

# Digital logger

## LS-G6-DIG-2-MON EDGE DEVICES

The Trimble® 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 up to 9 miles / 15 kilometres 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, Trimble 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 Trimble Geotech 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 Trimble gateway. A single gateway can support dozens of nodes. The units may also be used as standalone loggers for manual monitoring.



### FEATURES

- ▶ Compatibility with digital sensors like:
  - 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
  - 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. Mostly does not require external power.
- ▶ Robust, small and weather-proof box (IP67)
- ▶ Long-range communication through LoRa networks
- ▶ User-friendly Trimble Geotech app for Android included.

\* 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.
- ▶ Customer support from an expert team of geotechnical monitoring.
- ▶ Pioneer company in the field, long history in monitoring large-scale civil infrastructure.



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### 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)
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	Better than ±30 seconds
Device configuration	Trimble Geotech app for Android
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 records 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 (W x L x H)	100 x 200 x 61 mm (3.9 x 7.9 x 2.4 in)
Overall dimensions	140 x 220 x 61 mm (5.5 x 8.67 x 2.4 in) (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)	1154 g
External antenna	114 mm length (4.5 in) (including connector)
USB (configuration)	External mini USB
Box material	Aluminium alloy
Clamping range	4–10 mm (0.15 - 0.39 in)
Battery holder	from 1 up to 4 C-type cells
Grounding connector	Integrated

\* 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

### RADIO

Radio band	ISM sub 1GHz	
Operating frequency bands	Adjustable	
Bidirectional communications	Remote sampling rate change / clock synchronisation	
Maximum link budget	151 dB / 157 dB	
Network topology	Star and Tree Network Topology	
Radio range <sup>3</sup>	Range open sight	15 km (9.3 mi)
	Range city street	4 km (2.5 mi)
	Range manhole in a city street	2 km (1.2 mi)
	Tunnel	4 km (2.5 mi)

Notes: The distances have been tested by Trimble and have been accomplished in actual projects using the standard antenna. However, radio range depends on the environment so these distances are only indicative. Consult with us for your application.



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### ACCESSORIES

Other mounting brackets and accessories available upon request

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

- 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 The distances have been tested by Trimble 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 Trimble 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

### COMPATIBILITY

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

**It is strongly advised to verify sensor compatibility with T4D with your Trimble representative to ensure seamless compatibility with your existing setup or intended use.**

Sensor manufacturer	Sensors	Maximum number of sensors per data logger	External power is needed**	Remarks
Sisgeo digital instruments	Turbidity NTU, Conductivity C4E PH, Redox PHEHT, Dissolved oxygen OPTOD ORP Annular Conductivity CTZ Turbidity Suspended solid StacSense	20	-	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
Bauer	Load cells (extended)	10	-	
	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
Generic	Modbus RTU sensor drivers	-	-	On demand integrations. Contact Trimble for more details.
Geokon	In-place inclinometer systems within the +/- 15 range <sup>6</sup>	50	Yes	The digital logger can power up to 35 sensors
	Addressable Thermistor Strings	50	-	
Geosense digital sensors	In-place inclinometers, tiltmeters, tilt beams and submersible tiltmeters	50	-	Through RS-485 Integration
In-Situ	Level TROLL®, Modbus RTU	6	-	
	BaroTROLL®, Modbus RTU	6	-	
	Aqua TROLL® 200, Modbus RTU	6	-	



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COMPATIBILITY CONT.

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

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Sensor manufacturer	Sensors	Maximum number of sensors per data logger	External power is needed**	Remarks
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 RT	6	-	
Measurand ShapeArray	SAA segments in low power or regular mode <sup>7</sup>	100	-	
MDT	SMART MPBX (Multi-Point Borehole extensometer)	1	-	1 MPBX (up to 6 anchors) using Smart Link-485
Osprey Measurement Systems	IPX-08 In-Place Magnetic Extensometer	50	-	
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
Roctest	GEOSTRING in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
RST instruments digital sensors	In-Place Inclinometer System (Next-Gen IPI, also called Gen 4)	50	-	When using Trimble system, it is recommended to order the IPI s with the Modbus Address already configured from the factory
	Tiltmeters and tilt beams	30	-	
Sisgeo (Sisgeo v3)	MD-profile system, LT-inclibus, BH-Profile in-place inclinometers, Horizontal in-place inclinometers, MEMS in-place inclinometers, Digital Tilt Beam.D-Tiltmeter, Digital MEMS Tiltmeters, RDS Railway Deformation System.	30	-	
	H-level settlement system	30	-	
	Load cells	30	-	
	Piezometers	30	-	
	Extensometer probes (DEX)	30	-	Specifications assuming factory configuration. DEX and DEX-S always configured as TIMED.
	Extenso-inclinometer probes (DEX-S)	18	Yes	
	MPBX or MEXID extensometers up to 6 anchor points	12	Yes	
Sisgeo (MODBUS)	Through the "Sisgeo 50 incl - Sin " option Compatible with: MD-profile system, LT-inclibus, BH-Profile in-place inclinometers, Horizontal in-place inclinometers, MEMS in-place inclinometers, Digital Tilt Beam.D-Tiltmeter, Digital MEMS Tiltmeters, RDS Railway Deformation System	50	-	
Soil instruments	GEOSmart in-place inclinometers	50	Yes	The digital logger can power up to 10 sensors
Vaisala	Vaisala WTX536 weather transmitter. RS-485, Modbus RTU communication interface	1	Yes	



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### COMPATIBILITY CONT.

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

**It is strongly advised to verify sensor compatibility with T4D with your Trimble representative to ensure seamless compatibility with your existing setup or intended use.**

Sensor manufacturer	Sensors	Maximum number of sensors per data logger	External power is needed**	Remarks	
Yieldpoint	d-UMP	Utility Monitoring Poin	1	-	Up to 13 channels per instrument. This protocol can only be used for connecting one instrument.
	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 <sup>8</sup>				

4 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.  
 5 Contact us if you are interested in how to externally power the string of sensors.  
 6 The Geokon in place inclinometer system model 6180 range is + 90 and the calibrated range is + 30 . Trimble can read and transmit the measurements within +/- 15 covering the needs of most applications.  
 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.  
 8 Please contact us 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
Bauer Load cells (extended)	1 sensor	8 months	4.69 years
	5 sensors	1.6 months	1.42 years
	10 sensors	0.8 months	0.76 years
DGSI Slope	10 GeoFlex	20 days	7.7 months
Encardio	Encardio EAN-56 - 5 sensors	3.7 months	2.7 years
	Encardio EAN-56 - 10 sensors	1 month	11 months
	Encardio EAN-56 - 25 sensors	4 days	1.5 months
Geokon	10 IPIs	5 months	3.3 years
	20 IPIs	68 days	1.8 years
	20 Address. Therm	4.3 months	3 years
	50 Address. Therm	38 days	1.1 years
Geosense	10 sensors	4 months	2.8 years
	30 sensors	35 days	1 year
	50 sensors	17 days	6.3 months



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### BATTERY LIFE ESTIMATION

Sensors		Sampling rate 5 minutes	Sampling rate 1 h	Sampling rate 6 h
In-situ	In Situ - 1 Level TROLL®	2 years	6.9 years	8.5 years
	InSitu - 1 Aqua TROLL® 200	2 years	6.9 years	8.5 years
KELLER	1 36XiW-CTD prob	0.9 years	5.1 years	7.9 years
MDT	1 SMART MPBX	1.6 years	7.5 years	10 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
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
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
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
Sisgeo	30 IPIs (v3 protocol, timed mode)	22 days	8.5 months	4.1 years
	1 MEXID extensometer, up to 6 anchors, SF9 @14dBm	200.9 days	4.3 years	8.76 years
	6 MEXID extensometers, up to 6 anchors, SF9 @14dBm	52.97 days	1.54 years	5.45 years
	10 MEXID extensometer, up to 6 anchors, SF9 @14dBm	29.46 days	0.91 years	3.86 years

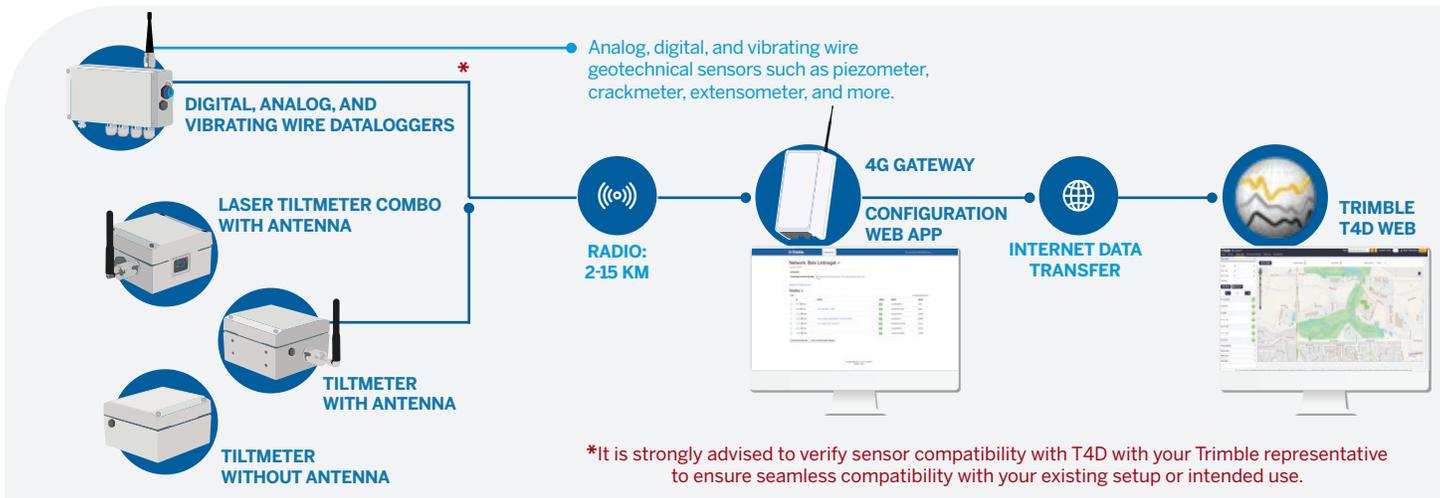
<sup>1</sup> Battery life may vary considerably from specifications depending on the actual set-up and working conditions; such as sensor version, sampling rate, wireless network status and environmental conditions. The battery life rating is only achieved on the specific sensor models and configurations tested by Trimble 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



# IoT-based Geotechnical Monitoring SYSTEM INSTALLATION



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