WORLD SENSING

EN ES FR PT

EDGE DEVICES

Digital Data logger

LS-G6-DIG-2

The Worldsensing Digital Logger is a robust, low-power, long-battery life device that allows for wireless data collection from digital sensors. It is capable of transmitting data via long range radio to a gateway 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 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.

Consult the list of compatible sensors and battery life estimations in this document. The list is periodically updated to include new sensors that respond to your monitoring needs.

FEATURES

Compatibility with digital sensors such as:

- ModBus RTU sensors
- In-place inclinometers from Sisgeo. Geosense. DGSI Slope. Soil Instruments, RST Instruments, Geokon and Encardio.
- Borehole extensometers from MDT, Sisgeo and YieldPoint and in place extensometers from Osprey.
- Strings of temperature probes.
- Weather stations from Vaisala and Gill Instruments.
- In-Situ Level TROLL®. BaroTROLL® and Aqua TROLL® 200.
- Liquid leveling systems.
- Measurand ShapeArray (SAAV, SAAV-Extend, SAAX).
- Water level sensors, water quality probes and weather transmitters.

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 (data server 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].

[1] 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.

WATER MANAGEMENT

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.

TECHNICAL 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	3.6 V C-size user-replaceable high energy density, batteries (recommended Saft LSH 14)
Reporting Period[2]	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 (3.9 x 7.9 x 2.4")
Overall dimensions (excluding antenna)	140 x 220 x 61 mm (5.5 x 8.67 x 2.4")
Operating temperature	–40 °C to 80 °C (–40 °F to 175 °F)
Weather protection[3]	IP68
Weight (excluding batteries)	1.154 kg (2.454 lb)
External Antenna (including connector)	114 mm (4.5")
USB (configuration)	External mini USB
Box material	Aluminum alloy
Clamping range	Ø 4–10 mm (0.15–0.39")
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	
Network topology	Star and Tree network topologies	
Radio Range[4]	Open sight	15 km (9.3 miles)
	City street	4 km (2.5 miles)
	Manhole in a city street	2 km (1.2 miles)
	Tunnel	4 km (2.5 miles)

ACCESSORIES

Other mounting brackets and accessories available upon request

WS-ACC-POLE-PL8	Aluminum plate for pole mounting.
WS-ACC-U35	U-bolts and nuts for a pole diameter less than 35 mm.
WS-ACC-U50	U-bolts and nuts for a pole diameter less than 50 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-C	Data logger – mobile cable. USB-C to mini USB cable, 1 m
LS-ACC-ANTC	Antenna cable extension RP-SMA to RP-N, 2.5 m.

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

[3] Water ingress protection also depends on the quality and condition of the cable coming from the sensor. Please note that the cable's curvature near the cable gland can reduce this protection

[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.

Please note that whe 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.

COMPATIBILITY

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

Sensor manufacturer	Sensor models[5]	Max. sensors per data logger	External power needed	Remarks
Aqualabo	Turbidity NTU, Conductivity C4E PH, Redox PHEHT, Dissolved oxygen OPTOD ORP Annular Conductivity CTZ Turbidity Suspended solid StacSense	20	No	A 'generic configuration' is available to facilitate the connection of chains with various types of sensors, including the integration of multi-parameter equipment such as TRIPOD
Arad	Octave Ultrasonic Water Meter	10	No	–
Bauer	Load Cells (extended)	10	No	–
	Load Cells (basic)	30	Yes	Contact us to assess the number of autonomously powered sensors
DGSI Slope	GeoFlex in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
Encardio	EAN-56 In-place Inclinometers (IPI)	32	Yes	The digital logger can power up to 25 sensors
	Geoprofile	50	No	-
Generic	Modbus RTU sensor/drivers	–	–	On demand integrations. Contact Worldsensing for more details.
Geokon	In-Place Inclinometer models 6180, 6185, and 6140, and tilt sensor model 6190, ±30° range.	50	No	–
	In-Place Inclinometer models 6180, 6185, and 6140, and tilt sensor model 6190, ±90° range.	40	No	–
	Addressable Thermistor Strings	50	No	–
Geosense digital sensors	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	50	No	–
Gestecno	IFF-510 in-place inclinometers	40	Yes	Compatibility for sensors with serial number above 2403700. Pending battery life estimations.
	CLS-100 tiltmeters	40	Yes	Compatibility for sensors with serial number above 2404000. Pending battery life estimations.
Gill	Maximet Weather Stations: GMX200, GMX240, GMX300, GMX301, GMX400, GMX500, GMX501, GMX550, GMX551, GMX560, GMX600	1	Yes	Please check the parameters that the LS-G6-DIG-2 reads and transmits to ensure they meet the project's requirements.
Gintec/Huasi	Array Flexible Inclinometer	50	No	When reporting in 3-axis mode, the number of supported sensors is reduced to 40. The Gintec P30 Data Converter is required for operation.
In-Situ	Level TROLL®, Modbus RTU	6	No	–
	BaroTROLL®, Modbus RTU	6	No	–
	Aqua TROLL® 200, Modbus RTU	6	No	–
	Aqua TROLL® 500/600	6	No	Water pressure and five combinations among the turbidity, conductivity, pH/ORP, and dissolved oxygen sensors. The wiper function is not supported.

[5] Worldsensing compatibility with the listed sensors varies depending on the generation of digital sensors because sensors manufacturers sell, in some cases, different versions overtime. In case of doubt, please contact us.

[6] Contact us if you are interested in how to externally power the string of sensors.

[7] 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.

COMPATIBILITY

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

Sensor manufacturer	Sensor models[5]	Max. sensors per data logger	External power needed	Remarks
iZC-Tech	ZCT-CX300 in-place inclinometer system	50	No	–
Keller	High precision level sensor (P and Temp) Series 36 X W, Modbus RTU	6	No	–
	Water multi-parameter probe (P, Temp and Conductivity) Series 36 Xi W (CTD), Modbus RTU	6	No	–
Measurand ShapeArray	SAA segments in low power or regular mode[6]	200	No	–
Meter	TEROS 32 Soil Tensiometer. 4-wire cable version.	40	No	Integration through Modbus RTU RS-485. The LS-G6-DIG-2 can power up to 10 sensors
MDT	SMART MPBX (Multi-Point Borehole extensometer)	1	No	1 MPBX (up to 6 anchors) using Smart Link-485
Littlefuse	RM2000 motor saver	1	No	Custom integration. Contact us for more information.
Osprey Measurement	IPX-08 In-Place Magnetic Extensometer	50	No	–
	Tilt String (OTS)	50	No	When reporting roll, pitch and yaw, number of sensors decreases to 40
	Automatic Settlement Profiler (AST)	50	No	–
Position Control PC-HSD4 V2	Modbus RTU communication protocol. The hose level (Liquid Leveling System) is an instrument for hydrostatic height measurement.	30	No	The digital logger can power up to 25 sensors
RST instruments	In-Place Inclinometer System (Next-Gen IPI, also called Gen 4)	50	No	When using Worldsensing system, it is recommended to order the IPI s with the Modbus Address already configured from the factory.
	Tiltmeters and tiltbeams	30	No	
Roctest	GEOSTRING in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
Sisgeo (Sisgeo v3)	eMD-profile system, LT-inclibus, BH-Profile inplace inclinometers, Horizontal in-place inclinometers, MEMS in-place inclinometers, Digital Tilt Beam. D-Tiltmeter, Digital MEMS Tiltmeters, RDS Railway Deformation System. Measurements in 2-axis. Compatible with Sisgeo's 360° Range Calibration Process	50	No	When reporting 3-axis, number of sensors decreases to 40
	H-Level settlement system	30	No	–
	Piezometers	30	No	–
	Extensometer probes (DEX)	30	Yes	–
	Extenso-inclinometer probes (DEX-S)	18	Yes	–
	MPBX or MEXID extensometers up to 6 anchor points	12	No	The digital logger can power up to 10 sensors
Sisgeo (MODBUS)	Through the "Sisgeo 50 incl – Sinα" option Compatible with: MD-profile system, LT-inclibus, BH-Profile in-place inclinometers, Horizontal inplace inclinometers, MEMS in-place inclinometers, Digital Tilt Beam.D-Tiltmeter, Digital MEMS Tiltmeters, RDS Railway Deformation System.	50	No	–
Soil Instruments	GEOSmart in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors

[8] Please contact support@worldsensing.com to get the list of Yieldpoint sensors available through this new digital integration.

COMPATIBILITY

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

Sensor manufacturer	Sensor models[5]	Max. sensors per data logger	External power needed	Remarks
Sommer	SQ-R Flow Meter	50	Yes	
Vaisala	Weather transmitter WXT530 series	1	Yes	–
Worldwide Electric	WD4X Variable Frequency Drive (VFD)	1	No	Custom integration. Contact us for more information.
Yieldpoint[8]	d-UMP Utility Monitoring Point d-Exto 1 to 6-Point Multi-Point Borehole Extensometer. d-Civil-Exto Soil Extensometer d-MPBX 2 to 6-Point MPBX with spring loaded anchors. d-Cable Instrumented 7-strand cable bolt. d-Rebar/d-Bolt Technology applicable to rebar elements, threaded bolts, and a variety of other steel elements. d-HID Device to re-transmit the RS232 signal from an ESS HID cell to an RS485 signal compatible. Others[8]	1	No	Up to 13 channels per instrument. This protocol can only be used for connecting one instrument

[9] 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 14 dBm. Considering standard laboratory conditions. Estimations for 4 Saft LSH14 batteries based on the lifetime mathematical model.

[10] The battery estimates are a bit lower in the case of requiring the tilt range of +/–90°. Please refer to the User Guide for more information.

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

BATTERY LIFE ESTIMATION[9]

Sensor manufacturer	Sensor model	Number of sensors	Reporting Period		
			5 min	1 h	6 h
Aqualabo	Turbidity NTU	1	2.2 years	8.3 years	10.5 years
	Conductivity C4E	1	2.1 years	8.1 years	10.4 years
	pH, Redox. PHEHT	1	2.1 years	8.1 years	10.4 years
	Generic (TRIPOD containing C4E, PHEHT, and Dissolved Oxygen (OPTOD).)	1	1.1 years	6.2 years	9.8 years
	Generic (Stacksense)	1	1.0 years	6.0 years	9.7 years
	Generic (Suspended Solids)	1	1.9 years	7.8 years	10.4 years
Bauer	Load Cells (extended)	1	8.0 months	4.7 years	9.0 years
	Load Cells [extended)	5	1.6 months	1.4 years	5.2 years
	Load Cells (extended)	10	24 days	9.1 months	3.4 years
DGSI Slope	Geoflex	10	20 days	7.7 months	2.9 years
Encardio	Encardio EAN-56	5	3.7 months	2.7 years	6.4 years
	Encardio EAN-56	10	1 months	11 months	3.6 years
	Encardio EAN-56	25	4 days	1.5 months	9 months
Geokon[10]	3-axis inclination ±30°	10	5.2 months	3.7 months	8.3 years
	3-axis inclination ±30°	20	1.9 months	1.7 years	5.7 years
	3-axis inclination ±30°	50	11 days	4.8 months	2.0 years
	Addressable thermistor strings	20	4.3 months	3.0 years	6.7 years
	Addressable thermistor strings	50	38 days	1.1 years	4.1 years
Geosense	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	10	4 months	2.8 years	6.6 years
	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	30	35 days	1 year	3.9 years
	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	50	17 days	6.3 months	2.4 years
Gintec/Huasi	Array Flexible Inclinometer	10	3.0 months	2.4 years	6.9 years
	Array Flexible Inclinometer	20	1.1 months	11.8 months	4.1 years
	Array Flexible Inclinometer	50	10 days	3.9 months	1.7 years
In-Situ	Level TROLL®	1	2 years	6.9 years	8.5 years
	Level TROLL® 200	1	2 years	6.9 years	8.5 years
	AquaTROLL 500/600 1	1	15.3 years	6.7 years	10.0 years
	AquaTROLL 500/600 2	1	15.0 months	6.7 years	10.0 years
	AquaTROLL 500/600 3	1	14.3 months	6.5 years	9.9 years
	AquaTROLL 500/600 4	1	10.6 months	5.6 years	9.5 years
	AquaTROLL 500/600 5	1	14,2 months	6.5 years	9.9 years
iZC-Tech	ZCT-CX300 IPI	10	4.0 months	3.0 years	7.6 years
	ZCT-CX300 IPI	30	27 days	10.2 months	3.7 years
	ZCT-CX300 IPI	50	12 days	4.7 months	2.0 years
Keller	36XiW-CTD probe	1	10.8 months	5.1 years	7.9 years

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

BATTERY LIFE ESTIMATION[9]

Sensor manufacturer	Sensor model	Number of sensors	Reporting Period		
			5 min	1 h	6 h
MDT	SMART MPBX	1	1.6 years	7.5 years	10 years
Measurand[12]	ShapeArray – low power mode	40	3.8 months	2.7 years	6.4 years
	ShapeArray – low power mode	100	49 days	1.4 years	4.7 years
	ShapeArray – regular mode	40	3.5 months	2.6 years	6.3 years
	ShapeArray – regular mode	100	42 days	14 months	4.3 years
	ShapeArray – extended mode	150	49 days	1.4 years	4.7 years
	ShapeArray – extended mode	200	32 days	11 months	3.7 years
Meter	Teros 32 Soil Water Potential and Temperature sensor	1	1.7 years	7.6 years	10.3 years
	Teros32 Soil Water Potential and Temperature sensor	10	4 months	3.0 years	7.7 years
Osprey	IP-08 In-Place Magnetic Extensometer	1	6.3 years	8.6. years	8.8 years
	IP-08 In-Place Magnetic Extensometer	5	2.5 years	2.5 years	2.5 years
	IP-08 In-Place Magnetic Extensometer	10	1.2 years	1.2 years	1.2 years
	IP-08 In-Place Magnetic Extensometer	30	5.6 months	5.6 months	5.6 months
	IP-08 In-Place Magnetic Extensometer	50	3.4 months	2.5 years	6.2 years
	Tilt String (OTS) 2-axis	10	4.0 months	3.0 years	7.7 years
	Tilt String (OTS) 2-axis	20	1.5 months	1.3 years	4.9 years
	Tilt String (OTS) 2-axis	40	13.7 days	5.3 months	2.2 years
	Tilt String (OTS) 3-axis	10	3.8 months	2.9 years	7.5 years
	Tilt String (OTS) 3-axis	20	1.4 months	1.2 years	2.2 years
	Tilt String (OTS) 3-axis	30	21.2 days	8.0 months	3.1 years
Position Control	PC HSD4 V2	5	2.4 months	2.4 months	7.9 years
	PC HSD4V2	5	15 days	5.5 months	7.9 years
RST	In-Place Inclinometer	10	6.5 months	3.8 years	7.3 years
	In-Place Inclinometer	30	78 days	2.0 years	5.7 years
	In-Place Inclinometer	50	48 years	1.4 years	4.6 years

BATTERY LIFE ESTIMATION[9]

Sensor manufacturer	Sensor model	Number of sensors	Reporting Period		
			5 min	1 h	6 h
Sisgeo	IPIs (v3 protocol. TIMED mode)	30	22 days	8.4 months	4.1 years
	MEXID extensometer, up to 6 anchors, SF9 @14 dBm	1	6.6 months	4.3 years	8.8 years
	MEXID extensometer, up to 6 anchors, SF9 @14 dBm	6	53 days	1.5 years	5.5 years
	MEXID extensometer, up to 6 anchors, SF9 @14 dBm	10	29 days	10.9 months	3.9 years
	IPIs (Sisgeo 50 incl Sin, Modbus)	10	3.1 months	2.5 years	7.0 years
	IPIs (Sisgeo 50 incl Sin, Modbus)	30	13 days	4.9 months	2.1 years
	IPIs (Sisgeo 50 incl Sin, Modbus)	50	5 days	1.9 months	6 months
	IPIs and inclination sensors calibrated in the 360° range, 2 axes	10	38 days	13.9 months	4.6 years
	IPIs and inclination sensors calibrated in the 360° range, 2 axes	30	8 days	3.0 months	16.4 months
	IPIs and inclination sensors calibrated in the 360° range, 2 axes	50	3 days	1.3 months	7.4 months
Somer	SQ-R	1	17.4 days	6.6 months	2.6 years

FOR MORE INFORMATION
Scan to access the user guide for this device.

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