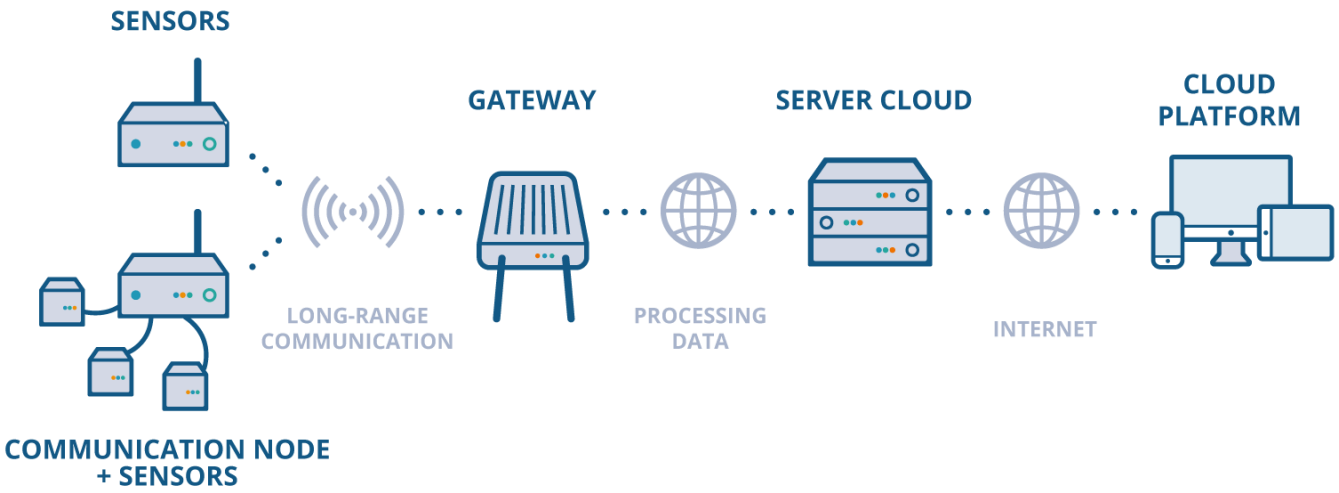
ACCELEROMETER DATASHEET

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



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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

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THE DEVICE: ACCELEROMETER

The Accelerometer measures acceleration and frequency in three axes, and it can be synchronised with other Accelerometers for Modal Analysis. With this device it is possible to detect seismic vibrations and assess the risk. It also monitors temperature, and it is wireless, plug-and-play and with a long-life battery.

ACCELEROMETER OUTPUT

The Accelerometer acquires acceleration data expressed in g on three axes at the selected sample rate. The sampling window duration depends on the sampling frequency and operation mode as expressed in the specifications table. Moreover, the sensors acquire temperature at each event. The sensor can be configured to start data acquisition in one of the following modes:

- **Threshold-triggered**: starts when programmed acceleration threshold is reached
- **Time-triggered (synchronized)**: planned acquisition mode which, thanks to the synchronization between sensors, allows extrapolation of forms and modal frequencies of the structure.
- **Threshold-triggered + Time-trigger**: both modes (Threshold and Time triggered) active at the same time.

The acquisition methods, the activation thresholds, the sampling frequency and the acceleration full scale can be configured remotely via the Web Platform provided by the service.

DOWNLOAD DOCUMENTATION

Visit the website at 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 Accelerometer device is “plug and play”; by screwing the special antenna on the cover, the device will immediately start to detect and try to send data to the Gateway device. To ensure correct operation the Accelerometer sensor must be correctly oriented and installed, following these specific steps:

1. **ORIENTATION:**

- The three axes shown on the orientation label, placed on the sensor cover, must be aligned as the axes of interest of the structure.
- The Accelerometer device can be rotated freely on the structure.

2. **INSTALLATION ON THE STRUCTURE:**

- Agree with the supplier company on the correct place of installation on the structure of the Accelerometer device.
- Firmly install the Accelerometer 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 install multiple Accelerometers 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 Accelerometer device will be able to detect and send data to the Gateway without interference or data alteration. Verify, via Move Solutions IoT 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	
Threshold triggered	Acquisition of 1024 triaxial acceleration samples subsequent to exceeding the activation threshold set by the user. Acquisition of the temperature in correspondence of each event.
Time triggered (Modal Analysis)	Acquisition of 8192 triaxial acceleration samples with a fixed rate set by the user (every 1, 2, 6, 12, 24 hours), synchronized between all sensors. Acquisition of the temperature at each event.
Custom Operation Software	It is possible to request custom features that the client deems necessary for their business.
Sample Rate	40Hz - 80Hz - 160Hz - 320Hz - 640Hz All derived from a 4 kHz sampling by means of downsampling
Absolute synchronization	± 1 seconds
Relative Synchronization (Modal Analysis)	500 µs

SAMPLE RATE	BANDWIDTH (-3dB)	THRESHOLD ACQUISITION DURATION	PLANNED ACQUISITION DURATION
40Hz	13.5Hz	25.6s	204.8s
80Hz	27Hz	12.8s	102.4s
160Hz	54Hz	6.4s	51.2s
320Hz	108Hz	3.2s	25.6s
640Hz	216Hz	1.6s	12.8s

MEASURMENT	
Technology	MEMS technology – Triaxial
Acquisition of	▪ Acceleration ▪ Temperature
Resolution	15bit (31.25µg, 62.5µg, 125µg)
Range	± 0.512g, ± 1.024mg, ± 2.048g
Noise density	22.5 µg/√Hz

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RADIO	
Radio channel	LoRaWAN communication protocol
Radio channel frequency	ISM 868Mhz
Link coverage*[1]	1km (line of sight with the Gateway)
GENERAL DATA	
Ingress protection*[2]	IP67
Battery	1 lithium battery type “D” 19Ah 3.6V
Operating temperatures	-40°C / +85°C
Dimensions	75 x 80 x 57 mm
Weight	1.1 Kg
Case material	Alloy GD-AlSi12
Corrosion resistance	>1000 hours in salt spray
INSTALLATION	
Method	Two-point mounting using screws and plugs (Ø6mm, L:30mm)
Site	▪ Fixing on wall ▪ Fixing on ceiling ▪ Fixing on ground

BATTERY LIFE		
Acquisition mode	**Radio connection quality**	**Estimated battery life*3**
Time triggered (1 hour)	Good	1.3 years
Time triggered (2 hours)	Good	2 years
Time triggered (6 hours)	Good	4.5 years
Time triggered (1 hour)	Bad	1 year
Time triggered (2 hours)	Bad	1.8 years
Time triggered (6 hours)	Bad	4 years
Threshold triggered (5 events/hour)	Good	1.4 years
Threshold triggered (5 events/hour)	Bad	1 year

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

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

***3** *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.