

EDGE DEVICES

# Digital logger

## LS-G6-DIG-2



The Worldsensing Digital Logger is a robust, low-power, long-battery life device that allows for data collection from digital sensors. 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.

Our data loggers can easily connect to MODBUS RTU sensors and proprietary protocols for in-place inclinometers (IPIs), multipoint borehole extensometers (MPBX), as well as other sensors from leading industrial device manufacturers. Beyond IPIs, other digital sensors used in geotechnical, structural, process control and environmental monitoring can also be connected by the digital logger.

In terms of energy consumption, Worldsensing digital loggers are autonomous battery-powered devices with C-size batteries thus avoiding the need of solar power systems in most cases.

The digital logger can be easily configured and connected with a USB cable to an Android device 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 Worldsensing gateway. A single gateway can support dozens of nodes. The units may also be used as standalone loggers for manual monitoring.

The catalog of sensors compatible with Worldsensing is growing rapidly to adapt to the needs of your project.

FEATURES
Compatibility with digital sensors such as: <ul style="list-style-type: none"> <li>• ModBus RTU sensors*</li> <li>• In-place inclinometers from Sisgeo, Geosense, DGSi Slope, Soil Instruments, RST Instruments, Geokon and Encardio.</li> <li>• Borehole extensometers from MDT, Sisgeo and YieldPoint and in-place extensometers from Osprey.</li> <li>• Strings of temperature probes.</li> <li>• In-Situ Level TROLL®, BaroTROLL® and Aqua TROLL® 200</li> <li>• Liquid leveling systems Measurand ShapeArray (SAAV, SAAV-Extend, SAAX)</li> <li>• Water level sensors, water quality probes and weather transmitters</li> </ul>
Low-power, long battery life devices. Mostly does not require external power.
Robust, small and weather-proof box (IP67)
Long-range communication through LoRa networks
SOFTWARE
User-friendly Android configuration app included.
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, API REST and MQTT <sup>1</sup> ).
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 <sup>1</sup> .

<sup>1</sup> MQTT available upon request

APPLICATIONS
Geotechnical monitoring
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.
Process Control
Water quality and high precision liquid level monitoring.
Water flow and pressure.
Structural health
Loads in rock bolts, ground anchors monitoring.
ADVANTAGES
Allows you to connect strings of digital sensors from major geotechnical and structural instrument manufacturers.
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 expert team of geotechnical monitoring
Pioneer company in the field, long history in monitoring large-scale civil infrastructure

**MAIN SPECIFICATIONS**

**GENERAL**

Output power	Regulated 12 V DC up to 200 mA in continuous operation. Maximum start up current peak of 1.5 A, up to 50 ms
Input	RS485 full or half duplex supported
Battery type	3.6V C-Size user-replaceable high energy density, batteries (recommended Saft LSH 14)
Sampling rate <sup>2</sup>	Selectable from: 30 s, 1, 2, 5, 10, 15, 30 min, 1, 2, 4, 6, 12, 24 h
Time synchronization discipline by radio	Better than ±30 seconds
Device configuration	Android Mobile Application
App advanced functionalities	Auto-setup, configure the threshold used to discard readings, take samples in the field and signal coverage test for an easy installation.
Sensor-specific App functionalities	Specific Modbus RTU drivers on demand. For the Measurand ShapeArrays: auto-detection of the segments and SAA protocol configuration (regular and low power).

**MEMORY**

Memory Structure	Circular Buffer
Memory Record Maximums	72.5k readings including time and 5 sensors
	200k readings including time and 1 sensor
	4k readings including time and 100 Measurand SAA segments
	8k 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 kg
External Antenna	114 mm length (including connector)
USB (configuration)	External mini USB
Box material	Aluminium alloy

Clamping range	∅ 4-10 mm
Battery holder	from 1 up to 4 C-type cells
Grounding connector	Integrated

**RADIO**

Radio band	ISM sub 1GHz	
Operating frequency bands	Adjustable	
Bidirectional communications	Remote sampling rate change / clock synchronization	
Maximum link budget	151 dB / 157 dB	
Configuration	Star and Tree network topologies	
Radio Range <sup>3</sup>	Open sight	15 km
	City street	4 km
	Manhole in a city street	2 km
	Tunnel	4 km

**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 (5.8 Ah)
LS-ACC-MUSB-OTG	Data logger - mobile cable. USB OTG to mini USB, 0.5 m
LS-ACC-MUSB-C	Data logger - mobile cable. USB C to mini USB cable, 1 m

<sup>3</sup> 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 WorldSensing 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 us if you need additional information.

<sup>2</sup> 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.

**COMPATIBILITY**

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

Sensor manufacturer	Sensors <sup>4</sup>	Maximum number of sensors per data logger	External power is needed <sup>5</sup>	Remarks
Geosense digital sensors	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	30	-	Through RS-485 Integration
	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	50	-	Through ModBus Integration
Sisgeo digital instruments <sup>5</sup>	BH-profile In-Place-Inclinometer, LT-inclibus, in-place inclinometers, Tiltmeter and Rail Deformation System (RDS)	30	-	Specifications assuming factory configuration: • from 1 to 15 sensors: ALWAYS-ON or TIMED • from 16 to 30 sensors: TIMED
	H-Level settlement system	30	-	
	Load cells	30	-	
	Piezometers	30	-	
	Extensometer probes (DEX)	30	Yes	Specifications assuming factory configuration. DeX and DEX-S always configured as TIMED.
	Extensometer 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)	1	-	1 MPBX (up to 6 anchors) using Smart Link-485
RST instruments digital sensors	In-Place Inclinometer System <sup>6</sup> (Next-Gen IPI, also called Gen 4)	50	-	When using Worldsensing system, it is recommended to order the IPI s with the Modbus Address already configured from the factory.
	Tiltmeters and tilt beams	30	-	
Geokon	In-Place Inclinometer Systems within the +/- 15 range <sup>6</sup>	50	Yes	The digital logger can power up to 20 sensors
	Addressable Thermistor Strings	50	-	
In-Situ	Level TROLL®, Modbus RTU	6	-	
	BaroTROLL®, Modbus RTU	6	-	
	Aqua TROLL® 200, 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	

<sup>4</sup> Worldsensing 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.

<sup>5</sup> Contact us if you are interested in how to externally power the string of sensors.

<sup>6</sup> The Geokon in place inclinometer system model 6180 range is + 90 and the calibrated range is + 30 . Worldsensing can read and transmit the measurements within +/- 15 covering the needs of most applications.

**COMPATIBILITY**

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

Sensor manufacturer	Sensors <sup>4</sup>	Maximum number of sensors per data logger	External power is needed <sup>5</sup>	Remarks
Position Control PC-HSD4 V2	Modbus RTU communication protocol. The hose level (Liquid Leveling System) is an instrument for hydrostatic height measurement.	30	-	The digital logger can power up to 25 sensors
Measurand ShapeArray	SAA segments in low power or regular mode <sup>7</sup>	100		
Osprey Measurement Systems	IPX-08 In-Place Magnetic Extensometer	50	-	
Bauer	Load Cells (extended)	10	-	
	Load Cells (basic)	30	Yes	Contact us to assess the number of autonomously powered sensors
Encardio	EAN-56 In-place Inclinometers (IPI)	32	Yes	The digital logger can power up to 25 sensors
Yieldpoint	dJUMP dPiezo D2cable dPPC dCSIRO d2MPBXT d2EXTO d5EXTO dCONV d6Exto Others <sup>8</sup>	1	-	Up to 13 channels per instrument. This protocol can only be used for connecting one instrument.
Generic	Modbus RTU sensor drivers	-	-	On demand integrations. Contact Worldsensing for more details.

<sup>7</sup> Regular mode available for SAA units with a serial number above 199 999. Low power mode available only for SAAs with a serial number above 350 000 and a firmware version equal or above 0.07. When using the Worldsensing system, the preferred configuration of the Measurand ShapeArray is in low power mode. The resolution of the measurement collected by Worldsensing from a ShapeArray configured in regular mode is equivalent to the measurements provided by a ShapeArray configured in low power mode.

<sup>8</sup> Please contact support@worldsensing.com to get the list of Yieldpoint sensors available through this new digital integration.

**BATTERY LIFE ESTIMATION\***

Sensors		Sampling rate 5 minutes	Sampling rate 1 h	Sampling rate 6 h
Geosense	15 In-Place-Inclinometers	3 months	2.5 years	6 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
	30 IPIs (Next-Gen IPI)	78 days	2 years	5.7 years
	50 IPIs (Next-Gen IPI)	48 days	1.4 years	4.6 years
Geokon	10 IPIs	5 months	3.3 years	7 years
	20 IPIs	68 days	1.8 years	5.4 years
	20 Address. Therm	4.3 months	3 years	6.7 years
	50 Address. Therm	38 days	1.1 years	4.1 years
In-situ	In Situ - 1 Level TROLL®	2 years	6.9 years	8.5 years
	In Situ - 1 Aqua TROLL® 200	2 years	6.9 years	8.5 years
KELLER	1 36XiW-CTD probe	0.9 years	5.1 years	7.9 years
Position Control	PC HSD4 V2 - 5 sensors	2.4 months	1.95 years	7.9 years
	PC HSD4 V2 - 25 sensors	0.5 months	5.5 months	7.9 years
Encardio	Encardio EAN-56 - 5 sensors	3.7 months	2.7 years	6.4 years
	Encardio EAN-56 - 10 sensors	1 month	11 months	3.6 years
	Encardio EAN-56 - 25 sensors	4 days	1.5 months	9 months
Osprey IP-08 In-Place Magnetic Extensometer	1 sensor	6.3 years	8.6 years	8.8 years
	5 sensors	2.5 years	7.3 years	8.6 years
	10 sensors	1.2 years	5.9 years	8.2 years
	30 sensors	5.6 months	3.5 years	7.1 years
	50 sensors	3.4 months	2.5 years	6.2 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
Bauer Load Cells (extended)	1 sensor	8 months	4.69 years	9.02 years
	5 sensors	1.6 months	1.42 years	5.19 years
	10 sensors	0.8 months	0.76 years	3.39 years

\* 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.

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