

SEMEQ

AI-Driven Factory Reliability



USER'S MANUAL

AXONHD VIBRATION SENSOR

1 CONTENTS

1	Contents	2
2	About.....	3
3	Technical Characteristics.....	4
4	Product Dimensions.....	6
5	WEB Interface.....	7
6	Available Variants	7
7	Extra Functionalities	8
8	Product Display	8
9	Installation Procedure.....	8
9.1	Mounting and Placement	8
9.1.1	Installation Point Selection	9
9.1.2	Surface Preparation	9
9.1.3	Fixation Methods	9
9.1.4	Sensor Placement.....	9
9.1.5	Maintaining Sensor Reliability	10
9.2	Linking.....	10
10	Battery Replacement	11
11	Triggering via Operational Variables.....	11
12	Triggering via Vibration Level	12
13	Manual Data Collecting.....	13
14	Remote Parameters	14
15	Device Availability	15
15.1	Gateway Configuration and Installation	15
15.2	Wireless Signal Strength	15
15.3	Gateway Capacity.....	16
15.4	Redundancy.....	16
15.5	Battery Level	16
15.6	Network Synchronization and Retransmissions	16
15.7	Availability Checklist.....	17
16	Regulatory Certifications	17
16.1	FCC (USA)	17
16.2	ANATEL (Brazil).....	18
17	Warranty.....	18
18	Contact.....	19

2 ABOUT

The AxonHD Vibration Sensor is an advanced vibration and temperature monitoring device. With its Bluetooth® Low Energy 5.1 technology, it connects easily and quickly to the SMQ 990 family of gateways, enabling efficient communication.

This sensor has features that make it an effective solution for detecting early-stage failures, resulting in a significant reduction in maintenance costs. Its triaxial sensitivity and high-frequency response allow for the identification of issues in machines even before they worsen, preventing unplanned downtime and more serious damage.

Its IP66/IP69K protection rating ensures that the sensor is protected against gases, dust, water, and even chemical attacks. This means that it can be installed in harsh industrial environments where durability and reliability are essential.

With a long-lasting, replaceable battery, the AxonHD Vibration Sensor guarantees continuous and reliable monitoring over time, reducing maintenance costs and improving operational efficiency. Since it is battery-powered, no cabling is required, making installation both simple and cost-effective. Its compact, low-profile design allows it to be installed even in hard-to-reach or space-constrained areas, ensuring flexibility across a wide range of equipment such as industrial pumps, fans, compressors, electric motors, and turbines.

To address the specific needs of different assets, SEMEQ offers four variants of the AxonHD Vibration Sensor. The standard version transmits data at

predefined intervals. The External Trigger variant enables synchronized acquisitions based on process variables. The Internal Trigger variant performs data acquisition when a configured vibration threshold is exceeded. Finally, the Data Collector variant allows handheld data collection across different machines, with results transferred directly to a user's smartphone via the SEMEQ — DataCollect app, available for both Android and iOS.

Its operational flow is similar to other SEMEQ WSN® sensors, where the acquisition of the monitoring data and its transmission to the gateway occur at predetermined and remotely configurable intervals, with the default being every one hour. The Gateway, in turn, is responsible for compressing all received data from surrounding sensors and sending them to the cloud.

All collected data is accessible through the SEMEQ Portal Stream, a user-friendly web interface combining simplicity with powerful features. This platform allows users to analyze data in detail, quickly identify issues, and optimize maintenance schedules, improving operational efficiency and machine reliability.

Built to combine advanced technology, robust design, and ease of use, the AxonHD Vibration Sensor delivers a complete and reliable solution for predictive maintenance. Its precision, durability, and flexibility across multiple industrial environments make it a benchmark in quality and performance, ensuring greater efficiency, reliability, and longevity for your machines.

3 TECHNICAL CHARACTERISTICS

General Info	
Compatible Gateways	Any model or version of the SMQ990 Family
Approximated Gateway Occupation per Transmission	16 seconds
Transmission Interval ¹	Customizable. Default: 1 hour
Output Data - Vibration	
Sensing Element	MEMS Accelerometer
Number of Axis	3
Acceleration Range ²	from ± 8 g up to ± 64 g
Acceleration Resolution ²	from 0.24 mg up to 1.95 mg
Average Noise Density	300 $\mu\text{g}/\sqrt{\text{Hz}}$
Mechanical Signal Cutoff Frequency	10 kHz (X and Y-axis) and 6 kHz (Z-axis)
Sampling Frequency	25,600 samples/second
Anti-Aliasing Filter	12.8 kHz
Samples Average	Customizable. Default: 2
Spectral Lines (Resolution)	Customizable up to 12,000 lines. Default: 1,600 lines
Measurements Types	Acceleration, Velocity and Envelope
Measurements Formats	Overall Level, Bands, FFT and Waveform on Time
Data units	g, mm/s and in/s
Wake-up by Vibration Threshold ³	
Minimum Vibration Duration to Trigger	12.5 seconds
Minimum Vibration RMS to Trigger	0.3 g
Wake-up by Wireless Trigger ⁴	
Fastest Wireless Trigger Perception Delay ⁵	21 milliseconds
Output Data - Temperature	
Sensing Element Measurement Range ⁸	-40 to 125 °C (-40 to 257 °F)
Sensing Element Measurement Resolution	0.08 °C
Sensing Element Measurement Precision	$\pm 4^\circ\text{C}$
Wireless Communication	
Protocol	Bluetooth® Low Energy 5.1
Frequency	2.402 to 2.480 GHz
TX Power	99 mW (20 dBm)
RX Sensitivity	-97 dBm
Antenna Range (Free Space) ⁶	200 m (656 ft)
Antenna Range (Industrial Environment) ⁶	70 m (230 ft)

¹Changing this value will increase or decrease the expected battery duration considerably.

²Automatically adjustable by the Axon HD during each acquisition.

³Only available for Axon HD IT variant. For the correct configuration of this product, contact the SEMEQ support team.

⁴Only available for Axon HD WT variant. For the correct configuration of this product, contact the SEMEQ support team.

⁵Will impact heavily in the battery duration, so change it with caution. For reference, the factory standard perception delay is 270 ms, which results in a battery lifetime of 2 months.

⁶These are empirical values and should be taken as an approximation since they are very sensitive to environment variables, as stated in the electromagnetic waves' theory.

Power Supply	
Battery Cell Type	CR123A
Battery Quantity	1
Battery Chemistry	Lithium Manganese Dioxide
Battery Voltage	3 V
Battery Capacity	1550 mAh
Approximate Battery Duration ⁷	2 years
General Mechanical Specifications	
Approximate Dimensions (W x L x H)	55 x 44 x 39.5 mm (2.2 x 1.7 x 1.6 in)
Weight	120 g (4.2 oz)
Material	PA66 GF30 and Stainless Steel A2
Battery Lid Allen Key Size	5/16 in
Mounting Screw	Socket Head Cap 1/4"-28 UNF x 1" 1/2
Screwdriver	Allen Key 3/16 in
Mounting Torque	8.5 to 9.5 Nm (6.3 to 7 ft.lb)
Environmental	
Minimum Ambient Operating Temperature	-30 °C (-22 °F)
Maximum Ambient Operating Temperature ⁸	70 °C (158 °F)
Maximum Surface Temperature at 25 °C Ambient ⁸	100 °C (212 °F)
Ingress Protection Rating	IP66 / IP69K

⁷Battery life will vary significantly depending on the configured transmission interval and may also be slightly affected by operating temperature. The estimated duration applies only to the standard AxonHD variant with a one-hour transmission interval under ambient temperature conditions. Since the other variants are highly customizable, providing an accurate estimate is not possible. For a detailed battery expectancy tailored to your application, please contact SEMEQ support.

⁸ The **Sensing Element Measurement Range** defines the temperature range that the sensing element can measure and should not be interpreted as the allowable temperature range of the complete product. The **Maximum Ambient Operating Temperature ($T_{a^{max}}$)** defines the highest surrounding air temperature at which the product can operate, while the **Maximum Surface Temperature (T_s)** defines the highest temperature of the surface on which the product can be installed. These two operating limits are interdependent: as the ambient temperature increases, the maximum allowable surface temperature decreases because heat from both the surrounding environment and the monitored surface contributes to the product's internal temperature.

The maximum allowable surface temperature (T_s) at a given ambient temperature (T_a) can be estimated as:

$$T_s = T_a + \frac{T_{s^{25^\circ\text{C}}} - 25}{T_{a^{max}} - 25}(T_{a^{max}} - T_a)$$

Where $T_{s^{25^\circ\text{C}}}$ is the **Maximum Surface Temperature at 25 °C Ambient** and $T_{a^{max}}$ is the **Maximum Ambient Operating Temperature**.

If further specifics are required, the product's Technical Datasheet offers an enhanced and detailed table. Please refer to it as needed.

4 PRODUCT DIMENSIONS

All dimensions are expressed in millimeters.

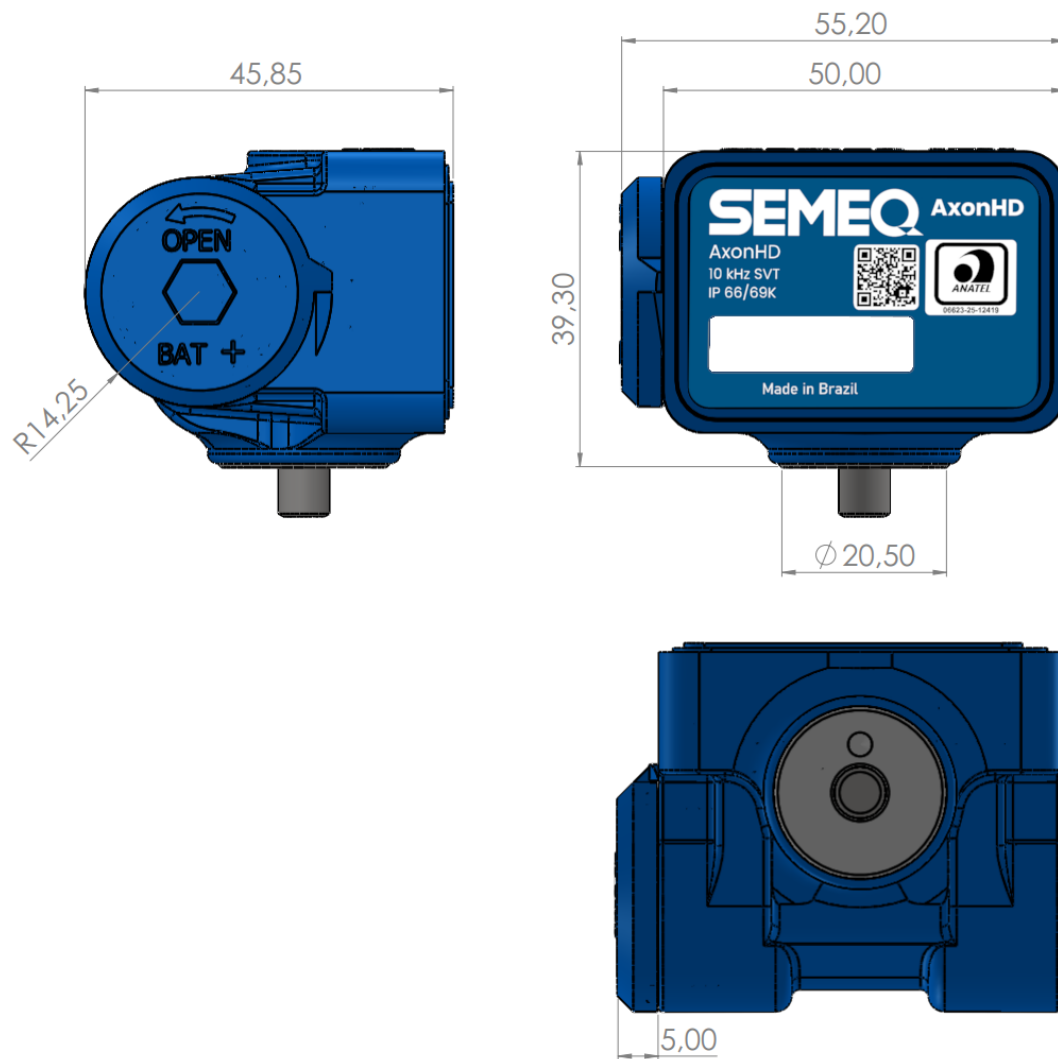


Figure 1 — AxonHD dimensions.

5 WEB INTERFACE



Figure 2 — Vibration Analysis dashboard from SEMEQ Portal Stream.

Once installed, the processed data from the AxonHD Vibration Sensor will be displayed on the Vibration Analysis screen of the SEMEQ Portal Stream. The dashboard includes the following graphs:

a) X, Y and Z-axis Velocity Spectrum:

with a default maximum frequency of 800 Hz and 1600 lines of resolution, providing a frequency resolution of 0.5 Hz.

b) X-axis Acceleration Spectrum:
two default options are provided:

- i. Maximum frequency of 12800 Hz and 3200 lines of resolution, providing a frequency resolution of 4 Hz.
- ii. Maximum frequency of 6400 Hz and 1600 lines of resolution, providing a frequency resolution of 4 Hz.

c) X-axis Envelope: with a default maximum frequency of 800 Hz and 1600 lines of resolution, providing a frequency resolution of 0.5 Hz.

d) X-axis Acceleration Waveform:
two default options are provided:

- i. Maximum time of 4 seconds and 4096 lines of resolution, providing a time resolution of approximately 1 millisecond.
- ii. Maximum time of 0.25 seconds and 4096 lines of resolution, providing a time resolution of approximately 0.1 milliseconds.

Each of these graphs is accompanied by Overall RMS and peak-to-peak trends, including historical data.

6 AVAILABLE VARIANTS

SEMEQ offers four variants of the AxonHD Vibration Sensor, designed to meet the specific needs of each of our clients' assets:

a) AxonHD: The standard variant of the vibration sensor. It performs the reading and transmission of data to the SMQ 990 gateway at predefined

intervals, with its default set to every 1 hour.

- b) **AxonHD — External Trigger:** A highly-customizable version that reads and transmits measurements to the SMQ 990 gateway when automatically triggered by it. This is particularly useful when acquisitions need to be synchronized with process variables. Refer to [Section 11](#) for details.
- c) **AxonHD — Internal Trigger:** A customizable version that reads and transmits measurements to the SMQ 990 gateway whenever a configured vibration threshold is exceeded. Refer to [Section 12](#) for details.
- d) **AxonHD — Data Collector:** A handheld-use variant designed to take measurements on different machines. Data is transferred directly to a user's smartphone through the SEMEQ Data Collect app, available on both the Google Play Store and the Apple App Store. Refer to [Section 13](#) for details.

7 EXTRA FUNCTIONALITIES

In addition to remote vibration monitoring, the AxonHD Vibration Sensor offers the following additional functionalities:

- a) **Remotely Configurable Parameters:** Some of the device's parameters can be adjusted remotely for enhanced flexibility. Refer to [Section 14](#) for details.
- b) **Over-the-Air (OTA) Firmware Updates:** Keep the device up to date effortlessly through automatic remote firmware updates.

8 PRODUCT DISPLAY



Figure 3 — AxonHD Front Panel.

The AxonHD Vibration Sensor has the following regions on its panel:

- 1) **Family Name:** Field displaying the family name of the product.
- 2) **Variant Specification:** Field displaying detailed information about the product variant.
- 3) **Regulatory Certification:** Field containing information about the product's radio and regulatory approvals.
- 4) **Serial Number:** Field containing the product's serial number (ID).
- 5) **QR Code:** A QR Code that links directly to this User's Manual.

9 INSTALLATION PROCEDURE

To ensure proper and safe installation of the AxonHD Vibration Sensor, the process must be performed by an authorized and qualified professional, adhering to the best practices outlined in this document. Detailed instructions are provided in the following sections.

9.1 MOUNTING AND PLACEMENT

We strongly recommend the physical installation of the AxonHD Vibration Sensor to be performed or supervised by a professional with experience in

vibration analysis for predictive maintenance. If needed, SEMEQ can provide this service; however, any qualified professional with relevant expertise is also suitable.

This type of analysis is extremely sensitive to how vibration data is collected, and factors such as sensor orientation, installation point, and the method of fixation can all significantly affect the quality and reliability of the acquired signal.

The following sections provide some recommended best practices, but users are encouraged to apply their expertise and go beyond these guidelines to ensure optimal measurement quality.

9.1.1 Installation Point Selection

The sensor should always be installed as close as possible to the vibration source, typically on the bearing housing of the machine. The installation point must be oriented either vertically or horizontally, meaning the sensor surface should be aligned parallel or perpendicular to the ground — never in the axial direction. Proper placement ensures accurate representation of the machine's dynamic behavior and minimizes signal distortion.

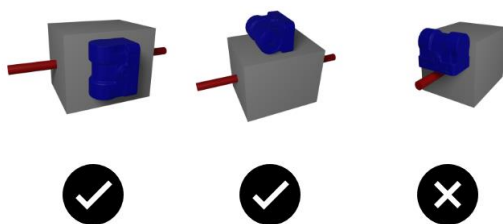


Figure 4 – Illustration showing the vertical, horizontal, and axial installation orientations, respectively.

9.1.2 Surface Preparation

The mounting surface should be as flat and smooth as possible. All paint, rust, or debris must be removed to ensure proper

contact between the sensor and the machine. For best results, milling the surface is recommended to create a clean, precisely aligned area. Proper surface preparation improves vibration transmission to the sensor, reduces signal distortion and damping, and enhances measurement reliability and repeatability.

9.1.3 Fixation Methods

Using the provided mounting screw is the preferred fixation method for optimal vibration measurements. This requires drilling a hole in the prepared surface and tapping it according to the mounting screw specifications provided in [Section 3](#), ensuring a secure and rigid connection.

If drilling is not feasible, alternative fixation methods such as adhesive or a magnetic base can be used. Even with a magnetic base, reinforcing the sensor with an adhesive is recommended to prevent displacement. Always follow the adhesive manufacturer's instructions for proper application and curing. When selecting an adhesive, refer to [Section 3](#) for guidance on sensor material. Key considerations include the mounting surface material, operating temperature, and the adhesive's shear and tensile strength to ensure a reliable and long-lasting installation.

9.1.4 Sensor Placement

Before mounting, energize the *AxonHD Vibration Sensor* using the provided battery. Ensure the battery is inserted with the correct polarity to avoid damage to the device. For detailed instructions on the battery installation process, please refer to [Section 10](#).

Once powered, the *AxonHD Vibration Sensor* must be securely mounted at the chosen installation point using the selected fixation method. The sensor

base must sit flush and parallel to the machine surface to ensure proper vibration transmission.

The sensor's Z-axis must be aligned with the shaft of the rotating machine. This Z-axis is marked on the top of the sensor, as illustrated below. In some units, the shaft direction may also be indicated by a label on the housing.



Figure 5 - Axis markings of the AxonHD Vibration Sensor on the enclosure.

Be sure to note the sensor's position and orientation relative to the equipment, as this information will be required later during the sensor linking process.

9.1.5 Maintaining Sensor Reliability

To ensure consistent predictive maintenance measurements, users should perform periodic inspections of the sensor. These checks verify that the sensor remains securely fixed and correctly oriented. Over time, vibration, thermal cycling, and environmental conditions may loosen screws or adhesives, negatively impacting measurement accuracy. Regular inspections help maintain signal quality and ensure the reliability and repeatability of collected data.

9.2 LINKING

After being properly mounted, the *AxonHD Vibration Sensor* must be registered to an installation point within

the site's tree. This process, known as Linking, is performed by navigating to the *PdM Plan* screen on the *SEMEQ Portal Stream* and locating the site's tree. Select the desired *Asset*, access its *Devices* menu, and click the *Link Device* button.

Figure 6 - Link Device menu from SEMEQ Portal Stream.

Inside the Figure 6 screen enter the device ID in the *Serial Number* field, which can be found on the *AxonHD's* panel (refer to [Section 8](#) for its precise location), and press TAB or ENTER. Complete all the following required fields with details about the installation:

- a) **Device image:** Upload an image of the device at its installation location. Ensure the image has an 800x600 resolution or a 4:3 aspect ratio to prevent distortion.
- b) **Device Base:** Fill this field according to the mounting method used. Leave the default if a standard mounting screw was used. For alternative methods, such as adhesive or magnetic bases, contact SEMEQ support to ensure the correct orientation.
- c) **Point Description:** Provide an industry-standard code that identifies the monitoring point on the machine.
- d) **VIBRATION:** Select the image representing the installation orientation of the sensor.
- e) **TEMPERATURE °C:** This side menu allows you to configure temperature alarms within the *SEMEQ Portal Stream*:
 - i. **Yellow:** The temperature at which a yellow alarm will be

triggered on the *SEMEQ Portal Stream* dashboard.

- ii. **Red:** The temperature at which a red alarm will be triggered on the *SEMEQ Portal Stream* dashboard.

To complete the Linking process, click the **SAVE** button.

Please note that the creation of the site's tree is not covered in this manual. For assistance with setting up the site's tree or for further troubleshooting, contact SEMEQ support.

10 BATTERY REPLACEMENT

To install the sensor for the first time or replace its battery, first open the battery lid located on the side of the *AxonHD Vibration Sensor* using the Allen key specified in [Section 3: General Mechanical Specifications](#).

Next, insert the battery into its housing with the negative terminal contacting the spring inside the sensor, as illustrated below.



Figure 7 - Correct orientation of the battery.

Finally, close the battery lid by rotating it back into position. Ensure the lid is **fully seated** so that its tab reaches the corresponding step, as shown below. This guarantees proper sealing and allows the sensor to **maintain its IP 66/69K protection rating**.

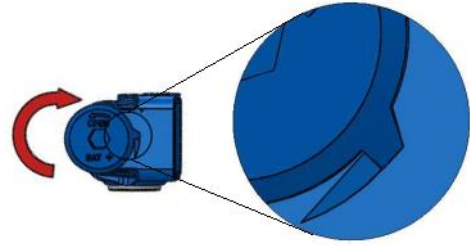


Figure 8 - Properly closed battery lid. The tab must be rotated fully until it stops against the illustrated step, ensuring correct sealing.

11 TRIGGERING VIA OPERATIONAL VARIABLES

The *AxonHD — External Trigger* variant (see [Section 6](#)) enables data acquisition and transmission based on external operational variables, offering greater integration flexibility. In this mode, the *SMQ 990 Gateway* monitors the variables and, whenever a defined condition is met, sends a Bluetooth command to all devices in range. Configured devices then start their acquisition and transmission process, ensuring seamless communication with protocols such as OPC, PLC, and Modbus.

Since the *AxonHD Vibration Sensor* is a battery-powered solution, operating in this mode can be very power-intensive and significantly reduce battery life expectancy. Because client requirements are often complex, this variant offers extensive customization to balance performance and autonomy. The following parameters are available for this purpose, all of which can be adjusted remotely (see [Section 13](#)):

- a) **Wireless Trigger Timeout:** Ensures that the device performs a transmission even if the operational variable condition has not been met. Once this timeout is reached, the device will force a transmission,

preventing long periods without data. The countdown begins when the device exits Deep Sleep mode, meaning that, in practice, the transmission interval in idle conditions will equal the sum of this parameter and the configured *Deep Sleep Duration*. These forced transmissions can later be filtered in the *SEMEQ Portal Stream* interface if needed.

- b) Deep Sleep Duration:** Defines how long the device remains in a deep low-power state during which it does not listen for transmission commands. This setting helps prevent excessive transmissions, allowing the device to conserve energy and only respond when truly required.
- c) Target Gateway:** Restricts the device to accept transmission commands only from a specific gateway, rather than any gateway in range. This provides greater control in environments where multiple gateways are present. By default, the device listens to all gateways.
- d) Start Delay:** A fixed, user-defined delay between receiving a transmission command and starting data acquisition. It always applies the exact delay configured, allowing precise alignment with the monitored process.
- e) Maximum Trigger Perception Delay:** The maximum time the sensor may take to wake up after a gateway trigger. Unlike Start Delay, this delay is not fixed — the sensor might respond immediately or at any point up to the configured maximum. Because this parameter has the strongest effect on battery consumption, it should be kept as high as possible when battery life is critical.

To enable transmission triggering via operational variables, the desired

protocol and operational variable must first be configured and integrated with a *SMQ990 Gateway*. Please note that this manual does not cover this setup. For assistance with this process, contact SEMEQ support.

12 TRIGGERING VIA VIBRATION LEVEL

The *AxonHD — Internal Trigger* variant (see [Section 6](#)) allows data acquisition to be initiated automatically whenever a predefined vibration threshold is exceeded. This feature is particularly valuable for equipment with intermittent operating cycles, where continuous monitoring may be inefficient or unnecessary. To adapt to different applications, the following parameters can be configured for this mode of operation, all of which can be adjusted remotely via the *SEMEQ Portal Stream* (see [Section 13](#)):

- a) Wakeup Threshold:** Defines the minimum vibration level that must be detected for the sensor to activate, acquire, and transmit data. Proper adjustment of this parameter ensures that the sensor reacts only to relevant machine activity, avoiding unnecessary measurements during idle periods or background noise.
- b) Deep Sleep Duration:** Defines how long the device remains in a deep low-power state during which it does not check the vibration level. This setting helps prevent excessive transmissions, allowing the device to conserve energy and only respond when truly required.
- c) Internal Trigger Timeout:** Ensures that the device performs a transmission even if the vibration level condition has not been met. Once this timeout is reached, the

device will force a transmission, preventing long periods without data. The countdown begins when the device exits Deep Sleep mode, meaning that, in practice, the transmission interval in idle conditions will equal the sum of this parameter and the configured *Deep Sleep Duration*. These forced transmissions can later be filtered in the *SEMEQ Portal Stream* interface if needed.

- d) Start Delay:** A fixed, user-defined delay between detecting the vibration level and starting data acquisition. It always applies the exact delay configured, allowing precise alignment with the monitored process.

13 MANUAL DATA COLLECTING

The *AxonHD — Data Collector* variant (see [Section 6](#)) allows user to collect data in the field from different machines using a smartphone.

To get started, install the **SEMEQ – DataCollect** app on your device, available on both [Google Play Store](#) and [Apple App Store](#).

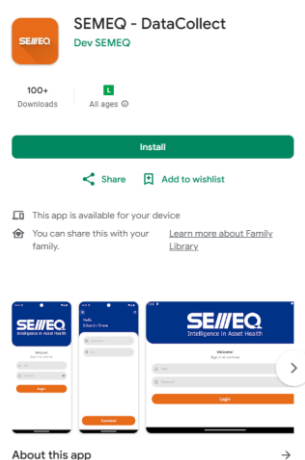


Figure 9- SEMEQ - DataCollect app in Google Play Store.

Open the installed app, enter your user credentials, select your site, and tap the *Download* button to retrieve the site's asset tree.

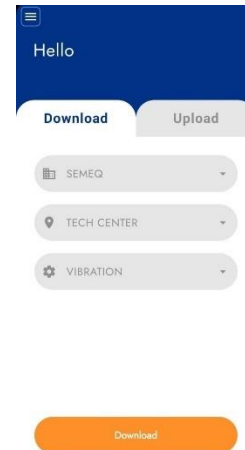


Figure 10 - Site selection screen.

Next, power on the *AxonHD — Data Collector* and place it at the desired measurement point (refer to [Sections 9.1](#) and [10](#) for details). In the app, navigate to the corresponding point in the site tree and tap it to start searching for available sensors. When the sensor is found, it will appear with the name *SMQCOL_XXXXX*, where *XXXXX* is the sensor's ID (refer to [Section 8](#) for its location). Tap the sensor to proceed.

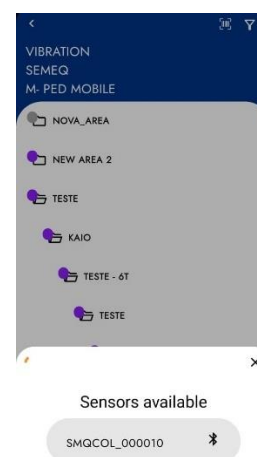


Figure 11 - Available sensors screen.

On the following screen, select the image that represents the orientation of

the sensor to begin data collection and transmission.

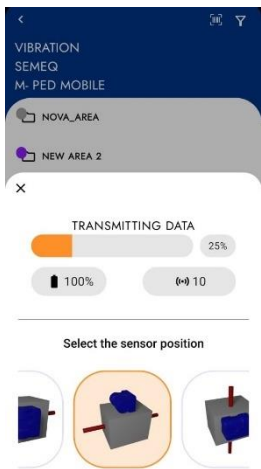


Figure 12 - Sensor orientation selection and data transmission screen.

Once data collection and transmission are complete, tap the button to proceed to the upload screen.

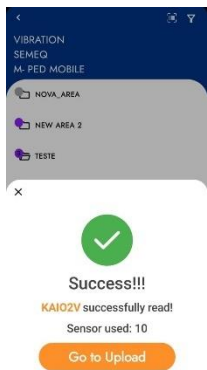


Figure 13 - Data collection sucess screen.

In the upload screen, simply tap **UPLOAD DATA** to send the collected information to the cloud, making it available in the *SEMEQ Portal Stream*.

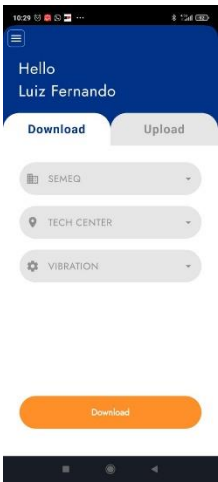


Figure 14 - Collected data upload screen.

For instructions on creating the site's asset tree or using advanced app features, please contact SEMEQ Support.

14 REMOTE PARAMETERS

The *AxonHD Vibration Sensor* offers the capability to edit certain device parameters remotely via the *SEMEQ Portal Stream*, providing users with the flexibility to refine their monitoring settings according to specific needs.

To access the parameters menu, navigate to the *PdM Plan* screen within the *SEMEQ Portal Stream*, locate the device in question, open its options, and click the *PARAMS* button.

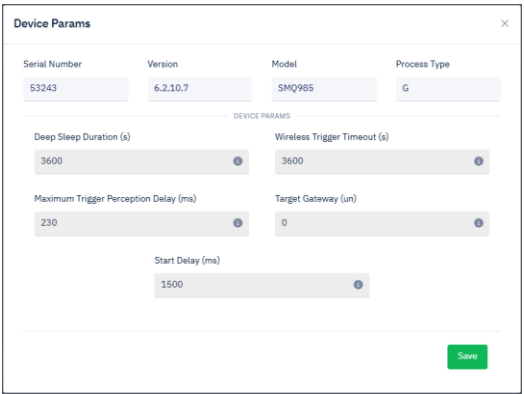


Figure 15 — Device Parameters editing menu.

Inside the Figure 15 menu, users will find the units of measurement along with

the default, minimum, and maximum allowed values for each parameter. Always refer to this menu, as these ranges may vary slightly depending on the sensor's firmware version. Below, we provide a detailed explanation of the configurable parameters, without repeating the numerical limits:

- a) Deep Sleep Duration:** Defines how long the device remains in a deep low-power state after transmitting data. For the standard variation of the *AxonHD Vibration Sensor*, this value will be equal to its transmission interval. For the other variants, please refer to Sections [11](#) and [12](#).
- b) Start Delay:** A fixed, user-defined delay before starting of data acquisition.
- c) Wireless Trigger Timeout:** A parameter specific to the *AxonHD — External Trigger* variant. Please refer to [Section 11](#) for details.
- d) Target Gateway:** A parameter specific to the *AxonHD — External Trigger* variant. Please refer to [Section 11](#) for details.
- e) Maximum Trigger Perception Delay:** A parameter specific to the *AxonHD — External Trigger* variant. Please refer to [Section 11](#) for details.
- f) Wakeup Threshold:** A parameter specific to the *AxonHD — Internal Trigger* variant. Please refer to [Section 12](#) for details.
- g) Internal Trigger Timeout:** A parameter specific to the *AxonHD — Internal Trigger* variant. Please refer to [Section 12](#) for details.

15 DEVICE AVAILABILITY

Device availability refers to the successful reception of the sensor's data by the SEMEQ servers. For example, if a sensor is configured to transmit once per hour, the expected behavior is approximately 24 successfully received

transmissions per day, assuming the sensor remains operational and the network is available.

SEMEQ has a specialized team experienced in deploying, configuring, and troubleshooting wireless sensor networks and can provide assistance with network planning and deployment. However, if you prefer to install and troubleshoot the network independently, the following guidelines can help identify the main factors that may affect device availability.

15.1 GATEWAY CONFIGURATION AND INSTALLATION

The gateway is one of the most important components for ensuring reliable data reception. Always verify that the gateway is correctly configured, properly installed, and has a stable connection to the SEMEQ servers. For detailed installation and configuration instructions, refer to the applicable Gateway User's Manual or contact SEMEQ Support.

15.2 WIRELESS SIGNAL STRENGTH

Make sure that each sensor has a strong *Bluetooth Low Energy®* signal to at least one gateway. A weak signal, typically indicated by a low RSSI value, can increase the probability of unsuccessful transmissions.

Whenever possible, position gateways so that sensors have adequate wireless coverage and avoid unnecessary obstacles or sources of interference between the sensor and gateway. For networks with critical availability requirements, it is recommended that each sensor have adequate signal coverage from more than one gateway.

15.3 GATEWAY CAPACITY

The number of sensors connected to a gateway and their transmission intervals directly affect network availability. Each sensor transmission occupies the gateway's wireless communication resources for a certain amount of time. During this period, the gateway may be unable to receive transmissions from other sensors.

The approximate gateway occupation time for each transmission is specified in the [Section 3](#) of this manual. When planning a network, consider the total occupation generated by all sensors communicating with the same gateway, including sensors from different product families.

Transmission intervals must also be considered. Sensors configured with shorter transmission intervals generate more traffic and consequently increase gateway occupancy. An excessively crowded network may result in transmission conflicts and an increased number of retransmissions.

15.4 REDUNDANCY

For applications where data availability is critical, gateway redundancy is recommended. Deploying multiple gateways within the same coverage area can provide additional opportunities for a sensor to successfully transmit its data if one gateway is temporarily unavailable or occupied.

Internet connectivity redundancy can also be implemented by configuring a gateway with more than one available Internet connection, where supported. This can help maintain communication with the SEMEQ servers if one Internet connection becomes unavailable.

15.5 BATTERY LEVEL

For battery-powered devices, make sure the sensor has sufficient battery capacity to maintain normal operation. Regularly monitor the battery level reported by the SEMEQ Portal Stream and plan battery replacement before the battery is depleted.

Network conditions can also affect battery consumption. An overcrowded network or a network with poor wireless coverage may cause sensors to perform additional transmission attempts. Over time, these additional attempts can increase battery consumption and reduce the expected battery life.

15.6 NETWORK SYNCHRONIZATION AND RETRANSMISSIONS

The *SEMEQ Wireless Sensor Network* includes a synchronization algorithm designed to distribute sensor transmissions over time. Therefore, users generally do not need to manually configure different transmission times to prevent all sensors from transmitting simultaneously.

When a network is first deployed, some sensors may initially transmit at similar times, which can temporarily create gateway occupancy conflicts and result in missed transmissions. As the network operates, the synchronization algorithm progressively distributes the transmission times, allowing the network to stabilize.

The sensors also include a retransmission mechanism. If a sensor cannot find an available gateway when attempting to transmit, it will retry the transmission a limited number of times before giving up. This mechanism is designed to improve data availability

while minimizing additional battery consumption.

Although the retransmission mechanism is optimized for low-power operation, an excessively crowded network or poor wireless coverage may result in frequent retransmissions. This can increase battery consumption over time. Therefore, both network availability and battery level should be monitored regularly.

15.7 AVAILABILITY CHECKLIST

If a device presents lower-than-expected availability, verify the following:

- a) The gateway is correctly installed and configured.
- b) The gateway has a stable connection to the SEMEQ servers.
- c) The sensor has adequate Bluetooth® Low Energy signal strength to at least one gateway.
- d) The gateway is not overloaded by excessive sensor traffic.
- e) Sensor transmission intervals have been considered when planning gateway capacity.
- f) The sensor has sufficient battery capacity.
- g) The network provides adequate gateway coverage and, when required, gateway redundancy.
- h) Excessive retransmissions are not occurring due to poor signal strength or gateway occupancy.

If the issue persists after these checks, contact SEMEQ Support for assistance with network analysis and troubleshooting.

16 REGULATORY CERTIFICATIONS

16.1 FCC (USA)



This device complies with Part 15 of the FCC Rules and with Licence exempt RSS standards of Industry Canada.

Operation is subject to the following two conditions:

(1) This device may not cause harmful interference, and

(2) This device must accept any interference received, including interference that may cause undesired operation.

Exposure to radio frequency energy.

The radiated output power of this device meets the limits of FCC/ISED Canada radio frequency exposure limits. This device should be operated with a minimum separation distance of 20 cm (8 inches) between the equipment and a person's body.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et

(2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

L'exposition à l'énergie radiofréquence. La puissance de sortie rayonné de cet appareil est conforme aux

limites de la FCC/ISDE Canada limites d'exposition aux fréquences radio. Cet appareil doit être utilisé avec une distance minimale de séparation de 20 cm entre l'appareil et le corps d'une personne.

WARNING: Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The term "IC:" before the radio certification number only signifies that Industry Canada technical specifications were met.

16.2 ANATEL (BRAZIL)



The products *AxonHD*, *AxonHD — External Trigger* and *AxonHD — Data Collector* are certified by ANATEL under certification number **06623-25-12419**. The product *AxonHD — Internal Trigger* is certified by ANATEL under certification number **06625-25-12419**.

This equipment is not entitled to protection against harmful interference and must not cause interference to authorized systems.

For more information, please visit <https://www.gov.br/anatel/pt-br>.

17 WARRANTY

According to the customer service policy, the product warranty period is 12 months.

18 CONTACT

TECHNICAL SUPPORT

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