

## EDGE DEVICES - WIRELESS SENSORS

# Tilt90 Event Detection

LS-G6-TIL90-XE / LS-G6-TIL90-IE

The Tilt90 Event Detection (Tilt90 EDS) is a wireless 3-axis tiltmeter that detects ground movement with high precision and low noise. It delivers alerts with under 2-second latency for the first 10 devices entering alert mode, ensuring timely responses to critical events. It is a key component for early warning systems for ground movements.

**Advanced Edge Processing**

The device continuously samples tilt data and evaluates whether readings exceed user-defined thresholds. When an anomaly is detected, it sends an alert and automatically increases sampling frequency to capture more detailed data—configurable to as low as 30 seconds. Settings can be adjusted via the Worldsensing App, CMT Edge, or CMT Cloud.

**FEATURES**

Wireless 2-in-1 sensor and data logger.

3-axis inclination with respect to gravity's direction and a range of  $\pm 90^\circ$ .

Embedded algorithm that can increase the data frequency when predefined thresholds are reached.

2-second latency for the first 10 simultaneous events

Configurable thresholds using the Worldsensing App or remotely via CMT Edge or CMT Cloud

Two versions available - external and internal antenna.

Long range communications through LoRa communications.

**SOFTWARE**

User-friendly Android configuration app included.

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, 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.

LS-G6-TIL90-XE



LS-G6-TIL90-IE

**Built for Longevity**

Powered by replaceable C-size batteries, the Tilt90 EDS offers up to 10 years of operation with minimal maintenance. It is IP68 rated and performs reliably from  $-40^\circ\text{C}$  to  $+80^\circ\text{C}$ .

**Low-Power, Long-Range Communication**

Operating on Worldsensing's LoRa network, the Tilt90 EDS transmits data up to 15 km (9 miles). The network handles hundreds of devices with minimal latency—even during simultaneous alerts.

**Easy Integration**

The Tilt90 EDS supports third-party system integration via MQTT, API, and FTP, enabling data-driven decisions in real time.

**APPLICATIONS****STRUCTURAL HEALTH**

Cant, twist and vertical alignment in rail track monitoring

Static deflections of piles, piers and decks of bridges and other structures

**GEOTECHNICAL MONITORING**

Slope movements in landslides, embankments

Ground movements in foundations and deep excavations

**ADVANTAGES**

Cost-efficient solution for early warning systems on ground movements

Very low maintenance equipment due to its robustness and low-power consumption.

Easily integrate to your data visualisation tools for rapid decision-making

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

|  |   |
|--|---|
| Product variants                         | <ul style="list-style-type: none"> <li>LS-G6-TIL90-XE with external antenna</li> <li>LS-G6-TIL90-IE with internal antenna</li> </ul>  |
| Sampling frequency                       | 3.9 Hz  |
| Reporting Period                         | Selectable from:<br>30 s<br>1, 2, 5, 10, 15, 30 min<br>1, 2, 4, 6, 12, 24 h   |
| Time synchronization discipline by radio | Better than $\pm 30$ seconds  |
| Power source                             | 2 x 3.6V C-Size user-replaceable, high energy density batteries   |
| Interfaces                               | Internal mini USB   |
| Device configuration                     | <ul style="list-style-type: none"> <li>Worldsensing App</li> <li>CMT Cloud</li> <li>CMT Edge</li> </ul>   |
| App advanced functionalities             | <ul style="list-style-type: none"> <li>Threshold configuration for each axis</li> <li>Reporting period configurable for both normal and alert mode</li> <li>Field samples and signal coverage test when connected to the app.</li> <li>Set the previous configuration to quickly configure tiltmeters for installation in the same project.</li> <li>Tiltmeter calibration parameters check using the app.</li> </ul> |

### SENSOR SPECIFICATIONS

|                               |   |             |
|-------------------------------|---|-------------|
| Sensor type                   | 3-axis MEMS accelerometer   |             |
| Range <sup>2</sup>            | ±90°  |             |
| Axis                          | 3-axis inclination measurement with respect to gravity's direction. Reports the two axes of rotation from the horizontal plane in any orientation |             |
| Accuracy f(α)                 |   |             |
| ± 2°                          | ±0.0025   | ± 0.0045°   |
| ± 4°                          | ±0.005  | ± 0.006°    |
| ± 45°                         | ±0.08   | ± 0.08°     |
| ± 15°                         | ±0.013  | ± 0.013°    |
| ± 80°                         | ±0.23   | ± 0.23°     |
| Resolution                    | 0.0001°   | 0.0001°     |
| Repeatability in Normal Mode  | <0.0003°  | <0.0015°    |
| Repeatability in Alert Mode   | <0.001°   | <0.005°     |
| Offset Temperature dependency | ± 0.002°/°C   | ± 0.005°/°C |
| Stability @ 14 h              | <0.003°   | <0.010°     |

|                               |  |
|-------------------------------|--|
| Measure of dispersion         | Standard deviation of the set of measurements collected during the reading and transmitted with each tilt measurement. It can be used to filter noisy data.  |
| Temperature sensor resolution | 0.1 °C   |
| <b>OPERATIONAL ASPECTS</b>    |  |
| Operation Mode                | <ul style="list-style-type: none"> <li>Normal Mode</li> <li>Alert Mode</li> </ul>  |
| Threshold breach              | When a reading in normal mode lays outside the threshold, the alert message is sent in real time. It also triggers the alert state that changes the data transmission according to the set reporting period for the alert state. |
| Communication latency         | 2 s for 10 simultaneous alerts 5 s for 25 simultaneous alerts  |
| Peak-to-peak noise            | <0.006°  |

## MECHANICAL

| Node                           | LS-G6-TIL90-XE   | LS-G6-TIL90-IE   |
|--------------------------------|--|--|
| Box dimensions (WxLxH)         | 100x100x61 mm  | 100x100x61 mm  |
| Overall dimensions             | 150x120x61 mm (excluding antenna)  | 103x100x61 mm  |
| Operating temperature          | -40 °C to 80 °C (-40 °F to 175 °F)   |  |
| Weather protection             | IP68 (at 2 m for 2 h)  |  |
| Weight (excluding batteries)   | 606 g  | 390 g  |
| Antenna                        | External: 100 mm length (including connector)  | Internal   |
| Mounting options               | <ul style="list-style-type: none"> <li>Clearance holes for M4 hexagon socket head cap screws in bottom.</li> <li>Blind holes for M5 screws on the lateral side.</li> </ul> |  |
| Configuration                  | Internal mini USB.   |  |
| Box material                   | Aluminium alloy  | Aluminium alloy  |
| Lid material                   | Aluminium alloy  | Polycarbonate  |
| Batteries                      | from 1 up to 2   |  |
| Vibration Resistance           | up to $\pm 8 g$  | Up to $\pm 80 g$<br><br>Test: random vibration test railroad profile according to level C.2 (on sleeper) of EN 50125-3:2003<br>CORR:2010 standard and methodology of EN 60068-2-64:2008 standard |
| Impact resistance <sup>3</sup> | Drop from 1 meter onto a concrete surface (20 000g)  |  |

## MEMORY

|                        |   |
|------------------------|---|
| Memory Structure       | Circular Buffer                             |
| Maximum Memory Records | 140 000 readings including time and 3 axis. |

<sup>2</sup> The recommended measuring range is  $\pm 85^\circ$ . Outside of this range, the margin of error increases. However, when one of the axes is close to  $90^\circ$ , the other axis will be close to  $0^\circ$  and measuring the same inclination.

<sup>3</sup> The tiltmeter has good impact resistance. However it should be treated carefully like any precision instrument.

## RADIO SPECIFICATIONS

|                              |   |                |
|------------------------------|---|----------------|
| Radio band                   | ISM sub 1GHz  |                |
| Operating frequency bands    | Ajustable   |                |
| Bidirectional communications | Remote sampling rate change / Clock synchronization |                |
| Maximum link budget          | 151 dB / 157 dB                                     |                |
| Configuration                | LoRa Star/ LoRa Tree                                |                |
| Radio range <sup>5</sup>     |   |                |
|                              | LS-G6-TIL90-XE                                      | LS-G6-TIL90-IE |
| Open sight                   | 15 km   | 10 km          |
| City street                  | 4 km  | 2 km           |
| Manhole in a city street     | 2 km  | 1 km           |
| Tunnel                       | 4 km  | 2 km           |

## BATTERY LIFE ESTIMATIONS<sup>6</sup>

|                  |                |                 |
|------------------|----------------|-----------------|
| Reporting Period | 2 LSH 14 cells | 2 LM26500 cells |
| 5 min            | 1.7 years      | 2.1 years       |
| 30 min           | 2.4 years      | 3.2 years       |
| 1 h              | 2.5 years      | 3.3 years       |
| 6 h              | 2.6 years      | 3.5 years       |

<sup>5</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. Consult with us for your application.

<sup>6</sup> Battery life estimations based on the lifetime mathematical model using Barcelona weather profile. Average values provided. Typical Europe radio configuration. Spreading factor 7, radio transmit power 20dBm. Considering laboratory conditions. Consumption varies depending on the sampling rate, environmental conditions and wireless network conditions.



## ACCESSORIES<sup>7</sup>

|                           |   |
|---------------------------|---|
| LS-ACC-IN15-VP            | Mounting plate for vertical mounting; attachment option: anchor rods.   |
| LS-ACC-IN15-HP            | Versatile plate for horizontal surface mounting recommended for both horizontal and vertical mounting; attachment option: anchor rods or glue. Includes a threaded hole available for installing a monitoring prism or a button head screw for precise levelling.                                     |
| LS-ACC-IN-HPTM            | Horizontal surface mounting plate for track monitoring; attachment option: glue.  |
| LS-ACC-IN15DP             | Versatile double plate for horizontal surface mounting; suitable for applications that need to eliminate the need to open the casing during installation; attachment option: glue; includes a threaded hole available for installing a monitoring prism or a button head screw for precise levelling. |
| LS-ACC-ANC-H <sup>8</sup> | Kit of 3 anchor rods for injection M8, 110 mm length. Nuts and washers included.  |
| LS-ACC-MAG <sup>9</sup>   | Kit of 3 magnets, Ø 32 mm, strength approx. 30 kg, screws included.   |
| WS-ACC-1BEAM              | 1m Aluminum beam with specific profile to attach a LS-G6-TIL90.   |
| WS-ACC-2BEAM              | 2m Aluminum beam with specific profile to attach a LS-G6-TIL90.   |
| WS-ACC-BEAMFIX            | Fixation kit for beam accessory mounting. Includes: anchors, brackets and washer assembly.  |
| LS-ACC-CELL-1C            | Saft LSH 14 C-size spiral cell 5.8 Ah.  |
| WS-ACC-CELL2-1C           | Saft LM26500 C-size spiral cell 7.4Ah.  |
| LS-ACC-ANTC               | Antenna cable extension RP-SMA to RP-N, 2.5m.   |
| LS-ACC-MUSB-C             | Data logger - mobile cable. USB C to mini USB cable, 1 m. Not compatible with LS-G6-TIL90-I.  |

## SERVICES

|                 |   |
|-----------------|---|
| WS-S-TILT-CAL   | Wireless Tiltmeter Recalibration Service. Includes the replacement of the screws and the verification of the different mechanical elements. Shipment to and from Worldsensing warehouse excluded. |
| WS-S-PRECON-SEN | Device Pre-configuration (Wireless Sensors)   |

<sup>7</sup> Other mounting brackets and accessories available upon request. Magnetic mounting options undergoing development.

<sup>8</sup> The kit can be used to fix the following mounting kits: LS-ACC-IN15-HP, LS-ACC-IN15-VP, LS-ACC-LAS-AP, LS-ACC-LAS-SB.

<sup>9</sup> The kit of 3 magnets can be used to fix the LS-ACC-IN15-VP mounting plate. Only available in Europe.



**Fig. 1: Surface mounting**  
Using the LS-ACC-IN15-HP plate recommended for both horizontal and vertical mounting.

**Fig. 2: Horizontal surface mounting with double plate**

Using a versatile double plate LS-ACC-IN15DP for horizontal surface mounting that avoids opening the casing for device installation.



**Fig. 3: Horizontal Surface Mounting**

Using the compact LS-ACC-IN-HPTM horizontal surface mounting plate. Designed to be glued to the surface for fast and robust fixing.

**Fig. 1: Pole mounting**

Using the LS-ACC-LVP aluminum plate together with WS-ACC-U50, 50 mm u-bolts.





## Consult our documentation

Scan to access the user guide for this device.

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