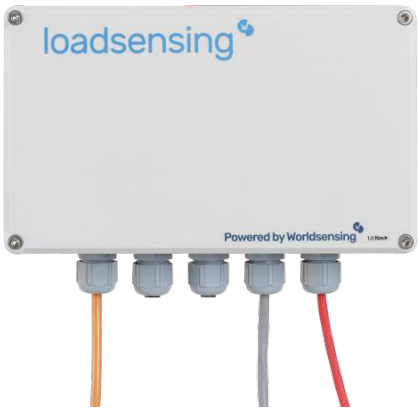
EDGE DEVICES - WIRELESS DATA ACQUISITION

Vibrating Wire

LS-G6-VW-RCR



The Worldsensing Vibrating Wire RCR (VW-RCR) is an ultra-robust 5-channel data logger suited to be embeded in concrete segments for tunnel linings. It securely connects vibrating wire instruments such as piezometers, load cells, strain gauges and pressure cells to monitor tunnel lining integrity from as early as the concrete segments manufacturing.

Made to resist concrete

The VW-RCR is made of an resistant polymer casing that withstands concrete pressure and chemical composition. The inside of the device is filled with a re-enterable resin that seals and insulates the device electronic components from unexpected concrete filtration during concrete setting in the manufacturing process.

Long-range capabilities

An whip antenna is fitted inside the casing so the device can sustain long-range radio communications. In tunnels with interfering machinery (such as TMB), it can transmit data up to 400 m and up to 3 km with good visibility.

The VW-RCR is an autonomous, battery-powered device with C-size batteries that can last up to 10 years with minimal to zero maintenance required. The devices can also be easily configured before they are embedded in concrete thorugh a USB cable and an Android phone. When installed near concrete surface, the VW-RCR can be accesed and reopened for battery exchange and to access the USB port.

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

FEATURES

Robust concrete-resistant polymer casing
Gel filling that provides extra protection to device components from unexpected concrete filtration
Long battery life (>10 years @6h sampling rate)
Sensor detection
Internal whip antena. Long-range communications (up to 400 m)
Durable and versatile

CONNECTIVITY

User-friendly Android configuration app included
Web-based software
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, 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]

[1] MQTT available upon request

APPLICATIONS

Strucutural health monitoring of concrete segments (voussoirs)
Lining integrity during tunnel construction
Long-term tunnel infrastructure maintenance

ADVANTAGES

Obtain critical monitoring data in early stages of tunnel construction.
Reduce the risk of damage from visible monitoring equipment during construction phases.
Reduce maintenance costs by remote monitoring that can last up to 10 years.
Minimize post-construction intervention by avoiding additional installation of IoT sensors.
Customer support from pioneer company in the field, experts in monitoring large-scale civil infrastructure.

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Main specifications

GENERAL

Battery life estimation[2,3]	**5 channels, 2 cells**
sampling rate 5 min	2.2 years
sampling rate 1 h	7.1 years
sampling rate 6 h	>10 years
Battery type	3.6V C-Size user-replaceable high energy density battery pack (recommended Saft LSP26500-20F)
Sampling rate	30 seconds to 1 day
Device Configuration	Android Mobile Aplication
App Advanced functionalities	Threshold configuration feature to discard readings and perform radio signal coverage tests for easy installation.

VIBRATING WIRE

Channels (frequency and temperature)	5 channels
Measurement method	Embedded algorithms increasing immunity to noise
Excitacion wave	± 5 V
Measurement range	300 to 7 000 Hz
Resolution[4]	<0.01 Hz

Accuracy[4] as *f*(sweep range)

Vibrating wire sweep range[5]	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

[2] Estimations for Saft LSP26500-20F batteries based on the lifetime mathematical model.

[3] 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.

[4] Resolution and accuracy within operating temperature

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

THERMISTOR

Measurement range	0 ohm to 4 Mohm
Resolution	1 ohm
Accuracy (20°C)[6]	0.05°C (0.04 % FS)

MEMORY

Memory Structure	Circular Buffer
Maximum Memory Records	72 500 readings (time and 5 sensors)

MECHANICAL

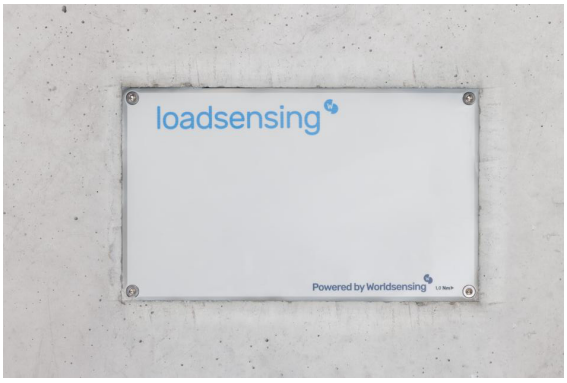
Box dimensions (WxLxH)	200 x 120 x 57 mm
Operating temperature	-20ºC to 65ºC (-4ºF to 149ºF)
Weather protection	IP68
Weight (including batteries)	690 g
Total weight (including filling and batteries)	1.4 kg
Antenna	Internal whip antenna - 89 mm length
USB (configuration)	Internal mini USB
Box material	ABS (thermoplastic)
Batteries	2-battery pack with supercap
Insulating filling	Polybutadiene resin
Clamping range ⌀	4-10 mm
Grounding connector	Integrated
Surge	Complies with IEC61000-4-5, Class 2, test level ±1 kV, 2 ohms

[6] Sensor error is not included

Main specifications

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	Star (no repeaters needed)
Radio Range	
Tunnel with TBM interferece	400 m
Straight tunnel	3 km
Curved tunnel	800 m

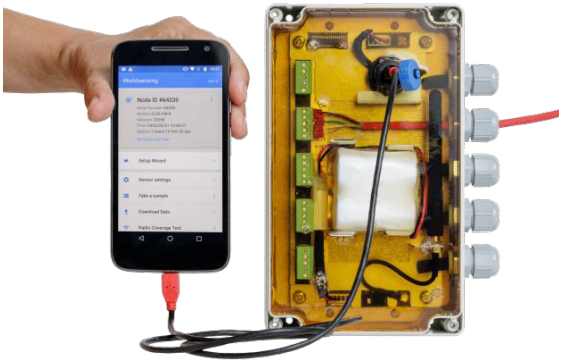


VW-RCR embedded in concrete. The product comes with a polyestirene protective cover (not shown). The surface layer of the concrete segment and the protective cover have been chiseled out in order to re-access the device for maintenance purposes.

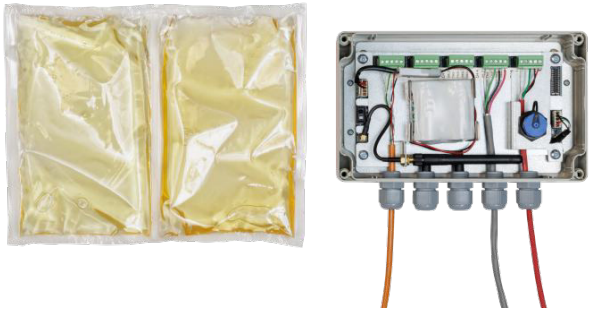
ACCESSORIES

Other mounting brackets and accessories available upon request.

WSACCVWRCRBR	2 mounting brackets for LS-G6-VW-RCR attachment to steel armature rods inside concrete elements with nylon cable ties or to a wall with M6 anchors



VW-RCR connected to the Worldsensing App. The device can be configured through USB cable after the resin is applied.



Pack of insulating resin to be applied after sensor setup, included with the VW-RCR (left). VW-RCR without the resin applied.Cables not included (right).

FOR MORE INFORMATION

Scan to access the user guide for this edge device.

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