

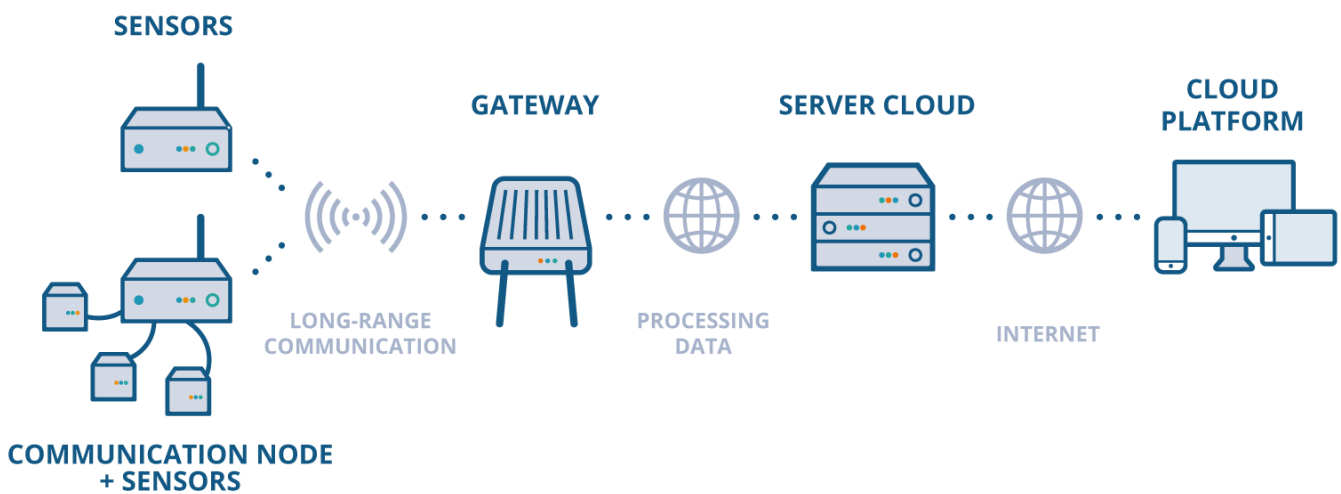
## VIBROMETER DATASHEET

### THE SYSTEM: SMART SHM

Move Solutions is a trusted leader in **Smart Structural Health Monitoring (Smart SHM)**. Our wireless system offers a remote, continuous and comprehensive analysis of the health of the structures. By integrating cutting-edge **Internet of Things (IoT)** technology with Structural Health Monitoring practices we promote more sustainable and resilient infrastructure.

#### KEY PARAMETERS

- Easy installation on the structure
- Minimum maintenance required
- Long-range communication
- Fully remote management and customization
- Data analysis with advanced algorithms
- Modular system
- High precision
- Waterproof rating IP67
- Long-life battery
- Integrated temperature sensor



## HOW IT WORKS

Move Solutions offers a wireless monitoring system for *static, dynamic, geotechnical and environmental analysis* of all civil infrastructures: bridges, construction sites, rails, and more.

Small **battery-powered sensors** combined with an **IoT Platform** and highly **advanced algorithms** provide a comprehensive monitoring solution aimed at simplifying asset management. The data recorded by the sensors can be viewed on Move Solutions IoT Platform, which allows users to remotely monitor and manage structures in real time. They can set different operating parameters of each sensor, such as sampling rates, resolution and full scale, alarm and activation thresholds, and much more. That allows users to detect structural damage in time to implement preventive maintenance and reduce costs. Move Solutions system empowers infrastructure owners with insights to promote a proactive monitoring approach for safer, more sustainable, and resilient infrastructures.

## ADVANTAGES

- Reduction of manual and on-site measurements
- Reduced downtime and disruptions to regular operations
- Real-time, remote and continuous data visualization
- Short-term and long-term data analysis
- Easy addition of sensors to extend the monitored area
- Cost reduction thanks to easy installation and maintenance
- Risk reduction and high reliability
- Preventive maintenance

## THE DEVICE: VIBROMETER

The Vibrometer measures triaxial vibration parameters, providing a complete analysis of the frequency and amplitude of the vibrations. With the use of Vibrometer devices it is possible to highlight any seismic vibrations, mainly induced by external factors, and monitor their risks. It also monitors temperature, and it is wireless, plug-and-play and with a long-life battery.



### VIBROMETER OUTPUT

The Vibrometer acquires triaxial velocity data (mm/s or inch/s) through the continuous integration of the onboard accelerometer output, with a high sample rate.

The system comes with two options:

**Time-triggered:** Velocity report is sent at a predefined period (remotely configurable between 1 minute - 2 minutes - 5 minutes...). This report contains the peak frequency and the peak amplitude measured on all three axes, together with the temperature.

The Vibrometer has a local storage system available where it saves all the acquisitions which exceeded the threshold. Wireless transmission of collected results are sent and displayed on the Move System.

**Threshold-triggered:** Velocity report is sent when a predefined threshold is exceeded. This report contains the peak frequency and the peak amplitude measured on all three axes, together with the temperature. Every acquisition is stored in the local storage. Wireless transmission of collected results are sent and displayed on the Move System.

### DOWNLOAD DOCUMENTATION

Visit the website at [www.movesolutions.it](http://www.movesolutions.it) to download further documentation relating to technical specifications and/or information on the Move Solutions™ structural monitoring system.

## QUICK GUIDE TO USE

The Vibrometer device is “plug and play”; by screwing the special antenna on the cover, the device will immediately start to detect and send data. The Vibrometer sensor must be correctly oriented and installed, following these specific steps:

### 1. ORIENTATION:

- X, Y axes shown on the orientation label, must be aligned as the axes of interest of the structure.
- The Z axis must always be oriented upwards.

### 2. INSTALLATION ON THE STRUCTURE:

- Agree with the supplier company on the correct place of installation on the structure of the Vibrometer device.
- Firmly install the Vibrometer on the wall, ceiling or floor using the special plate and screws/wall plugs supplied. It is possible to rotate the plate relative to the device to keep the Z axis parallel to the gravitational axis and oriented upwards, regardless of the agreed installation location.
- To install multiple Vibrometers on the same structure, use the same orientation convention, i.e. with the axes shown on the label of each specific device oriented in the same way.
- Install all sensors on the structure before powering and turning on the Gateway device.

### 3. SCREWING THE ANTENNA:

- Before activating the Gateway, screw the LoRaWAN 868 Mhz antenna onto the device cover.

After meeting these orientation and installation requirements, the Vibrometer device will be able to detect and send data to the Gateway without interference or data alteration.

Verify, via the Web Platform, the correct functioning of the sensor just installed. From the moment the Gateway is powered up, and therefore from the actual start-up and activation moment, a maximum waiting of about an hour is required before it is possible to correctly view all the sensors online.

## TECHNICAL SPECIFICATIONS

### OPERATION

|                                      |  |
|--------------------------------------|--|
| <b>Wireless data transmission of</b> | Maximum detected PPV, timestamp, maximum amplitude and frequency detected for each axis, maximum velocity detected for each axis, temperature. |
| <b>Local storage of</b>              | Up to 2000 acquisitions, one acquisition is composed of 1024 Datapoint. All the acquisitions are retrievable by USB Connection with a PC.      |
| <b>Custom operation software</b>     | It is possible to request custom features that the client deems necessary for their business.  |
| <b>Sample rate</b>                   | 512Hz (Derived from a 4 kHz sampling rate by means of downsampling)  |
| <b>Absolute synchronization</b>      | ± 1 second   |
| <b>Supportable Standards*1</b>       | DIN4150, UNI9916, BS7385, SN 640 312a, RI8507  |

### MEASUREMENT

|                       |  |
|-----------------------|--|
| <b>Technology</b>     | MEMS technology - Triaxial   |
| <b>Acquisition of</b> | <ul style="list-style-type: none"> <li>▪ Velocity</li> <li>▪ Frequency</li> <li>▪ Temperature</li> </ul> |
| <b>Resolution</b>     | 0.0015 mm/s  |
| <b>Range</b>          | ± 100 mm/s   |
| <b>Noise density</b>  | 22.5 µg/√Hz  |

### RADIO

|                                |                                      |
|--------------------------------|--------------------------------------|
| <b>Radio channel</b>           | LoRaWAN communication protocol       |
| <b>Radio channel frequency</b> | ISM 868MHz / 915MHz                  |
| <b>Link coverage*2</b>         | 1km (line of sight with the Gateway) |

### GENERAL DATA

|                             |                                      |
|-----------------------------|--------------------------------------|
| <b>Ingress protection*3</b> | IP67                                 |
| <b>Battery</b>              | 1 lithium battery type "D" 19Ah 3.6V |

|                               |                           |
|-------------------------------|---------------------------|
| <b>Operating temperatures</b> | -40°C / +85°C             |
| <b>Dimensions</b>             | 75 x 80 x 57 mm           |
| <b>Weight</b>                 | 1.1 Kg                    |
| <b>Case material</b>          | Alloy GD-ALSi12           |
| <b>Corrosion resistance</b>   | >1000 hours in salt spray |

### INSTALLATION

|               |   |
|---------------|---|
| <b>Method</b> | Two-point mounting using screws and plugs (Ø6mm, L:30mm)  |
| <b>Site</b>   | <ul style="list-style-type: none"> <li>▪ Fixing on wall</li> <li>▪ Fixing on ceiling</li> <li>▪ Fixing on ground</li> <li>▪ Fixing underground</li> </ul> |

### BATTERY LIFE

| Acquisition rate | Radio connection quality | Estimated battery life**4 |
|------------------|--------------------------|---------------------------|
| 1 minute         | Good                     | 1.4 years                 |
| 5 minutes        | Good                     | 1.5 years                 |
| 1 minute         | Bad                      | 1 year                    |
| 5 minutes        | Bad                      | 1.3 years                 |

\*1 A calibration may be necessary to be fully compliant with the standards. Calibration service available on request.

\*2 Wireless coverage of the device may vary depending on the scenario.

\*3 Guaranteed only with the dust cap or smart cable correctly screwed.

\*4 Battery life may shorten when operating in extreme temperatures.

## REVISION HISTORY

Version v3.

| Version | Changelog                                 |
|---------|---|
| v1      | First revision                            |
| v2      | Improved accelerometer output description |
| v3      | Document template update                  |

Note: Specifications are subject to review and change without notice.