EDGE DEVICES

Digital logger

LS-G6-DIG-2

The Loadsensing Digital logger brings the advantages of electronics to the geotechnical world. It can easily connect a wireless network of in-place inclinometres (IPIs) on a chain in a hole or excavation, multipoint borehole extensometers (MPBX) and other sensors from leading manufacturers. It transforms manual and sporadic data collection to a more regular and automatic process, making it the most cost-efficient way to capture data from any environment. It is capable of transmitting data via long-range radio to a gateway connected to the Internet up to 9 miles / 15 kilometers away.

In-place inclinometers enable precise, remote, continuous and automatic monitoring of ground movement. The Loadsensing digital loggers are autonomous battery-powered devices with C-size batteries thus avoiding the need of solar power systems in most cases. Beyond IPIs, other digital sensors used in geotechnical, structural and environmental monitoring can also be connected by the digital logger.

The digital logger can be easily configured and connected with a USB cable to an Android phone with the configuration software Android app. The app includes features adapted to each supported sensor such as auto-setup, set up of a voltage threshold to check the power supply received by the sensor, set up of addresses, checking of readings in the field and others.

The data collected are stored in the digital logger and shared wirelessly to the closest Loadsensing gateway. A single gateway can support dozens of nodes. The units may also be used as standalone loggers for manual monitoring.

The Loadsensing digital logger is rapidly evolving and integrating new sensors so it is recommended to constantly check for device updates.

FEATURES

Compatibility with digital sensors like:

- In-place inclinometers from Sisgeo, Geosense, DGSI Slope, RST Instruments and Geokon.
- Borehole extensometers from MDT and Sisgeo.
- Strings of temperature probes.
- Water level sensors, water quality probes and weather transmitters.
- Measurand ShapeArray (SAAV and SAAX).

Low-power, long battery life. Mostly does not require external power.

Durable and versatile.

SOFTWARE

Web browser 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 and API REST).

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.*

* MQTT available upon request

APPLICATIONS

Lateral ground movement in and around tunnels and deep excavations.

Lateral ground movement of tailings dams and embankments.

Landslides and slope stability.

Ground movement around tunnels and underground excavation.

Settlement and heave under embankments, tanks, and landfills.

Water quality and high precision level monitoring.

ADVANTAGES

High reliability and robustness.

Long-range communications (up to 15 km / 9 miles)

Robust, small and weather-proof box.

Easy configuration.

Connectivity for strings of digital sensors from major geotechnical and structural instrument manufacturers.

Proven track record, pioneer in the field.

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MAIN SPECIFICATIONS

GENERAL

One RS485 channel and two SDI-12 channels.
Power supply: Regulated 12 V DC up to 200 mA in continuous operation. Maximum start up current peak of 1.5 A, up to 50 mseconds.
RS485 full or half duplex supported.
Battery type: 3.6V C-Size user-replaceable high energy density, batteries (recommended Saft LSH 14).
Sampling rate: 30 seconds[1] to 1 day.
Time synchronization by radio: Time discipline better than ±30 seconds.
Configuration software Android App.
App features: auto-setup, configure the threshold used to discard readings, take samples in the field and signal coverage test for an easy installation. For the Measurand ShapeArrays: auto-detection of the segments and SAA protocol configuration (regular and low power).

MEMORY - CIRCULAR BUFFER STRUCTURE

Memory records: Up to 72 500 readings including time and 5 sensors.
Memory records: up to 200 000 readings including time and 1 sensor.
Memory records: up to 4 000 readings including time and 100 Measurand SAA segments.
Memory records: up to 8 000 readings including time and 50 Measurand SAA segments.

MECHANICAL

Box dimensions (WxLxH): 100 x 200 x 61 mm.
Overall dimensions: 140x220x61 mm (excluding antenna).
Operating temperature:-40°C to 80 °C (-40°F to 175°F).
Weather protection: IP67 with proper use of cable entry points.
Weight (excluding batteries): 1 154 g
Antenna: external: 114 mm length (including connector).
USB (configuration/ext. power): external mini USB.
Box material: Aluminium alloy.
Clamping range ⌀: 4-10 mm.
Batteries: from 1 up to 4.
Grounding connector: Integrated.

[1] The higher frequency of acquisition allowed varies depending on the sensor used and the number of sensors or segments connected to the chain. E.g. for a 100 SAA segments array, in this case the higher frequency of acquisition allowed is 5 minutes.

RADIO - ISM sub 1 GHz operating frequency bands adjustable	
Range open sight	15 km
Range city street	4 km
Range manhole in a city street	2 km
Tunnel	4 km

Notes: 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.

The presented distances are the standards of Loadsensing Digital Logger. When the digital logger is connected to a Measurand ShapeArray, these distances can be shorter.

As an estimate, it is assumed that:

For regions like in the USA, Canada and Brazil. The radio coverage achieved when reading Measurand ShapeArray will be 20% lower to the presented in the above table.

For regions like in Europe, Singapore and Australia the radio coverage achieved when reading Measurand ShapeArray will be 50% lower to the presented in the above table.

Contact with us if you need additional information.

Maximum link budget: 151 dB / 157 dB
Configuration: Star (no repeaters needed)
Bidirectional communications: Remote sampling rate change / Clock synchronization
Configuration: Star (no repeaters needed)

ACCESSORIES

Other mounting brackets and accessories available upon request

LS-ACC-POLE50-AL	Plate for pole mounting. Includes: U-bolts and nuts for a pole ⌀ less than 50 mm.
LS-ACC-POLE35-AL	Plate for pole mounting. Includes: U-bolts and nuts for a pole ⌀ less than 35 mm.
LS-ACC-MEC-MP	External mounting brackets (set of 2) for wall mounting.
LS-ACC-CELL-1C	Saft LSH 14 C-size spiral cell (5.8Ah).
LS-ACC-MUSB-OTG	Data logger - mobile cable. USB OTG to mini USB, 0.5m.
LS-ACC-MUSB-C	Data logger - mobile cable. USB C to mini USB cable, 1 m.

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COMPATIBILITY

Frequency of acquisition allowed varies depending on the sensor used and the number of sensors connected to the chain

Sensor manufacturer	Sensors[2]	Maximum number of sensors per data logger	External power is needed[3]	Remarks
Geosense digital sensors	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	30	-	
Sisgeo digital instruments	BH-profile In-Place-Inclinometer, IPIs, Tiltmeter and Rail Deformation System (RDS)	30	-	
	H-Level settlement system	30	-	
	Load cells	30	-	
	Piezometers	30	-	
	Extensometer probes (DEX)	30	Yes	
	Extenso-Inclinometer probes (DEX-S)	18	Yes	
	MPBX or MEXID extensometers up to 2 anchor points	30	-	
	MPBX or MEXID extensometers 3 anchor points	18	-	
	MPBX or MEXID extensometers up to 6 anchor points	12	-	
DGSI Slope	GeoFlex in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
Soil Instruments	GEOSmart in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
Roctest	GEOSTRING in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
MDT	SMART MPBX (Multi-Point Borehole eXtensometer) - six anchor points	1	-	1 MPBX (up to 6 anchors)
RST instruments digital sensors	In-Place Inclinometer System[4] (Next-Gen IPI, also called Gen 4)	50	-	
	Tiltmeters and tilt beams	30	-	
Geokon	In-Place Inclinometer Systems	50	Yes	The digital logger can power up to 20 sensors
	Addressable Thermistor Strings	50	-	
In-Situ	Water Level TROLL, Modbus RTU	6	-	
	BaroTROLL, Modbus RTU	6	-	
Keller	High precision level sensor (P and Temp) Series 36 X W, Modbus RTU	6	-	
	Water multi-parameter probe (P, Temp and Conductivity) Series 36 Xi W (CTD), Modbus RTU	6	-	
Vaisala	Vaisala WXT536 weather transmitter. RS-485, Modbus RTU communication interface	1	Yes	
Measurand ShapeArray	SAA segments in low power or regular mode[5]	100		

[2] Loadsensing compatibility with the listed sensors varies depending on the generation of digital sensors because sensors manufacturers sell, in some cases , different versions over time. In case of doubt, please contact us.
[3] Contact us if you are interested in how to externally power the string of sensors.
[4] When using Loadsensing system, it is recommended to order the IPI's with the Modbus Address already configured from the factory.
[5] When using Loadsensing system, the preferred configuration of the Measurand ShapeArray is the low power mode.

BATTERY LIFE ESTIMATION

Sensors	Sampling rate 5 minutes	Sampling rate 1 h	Sampling rate 6 h
Geosense - 15 IPIs	3 months	2.5 years	6 years
Sisgeo - 30 IPIs (v3 protocol, always on)	12 days	5 months	2.3 years
Sisgeo - 30 IPIs (v3 protocol, timed mode)	22 days	8.5 months	4.1 years
DGSI Slope - 10 GeoFlex	20 days	7.7 months	2.9 years
MDT - 1 SMART MPBX	1.6 years	7.5 years	10 years
RST - 10 IPIs (Next-Gen IPI)	6.5 months	3.8 years	7.3 years
RST - 30 IPIs (Next-Gen IPI)	78 Days	2 years	5.7 years
RST - 50 IPIs (Next-Gen IPI)	48 Days	1.4 years	4.6 years
Geokon - 10 IPIs	5 months	3.3 years	7 years
Geokon - 20 IPIs	68 Days	1.8 years	5.4 years
Geokon - 20 Address. Therm	4.3 months	3 years	6.7 years
Geokon - 50 Address. Therm	38 days	1.1 years	4.1 years
In Situ - 1 Water level TROLL	2 years	6.9 years	8.5 years
KELLER - 1 36XiW-CTD probe	0.9 years	5.1 years	7.9 years
Measurand ShapeArray segments			
40 segments in low power mode	3.8 months	2.7 years	6.4 years
100 segments in low power mode	49 Days	1.4 years	4.7 years
40 segments in regular mode	3.5 months	2.6 years	6.3 years
100 segments in regular mode	42 days	14 months	4.3 years

Note: Battery life may vary considerably from specifications depending on the actual set-up and working conditions; such as sensor version, sampling rate, wireless network status and environmental conditions. The battery life rating is only achieved on the specific sensor models and configurations tested by Worldsensing under the specific test settings at the time of publication and is not an estimate of a system's battery life under any conditions other than the specific test settings.

Test settings in terms of radio: Europe radio configuration. Spreading factor 9. Radio transmit power 14dBm. Considering standard laboratory conditions. Estimations for 4 Saft LSH14 batteries based on the lifetime mathematical model.

Test settings in terms of radio for the Measurand ShapeArrays: US 902-928MHz (FCC) radio configuration. Spreading factor 8. Radio transmit power 20dBm. Considering standard laboratory conditions. Estimations for 4 Saft LSH14 batteries based on the lifetime mathematical model.