors and pumps **up to 15kW (20HP)**.
    - These assets are lightweight and typically have high natural frequencies. Even small vibrations can indicate an issue.
    - Examples: Small electric motors, fans, pumps, or auxiliary drives.
- **C2 – Medium Machines:** Medium-sized machines, between **15-75kW (20-100HP)** and rigidly mounted to solid foundations.
    - Examples: Industrial motors, compressors, pumps, etc.
- **C3 – Large Machines, Rigid Foundations:** Large, heavy-duty machines between **75-300kW (100-400HP)** anchored to concrete or steel.
    - Examples: Large process motors, plant compressors, etc.
- **C4 – Large Machines, Soft Foundations:** Heavy-duty machines **> 300kW (> 400HP)** on flexible or vibration-isolated mounts.
    - Turbines, industrial chillers, etc.

Selecting a Class & Thresholds

When selecting a class, it is best to begin with the class closest to the machine's characteristics. After selection, it may be necessary to adjust the thresholds up or down from the default values based on the machine's condition. For more information on establishing a data baseline and adjusting thresholds see *Section 7 — Data Analysis & Fault Diagnosis*.

8.3 Mounting

When mounting, these points will help ensure consistent, accurate measurements:

- Select a rigid, fixed metal surface on the machine housing — ideally as close as possible to the bearing or other part you wish to monitor.
- Clean the area of oil, paint, and other debris to ensure firm connection.
- Avoid mounting the sensor to covers, guards, or non-structural parts as these may isolate vibrations and provide less useful data.
- Check that the sensor has attached firmly and does not wobble.

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9. Data Analysis & Fault Diagnosis

Data trends and frequencies allow teams to understand their equipment and make informed maintenance decisions. This section gives the basics of sensor data analysis and how to use advanced sensor settings to diagnose issues.

9.1 Establishing a Data Baseline

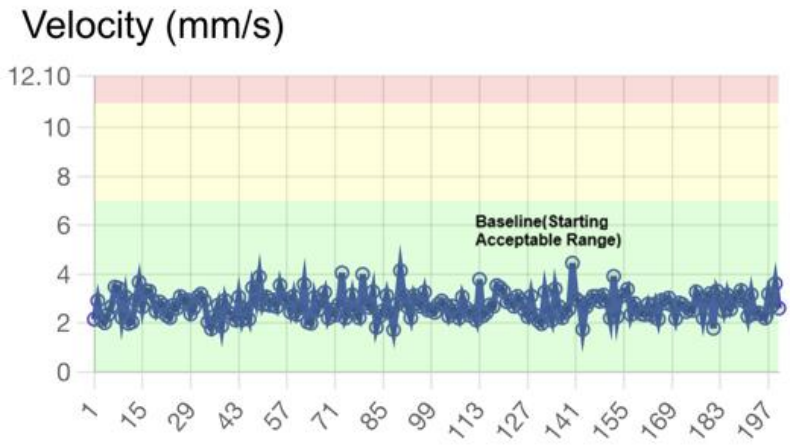
Every asset is different and has unique characteristics that impact vibration. Factors such as age, prior maintenance, and material composition all contribute to an asset's operational baseline. The *baseline* of an asset describes the normal vibration conditions of an asset when monitoring begins. Regardless of where an asset starts, it will have a baseline vibration range that worsens as it ages and deteriorates.

By establishing an asset's baseline, teams can monitor that asset's progression over time and receive alerts as conditions change.

Creating a Baseline

1. After mounting, allow the sensor to gather at least five readings under normal machine operating conditions (possibly more if a machine experiences wide variations in load).
2. Access sensor data to view velocity and temperature graphs. You will likely see a stable range of readings. This range is the machine's baseline.
3. Evaluate if the baseline is within the default thresholds defined by ISO 10816 or if adjustments are necessary.
4. If adjustments are needed, set the thresholds so the baseline values are within the green zone. This ensures alerts will only trigger when vibration or temperature rise above normal levels.
5. Return to the sensor periodically and make adjustments as necessary.Example

For the data pictured below, vibration consistently fluctuates when the asset is under load. The general range of peaks for this data set should be considered its baseline.



Over time, vibration peaks will rise steadily into the yellow or red zones (signifying deterioration). Starting thresholds should begin with the baseline in the green zone.

9.2 Advanced Settings

Once a machine exhibits a worsening trend of vibration or temperature, it becomes important to investigate the root cause in order to prevent unplanned downtime. For most applications, basic settings will provide enough information for teams to act. If teams wish to dive deeper into the data, the *Advanced Settings* and *Advanced Graphs* on the *Setup* and *Graph Data* pages can help teams identify specific machine issues.

Running Threshold

What it is:
The running threshold determines the minimum vibration level at which the sensor recognizes a machine is running. When vibration is below this threshold, the system assumes the machine is off or idle.

Why it matters:
This prevents false alerts or unnecessary data collection while the machine is not operating. Machines naturally have some background vibration or electrical noise — the running threshold helps the sensor ignore these conditions. *The default value of 0.40 is suitable for most applications*. If 0.40 is not enough to filter out background noise (or if it prevents measurements), adjust the threshold up or down as needed.

High-Pass Filter

What it is:
The high-pass filter blocks low-frequency vibration signals and allows only higher frequencies to pass through.

Why it matters:
Very low frequencies can come from sources like structural movement, slow machine drift, or environmental vibration. These can mask important data. By setting a high-pass filter, you remove "background noise" and focus on meaningful vibration. *The default value of 10 is best for most applications.* You may need to adjust the filter up for faster running machines or down for slowing running machines.

Rule of thumb:
Set the high-pass filter to about 20–30% of the shaft's speed in Hz.

$$\text{High-Pass Filter (Hz)} \approx 0.2 \times (\text{RPM}/60)$$

<u>Band Velocity</u>

What it is:
Band velocity measures the strength of vibration within a specific frequency range (called a "band").

Why it matters:
Different machine problems occur in different frequency bands. For example, imbalance shows up in low frequencies, while bearing wear appears in high frequencies. Measuring vibration in specific bands helps isolate the source of a problem.

How to use it:
Select the frequency range (for example, 10 – 1,000 Hz) that matches the type of issue you want to monitor. The sensor calculates the vibration velocity (in mm/s) within that range and reports how severe it is. Rising velocity over time means the problem in that band is getting worse.

- *Band Velocity (Hz)* – Set the frequency band you wish to monitor.
- *Band Velocity Thresholds (mm/s)* – Set thresholds for the band you have selected.

Below are common bands and the problems they usually demonstrate (chart based on ISO 13373 standards):

Band Category	Approx. Frequency Range (Hz)	Typical Fault Types Detected	Notes
Low-Frequency Band	≤ 10 Hz	• Imbalance • Misalignment • Coupling or bearing housing resonance	Heavy or slow-speed rotating parts cause large amplitude, slow vibrations.
Medium-Frequency Band	10 – 1,000 Hz	• Mechanical looseness • Coupling or bearing housing resonance • Gear-mesh vibration	Used for overall machine trend measurements and severity checks.
High-Frequency Band	> 1,000 Hz (Up to ≈ 10 kHz)	• Rolling-element bearing wear • Gear tooth damage • Lubrication breakdown • Cavitation (in pumps)	Detects early, high-energy fault signatures before a rise in low-frequency vibration.

Dominant Frequency

What it is:
The dominant frequency is the frequency where vibration is the strongest.

Why it matters:
Each mechanical issue tends to occur at a specific frequency. For example:

- Imbalance: 1x shaft speed in Hz
- Misalignment: 2x shaft speed in Hz
- Bearing Defects: higher frequencies in Hz

By looking at the dominant frequency readings, you can identify what kind of problem is causing vibration.

How to use it:
When reviewing data, note the dominant frequency and compare it to your machine's shaft speed in Hz (RPM/60). This helps pinpoint the source of the vibration.

- *Dominant Frequency Thresholds (Hz)* – Set thresholds for dominant frequency if desired.

Dominant Velocity

What it is:
Dominant velocity is the amplitude (or strength) of vibration at the dominant frequency.

Why it matters:
It shows how much vibration occurs at the dominant frequency. A higher dominant velocity means a stronger vibration — and usually, a more severe problem.

How to use it:
A steady increase in dominant velocity over time often signals worsening problems such as imbalance, looseness, misalignment, or bearing wear.

- *Dominant Velocity Thresholds (mm/s)* – Set thresholds for dominant velocity if desired.

Acceleration

What it is:
Acceleration measures how fast the vibration is changing (expressed in m/s^2).

Why it matters:
Acceleration highlights high-frequency, short-duration events — such as bearing defects, gear impacts, or cavitation — which velocity might miss.

How to use it:
Use acceleration measurements when monitoring fast-moving parts (like bearings or gear teeth). High spikes in acceleration may mean impacts, looseness, or early bearing damage.

- *Acceleration Thresholds (m/s^2)* – Set thresholds for acceleration. No ISO standards currently exist, so establish thresholds that will alert you of a significant change over time.

Crest Factor

What it is:
Crest factor is the ratio of peak acceleration to average acceleration.

Why it matters:
A higher crest factor means short, sharp vibration spikes — often caused by impacts, looseness, or bearing defects.

How to use it:
Monitor the crest factor along with velocity and acceleration.

- A low crest factor (around 3 or less) means smooth operation.
- A high crest factor (above 5) may indicate impacts or mechanical looseness.

- *Crest Factor Thresholds* – Set desired thresholds for crest factor.

Battery Thresholds (V)

Sensor battery voltage is reported on the Graph Data page. Use the Battery Thresholds setting to adjust when the sensor will give a low power alert. Default values are best for most applications.

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10. Best Practices for Sensor Use

- Establish baseline readings when a machine is healthy.
- If possible, compare data to an established baseline instead of absolute numbers alone.
- Use trend analysis — tracking multiple factors over time often provides the most insight.
- Keep thresholds conservative initially, then adjust after collecting several data sets.
- If readings suddenly spike, check the sensor mounting and verify no outside anomalies before making decisions.
- Replace the battery when voltage drops between 2.6 – 2.7 V

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11. Sensor Maintenance

Task	**Frequency**
Check sensor battery	Every 3 months
Inspect mounting	Every 3 months
Review data	As desired and after major maintenance

12. Troubleshooting

Issue	Possible Cause	Solution
No vibration data	Machine off or vibrating below *Running Threshold*	Lower *Running Threshold* in *Advanced Settings*
Graphs missing colors	Thresholds set to 0	Set both yellow and red thresholds
Flashing red alert without a poor vibration trend(s)	Low battery	Check battery voltage and replace CR123A cell as needed

13. Technical Specifications

MEASUREMENTS

Frequency Range
- 0 Hz to 16,000 Hz

Acceleration
- Up to 588 m/s^2 (60 g)

Velocity
- Up to 375 mm/s RMS

Sample Configuration
- 4096 lines (per axis)

Sample Frequency
- 500 Hz to 32,000 Hz

Data Storage
- 10,000 data sets

WIRELESS COMM.

Frequency
- 2.4 GHz

Protocol
- IEEE 802.11

Range
- Up to 100 ft *

*Range may vary based on obstructions

PHYSICAL CHAR.

Dimensions
- 1.5” (D) x 3.25” (H)

Weight
- 230 g (sensor)
- 160 g (magnet base)

External Material
- HDPE (cover) / PC UL94
- 304SS (base) / 316SS

Electronic Sealing
- Conformal coating applied

ENVIRONMENTAL

IP Rating
- IP68

Humidity
- Suitable in high-humidity

Operating Temperature
- From -4° F to 140° F

POWER SOURCE

Battery
- CR123A lithium battery

Battery Life
- From 1-2 years *

*Based on default sample interval. May vary based on interval settings.

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14. Contact and Support

QI Dynamics, LLC
Website: www.qi-dynamics.com