

EDGE DEVICES - WIRELESS SENSORS

Vibration Meter



LSG7ACL-BILH-VIB

Worldsensing Vibration Meter is a wireless sensor that automates data collection for long term, continuous vibration monitoring. It features a tri-axial accelerometer and an exception-based, edge algorithm that allows the detection of threshold breaches for vibration-based parameters such as L_{AW} /PPV and frequency.

The Vibration Meter is suitable to comply with vibration regulations regarding building integrity (DIN 4150-3, BS7385-2, among others) and vibrations effect on people (ISO2631-2).

Long-range and low-power

The Vibration Meter is a robust, IP68 device, and can operate under minimum maintenance. It transmits data via long-range radio to a gateway up to 15 km/9 miles away. Using a 30 minutes reporting period with events occurring at 2-3 minutes rate, it can last up to 1.5 years without battery replacements.

Enhanced vibrations monitoring

The Vibration Meter can be a complement to an existing high-sensitivity vibration monitoring system. It allows you to increase the data density to detect isolated events, thus increasing the reliability of the entire system.

Easy and Efficient Network Management

One Worldsensing Gateway can support hundreds of Worldsensing edge devices in the same network that are also measuring other sensors installed in the monitoring sections. Worldsensing edge devices can also be easily configured and connected with a USB cable and an Android phone. The device network can also be easily managed through the Connectivity Management Tool.

FEATURES

- Tri-axial MEMS accelerometer.
- Band pass filter according to the processing requirements, from an original band range of 0.5-250 Hz
- Robust, small and IP68 grade weather-proof box.
- Advanced edge processing with exception-based algorithms
- Up to 2 years battery lifespan at 30 min reporting period, with an event occurrence every 2 to 3 minutes.

SOFTWARE

- User-friendly Android configuration app included.
- Web browser software for network, device and data management.
- Single-gateway network setup with CMT Edge software (dataserver and radio server hosted in the gateway and data access through standard CSV downloads, FTP push, API REST and MQTT).
- Multi-gateway network setup with CMT Cloud software and advanced features with data access via standard CSV downloads, FTP push, API REST and MQTT push¹.

APPLICATIONS

- Vibration monitoring for building integrity.
- Vibration monitoring for vibrations effect on people.

ADVANTAGES

- Can be used to comply with PPV-based regulations such as DIN4150-3 and BS7385-2
- Can be used to comply with MTVV-based regulations such as ISO2631-2
- Very low maintenance equipment due to its robustness and low-power consumption.
- Easy configuration through the Worldsensing mobile application and through CMT Edge and Cloud.
- Customer support from a team of application monitoring and network experts.
- Pioneer company in the field, long history in monitoring large-scale civil infrastructure.

¹ MQTT available upon request



TECHNICAL SPECIFICATIONS

GENERAL

Sensor type	3-Axis MEMS Accelerometer
Sampling Rate	1000 Hz derived from a 4k Hz signal
Secondary sensor	Thermometer
Noise Floor	22.5 $\mu\text{g}/\sqrt{\text{Hz}}$
Original Frequency Band	0.5 - 250 Hz
Power Source	3,6 V D-size user-replaceable, high energy density batteries
Reporting Period	Selectable from: 30 s, 1, 2, 5, 10, 15, 30 min, 1, 2, 4, 6, 12, 24 h
Reporting format	<ul style="list-style-type: none"> Time stamp and reported parameters for the 9 most critical events of the reporting period. Total number events per reporting period.
Time synchronization discipline by radio	Better than ± 30 seconds
Device configuration	<ul style="list-style-type: none"> Worldsensing App CMT Cloud CMT Edge
Advanced functionalities	<ul style="list-style-type: none"> Configurable data processing/operation mode according to PPV and MTVV-based regulations. Threshold setup for different parameters (L_{AW} and PPV) Automatic selection of the nine most critical events for reporting purposes. Field samples and signal coverage test when connected to the app.

DEVICE CONFIGURATION

Operation Mode	<ul style="list-style-type: none"> PPV MTVV
Transmission Threshold	Based on output parameters.

PPV-BASED MODE SPECIFICATIONS

Reported parameters	<ul style="list-style-type: none"> PPV_{x,y,z} (mm/s), $f_{x,y,z}$ (Hz) T (°C)
Range (velocity)	0-60 mm/s
Internal Resolution (velocity)	0.00154 mm/s @4Hz
Output Resolution (PPV)	0.01 mm/s
Frequency output range	1 - 100 Hz
Frequency accuracy	1% (2% along the full temperature range)
Frequency output resolution	0.5 Hz

MTVV-BASED MODE SPECIFICATIONS

Reported Parameters	<ul style="list-style-type: none"> $L_{AW-x,y,z}$ (dBm) T (°C)
Acceleration Range	$\pm 2 g$
L_{AW} Range	<100 dB
Internal Acceleration resolution	3.9 μg
L_{AW} Output Resolution	0.05 dB
MTVV computation	Running RMS method
Frequency Weighting	Wm

MEMORY

Maximum Memory Records	>150 000 events including time stamp and reporting parameters.
Memory Structure	Circular Buffer

MECHANICAL	
Box dimensions (WxLxH)	100x100x61 mm
Overall dimensions	103x100x61 mm
Operating temperature	-40 °C to 80 °C (-40 °F to 175 °F)
Weather protection	IP68 (at 2 m for 2 h)
Weight (excluding batteries)	390 g
Antenna	Internal
Mounting options	Clearance holes for M4 hexagon socket head cap screws in bottom.
Configuration port	Internal USB-C
Box material	Aluminium alloy
Lid material	Polycarbonate
Battery holder	D-size battery holder
Impact resistance ²	Drop from 1 meter onto a concrete surface (20 000g)

BATTERY LIFE ESTIMATIONS ³				
SF9				
Threshold Sensibility		20 events/h	60 events/h	No events
Reporting Period	10 min	1.5 years	13 months	2.3 years
	30 min	2 years	15 months	2.5 years
SF11				
Threshold Sensibility		20 events/h	60 events/h	No events
Reporting Period	10 min	11 months	8 months	1.7 years
	30 min	1.4 years	1 year	2.2 years

² The Vibration Meter has good impact resistance. However it should be treated carefully like any precision instrument.

³ Battery life estimations using recommended Saft batteries LSH20. Computations considering a transmission power of 14dB, at 27°C, and event duration of 60 seconds. Device configured at operational mode PPV (most energy-demanding configuration). Reported events truncated when the maximum number of events per period are exceeded.

RADIO SPECIFICATIONS	
Radio band	ISM sub 1 GHz
Operating frequency bands	Adjustable
Bidirectional communications	Remote reporting period change/ clock synchronization
Maximum link budget	151 dB / 157 dB
Radio configuration	LoRa/ LoRaWAN
Network topology	<ul style="list-style-type: none"> LoRa Star LoRa Tree (K20 Edge repeater)
RADIO RANGE ⁴	
Range open sight	15 km
Range city street	4 km
Range manhole in a city street	2 km
Tunnel	4 km

⁴ The distances have been tested by Worldsensing and have been accomplished in actual projects using the standard antenna. However, radio range depends on the environment so these distances are only indicative. Consult with us for your application.



ACCESSORIES⁵

LS-ACC-IN15-HP	Versatile plate for horizontal surface mounting recommended for both horizontal and vertical mounting; attachment option: anchor rods or glue. Includes a threaded hole available for installing a monitoring prism or a button head screw for precise levelling.
LS-ACC-IN-HPTM	Horizontal surface mounting plate for track monitoring; attachment option: glue.
LS-ACC-IN15DP	Versatile double plate for horizontal surface mounting; suitable for applications that need to eliminate the need to open the casing during installation; attachment option: glue; includes a threaded hole available for installing a monitoring prism or a button head screw for precise levelling.
LS-ACC-ANC-H ⁶	Kit of 3 anchor rods for injection M8, 110 mm length. Nuts and washers included.
WS-ACC-CELL-1D	Saft LSH20 high power density 3.6 V, D-size spiral cell.

⁵ Other mounting brackets and accessories available upon request.

⁶ The kit can be used to fix the following mounting kits: LS-ACC-IN15-HP.



Fig. 3: Versatile horizontal surface mounting plate (LS-ACC-IN15-HP), recommended for both horizontal and vertical mounting. The plate has three clearance holes for M8 anchor rods and an M8 threaded hole available for installing a monitoring prism or a button head screw for precise levelling.



Fig. 6: Vibration Meter mounted on a double plate for horizontal surface mounting (LS-ACC-IN15DP). This is suitable for applications that need avoid opening the casing during installation.



Fig. 4: The Vibration Meter with the LS-ACC-IN-HPTM horizontal surface mounting plate.

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