

EDGE DEVICES - WIRELESS DATA LOGGERS

Vibrating wire

LS-G6-VW / LS-G6-VW-1M

The vibrating wire (VW) one- and five-channel data loggers automate data collection by connecting your vibrating wire instruments such as piezometers, load cells, strain gauges and pressure cells wirelessly to your monitoring systems.

The vibrating wire data loggers are autonomous battery-powered devices with C-size batteries that can last up to 22 years with minimum maintenance required. The units may also be used as standalone loggers for manual monitoring and can be easily configured and connected with a USB cable and an Android phone.

Vibrating wire sensors are widely used in geotechnical, hydrological and structural monitoring because of their robustness and long term stability. The VW data loggers provide accurate measurements of the vibrating wire sensors and their thermistors.

The vibrating wire data logger comes with an internal barometer which collects and transmits barometric pressure data with each reading. This compensates for changes in atmospheric pressure that vibrating wire sensors, particularly piezometers, are usually subjected to in various applications. This feature also eliminates the need for an external barometric sensor in order to acquire accurate measurements.

FEATURES

- Accurate vibrating wire measurement, with integrated barometer.
- Robust, small and IP68 grade weather-proof box.
- Long battery life (>22 years @1h sampling rate).
- Sensor detection - Filter for anomalous readings when the VW sensor disconnects.
- Two versions available - 1 and 5 channels.
- Long range communications through LoRa networks.

SOFTWARE

- User-friendly Android configuration app included.
- Web browser software for network, device and data management.
- Data processing with formulas to convert raw readings into engineering unit values.
- 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, Modbus TCP, API REST and MQTT[1]).
- Multi-gateway network setup with CMT Cloud software and advanced features with data access via standard CSV downloads, FTP push, API REST and MQTT push[1].

The vibrating wire data loggers are capable of detecting if a sensor is properly connected, and if not, the reading is discarded to avoid false measurements.

Vibrating Wire 5-channel (LS-G6-VW)

The 5-channel data data logger may be used for scenarios in which one borehole contains multiple sensors. This can be the case in mining or civil works, for example, where up to 5 piezometers or multipoint borehole extensometers may be installed in a single borehole. It is also ideal for groups of sensors like strain gauges and load cells with 3 to 5 sensors.

Vibrating Wire 1-channel (LS-G6-VW-1M)

The 1-channel version of the vibrating wire data logger is the perfect fit for applications in which you need to connect single, scattered sensors such as piezometers, crackmeters and joint meters.

APPLICATIONS[2]

Geothecnical Monitoring

- Ground stability wirelessly using vibrating-wire multi-point extensometers.
- Ground settlement connecting settlement cells to a vibrating wire data logger.
- Pore water pressure and level with vibrating wire piezometers.

Structural Health Monitoring

- Monitor the structural health of buildings and other infrastructure using crackmeter and joint meters.
- Structural loads and tensions with load cells and strain gauges.

ADVANTAGES

- Suitable for unattended, large scale projects.
- Very low maintenance equipment due to its robustness and low-power consumption.
- Easy configuration through the Worldsensing mobile application.
- Customer support from a team of geotechnical monitoring and network experts.
- Pioneer company in the field, long history in monitoring large-scale civil infrastructure.

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TECHNICAL SPECIFICATIONS

GENERAL

Input Types	Vibrating wire and thermistor per channel	
Data logger	LS-G6-VW	LS-G6-VW-1M
Channels (VW + TH)	5	1
Power source	3.6V C-Size user-replaceable high energy density	
Reporting Period	Selectable from: 30 s, 1, 2, 5, 10, 15, 30 min, 1, 2, 4, 6, 12, 24 h	
Time synchronization discipline by radio	±30 s	
Device configuration	Worldsensing App	
Advanced functionalities	• Field samples and signal coverage test when connected to the app. • Threshold configuration to discard anomalous readings when vibrating wire sensor is disconnected. • Custom sweep frequency range configuration.	

VIBRATING WIRE

Measurement method	Embedded algorithms increasing immunity to noise
Excitacion wave	± 5 V
Measurement range	300 to 7 000 Hz
Resolution[3]	<0.01 Hz

Accuracy[3] as *f*(sweep range)

Vibrating wire sweep range[4]	Excitation Frequencies (Hz)	Accuracy - Error (%)	Resolution (Hz)
Sweep A	450 - 1 125	0.013	0.002
Sweep B	800 - 2 000	0.008	0.002
Sweep C	1 400 - 3 500	0.010	0.004
Sweep D	2 300 - 6 000	0.009	0.007

[1] MQTT available upon request.

[2] The LS-G6-VW cannot be permanently submerged in water nor embedded in concrete linings. Please refer to the LS-G6-VW-RCR for these applications.

[3] Resolution and accuracy within operating temperature.

[4] The vibrating wire sweep range selection is determined by the frequency range of the type of instrument you are reading.

THERMISTOR

Measurement range	0 Ω to 4 MΩ
Resolution	1 Ω
Accuracy (20°C)[5]	0.05°C (0.04 % FS)

BAROMETER

Pressure Range	300 to 1 100 hPa
Relative accuracy	±0.12 hPa (700 to 900 hPa at 25° C)

MEMORY

Maximum Memory Records	73 500 readings for 5 channels 200 000 readings for 1 channel
Memory Structure	Circular Buffer

MECHANICAL

Node	LS-G6-VW	LS-G6-VW-1M
Box dimensions (WxLxH)	100x200x61 mm	100x100x61 mm
Overall dimensions (excluding antenna)	140x220x61 mm	140x120x61 mm
Operating temperature	-40ºC to 80ºC (-40ºF to 175ºF)	
Weather protection	IP68[6]	
Weight (excluding batteries)	1 268 g	662 g
External Antenna (including connector)	114 mm	114 mm
Configuration/ ext. power interface	External mini USB	Internal mini USB
Box material	Aluminium alloy	
Clamping range ⌀	4-10 mm	
Battery holder capacity	≤4	1
Grounding connector	Integrated	
Surge protecion compliance	IEC61000-4-5, Class 2, test level ±1 kV, 2 Ω	

[5] The accuracy and resolution are calculated based on a 3K thermistor.

[6] Water ingress protection also depends on the quality and condition of the cable coming from the sensor. Additionally, the cable's curvature near the cable gland can reduce this protection.

RADIO SPECIFICATIONS

Radio band	ISM sub 1 GHz
Operating frequency bands	Adjustable
Bidirectional communications	Remote sampling rate change/ clock synchronization
Maximum link budget	151 dB / 157 dB
Radio configuration	LoRa/ LoRaWAN
Radio range	
Range open sight	15 km
Range city street	4 km
Range manhole in a city street	2 km
Tunnel	4 km

BATTERY LIFE ESTIMATIONS[7]

VIBRATING WIRE 1 CHANNEL

Battery Model		LSH14	LM26500
Number of cells		1 cell	1 cell
Sampling Rate	5 min	1.2 years	1.7 years
	1 h	5.7 years	8.6 years
	6h	7.9 years	12.5 years

VIBRATING WIRE 5 CHANNEL

Battery Model		LSH14	LM26500	
Number of cells		4 cells	2 cells	4 cells
Reporting Period	5 min	3.7 years	2.3 years	4.6 years
	1 h	11.4 years	11.3 years	22.7 years
	6h	13.1 years	16.3 years	>25 years

[7] Typical Europe radio configuration. Spreading factor 9, radio transmit power 14dBm. Considering laboratory conditions. Consumption varies depending on the sensor used, sampling rate and environmental and wireless network conditions.

Battery life estimations based on the lifetime mathematical model using Barcelona weather profile. Average values provided.

ACCESSORIES[7]

WS-ACC-POLE-PL8	Aluminum plate for pole mounting. Works with both U-bolts of 35mm or 50mm.
WS-ACC-U35	U-bolts and nuts for a pole diameter less than 35 mm. To use with WS-ACC-POLE-PL8.
WS-ACC-U50	U-bolts and nuts for a pole diameter less than 50 mm. To use with WS-ACC-POLE-PL8.
LS-ACC-IN15-HP	Versatile plate for horizontal and vertical surface mounting. Not compatible with LS-G6-VW.
LS-ACC-MEC-MP	External mounting brackets (set of 2) for wall mounting.
LS-ACC-CELL-1C	Saft LSH 14 C-size spiral cell 5.8 Ah.
WS-ACC-CELL2-1C	Saft LM26500 C-size spiral cell 7.4Ah.
LS-ACC-ANTC	Antenna cable extension RP-SMA to RP-N, 2.5m.
LS-ACC-MUSB-C	Data logger - mobile cable. USB C to mini USB cable, 1 m.

[7] Other mounting brackets and accessories available upon request.



Fig.1: An inner view of a vibrating wire data logger 1 channel. The data loggers are autonomous battery-powered devices with C-size batteries that can last several years with minimal to zero maintenance required.

FOR MORE INFORMATION

Scan to access the user guide for this edge device.

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