loadsensing
WORLDSENSING

WIRELESS MONITORING SYSTEM

GATEWAY

SOFTWARE SUITE

WIRELESS DATA UNIT

WIRELESS TILT METER
**Loadsensing** is a data acquisition and monitoring system which combines state-of-the-art wireless monitoring and advanced software tools. It is widely recognized as the leading solution for connecting and monitoring infrastructures in remote locations. **Loadsensing** devices are battery-powered and equipped with long-range, low-power wide area network (LPWA) radio communications and are compatible with a wide range of geotechnical sensors. The software suite is web-based and facilitates real-time data capture and analytics. It is also possible to set automatic alarms to make operations safer.

Mining and construction companies and operators of bridges, tunnels, dams, railways and many other inaccessible assets can now work with reliable data. Having access to this information and real-time insights enables operators to anticipate needs, manage their workforce, diminish risks, and even prevent disasters.

**FEATURES**
- Long-range communication of over 9 miles / 15km
- Truly low-power, 10 years of unattended runtime
- Wireless LPWA communication
- Supports most structural and geotechnical sensors (vibrating wire, digital, analog)
- Wireless tiltmeter
- Integrated alarm system
- User-friendly web software

**BENEFITS**
- Leverage already formatted data to optimize operations
- Remotely monitor hard-to-access infrastructures
- Cover a wide area with geotechnical sensors
- Easily add sensors to extend measurement range
- Save resources through fast implementation
- Decrease costs through easy maintenance
- Diminish risks and make operations safer
Operational Intelligence for Mines and Industrial Companies

Worldsensing is not only among the best in the world at connecting distributed infrastructures with smart devices, we also know how to extract intelligence from collected data to transform operations. Our software solutions combine location intelligence with infrastructure monitoring.

### SOFTWARE SUITE

#### NETWORK AND ASSET MANAGEMENT SOFTWARE
- Network communications configuration and control
- Wireless data unit and sensor attributes display
- Wireless data unit configuration
- Sensor data in near real time
- Conversion of raw sensor data in engineering units
- Manual and automatic data download in .csv
- Data transmitted in a secure manner
- Remote change of sensor’s sampling rate
- Data accessible through Modbus TCP
- Able to push data on user FTP

### DATA MANAGEMENT SOFTWARE
- Sensor data visualization and download (tables and graphs)
- Topological view
- Creation of virtual variables
- Configuration of alarm thresholds
- Alarms sent to stakeholders by email
- Automatically generated reports (tables, graphs and notes)

### HOW IT WORKS
VIBRATING WIRE NODE 1ch and 5ch

Measurement method: Embedded algorithms increasing immunity to noise
Excitation wave: +/- 5 V
Measurement range: 300 to 7,000 Hz
Resolution (-40 to +85ºC): 0.018 % FS
THERMISTOR
Measurement range: 0 ohm to 4 Mohm
Resolution: 1 ohm
Accuracy (20ºC): 0.05ºC (0.04 % FS)
BAROMETER
Pressure Range: 300 to 1,100 hPa
Relative Accuracy (950 to 1,050 hPa at 25ºC): ±0.12 hPa

APPLICATIONS
Remote tilt monitoring from retaining and building walls
Landslide monitoring
Bridge pier monitoring
Structural load monitoring
Ground subsidence

SPECIFICATIONS
Type: MEMS (Micro-Electro-Mechanical) Inclinometer
Range: ± 15º
Accuracy (± 5º): 0.03% FS / 0.004º
Accuracy full range: 0.1ºF / 0.025º
Resolution: 0.001º
Repeatability: 0.005º
Axes: Two (biaxial)
Temperature sensor resolution: 0.1 ºC
Temperature sensor accuracy: ±0.5 ºC

BATTERY LIFE ESTIMATION Wireless tiltmeter
<table>
<thead>
<tr>
<th>SAMPLING RATE</th>
<th>Barcelona temperature profile*</th>
<th>Singapore temperature profile*</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 min</td>
<td>1.2 years</td>
<td>11 years</td>
</tr>
<tr>
<td>1 h</td>
<td>5.8 years</td>
<td>4.7 years</td>
</tr>
<tr>
<td>6 h</td>
<td>8.3 years</td>
<td>6.4 years</td>
</tr>
</tbody>
</table>

*Estimations for 2 x Saft LSH 14 batteries

Specifications are subject to review and change without notice.

BATTERY LIFE ESTIMATION Vibrating wire nodes

<table>
<thead>
<tr>
<th>CHANNELS &amp; SAMPLING</th>
<th>BATTERIES*</th>
<th>BATTERY LIFE ESTIMATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 CH 5 min</td>
<td>1 cell</td>
<td>0.9 years</td>
</tr>
<tr>
<td>1 CH 1 hr</td>
<td>1 cell</td>
<td>3.5 years</td>
</tr>
<tr>
<td>1 CH 6 hr</td>
<td>1 cell</td>
<td>4.6 years</td>
</tr>
<tr>
<td>5 CH 5 min</td>
<td>4 cells</td>
<td>2.2 years</td>
</tr>
<tr>
<td>5 CH 1 hr</td>
<td>4 cells</td>
<td>7.1 years</td>
</tr>
<tr>
<td>5 CH 6 hr</td>
<td>4 cells</td>
<td>&gt;10 years</td>
</tr>
</tbody>
</table>

*Estimations for Saft LSH 14 batteries. Typical Europe radio configuration. Spreading factor 9, radio transmit power 14dBm. Considering laboratory conditions. Consumption varies depending on the sensor used, sampling rate and environmental and wireless network conditions.
ANALOG NODE
LS-G6-ANALOG-4

Each channel is individually configured by the user.

**Power supply:** 5 V DC / 12 V DC / 24 V DC up to 60 mA selectable for each channel.

**VOLTAGE**
Measuring ranges [V DC]: +/-10 ; +/-1.25 (8x)
Accuracy (-40 to +85ºC): +/- 0.05 % FS

**CURRENT LOOP** (2-3 wires)
Measuring range: 4-20 mA
Accuracy (0 to +50ºC): 0.05 % FS

**POTENTIOMETER (POT)**
Accuracy (0 to +50ºC): +/- 0.02 % FS

**FULL WHEATSTONE BRIDGE (FWB)**
Accuracy (0 to -50ºC): +/- 0.1 % FS

**THERMISTOR**
Accuracy (0 to +50ºC): +/- 0.2ºC

**PT 100**
Accuracy (20ºC): +/- 0.8ºC

**BATTERY LIFE ESTIMATION **

<table>
<thead>
<tr>
<th>Channels &amp; Sampling</th>
<th>Current @12V@24mA</th>
<th>Current @24V@24mA</th>
<th>Voltage @12V@24mA</th>
<th>FwB@5V@0.7 k</th>
<th>Pot@5V@1.5 k</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm up time</td>
<td>1 second</td>
<td>1 second</td>
<td>1 second</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 CH 5 min</td>
<td>6 months</td>
<td>4 months</td>
<td>5 months</td>
<td>1.5 years</td>
<td>1.5 years</td>
</tr>
<tr>
<td>1 CH 6 hours</td>
<td>&gt;10 years</td>
<td>&gt;10 years</td>
<td>&gt;10 years</td>
<td>8.5 years</td>
<td>&gt;10 years</td>
</tr>
<tr>
<td>4 CH 5 min</td>
<td>1.5 months</td>
<td>39 days</td>
<td>2 months</td>
<td>1.5 months</td>
<td>7 months</td>
</tr>
<tr>
<td>4 CH 6 hours</td>
<td>8 years</td>
<td>6.5 years</td>
<td>&gt;10 years</td>
<td>8.5 years</td>
<td>&gt;10 years</td>
</tr>
</tbody>
</table>

**DIGITAL NODE
LS-G6-DIG-2**

One RS485 channel and two SDI-12 channels.

**Power supply:** 12 V DC up to 120 mA.

RS485 full or half duplex supported.

Suitable for a chain of in-place inclinometers.

Modbus RTU RS485.

**BATTERY LIFE ESTIMATION **

<table>
<thead>
<tr>
<th>RST and Sisgeo chains of inclinometers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of sensor</td>
</tr>
<tr>
<td>-------------------</td>
</tr>
<tr>
<td>10 (RST)</td>
</tr>
<tr>
<td>30 (RST)</td>
</tr>
<tr>
<td>10 (SISGEO)</td>
</tr>
</tbody>
</table>

**SHARED SPECIFICATIONS**

**INTERNAL DATA STORAGE**
Up to 72,500 readings including time and 5 sensors.
Up to 200,000 readings including time and 1 sensor.
Sampling rate: 30 seconds to 1 day.
Time synchronization by radio: Time discipline better than ± 10 seconds.
Operating temperature: -40ºC to 80ºC (-40ºF to 175ºF).

**ACCESSORIES**

- Saft LSH 14 C-size spiral cell
- Node-mobile cable
- External mounting brackets for wall mounting
- Plate for pole mounting
- Tiltmeter horizontal mounting plate
- Tiltmeter vertical mounting bracket

Specifications are subject to review and change without notice.
HOW IT WORKS IN MINES
### HOW IT WORKS IN MINES

**DLOG APP**

- Simple and fast connection to wireless node
- Runs on Android devices
- Easy sensor configuration (ID, sampling rate, frequency sweep, interface type, etc.)
- Checks radio signal coverage
- Records coordinates (GPS)
- Downloads data from wireless node and sends by e-mail or saves it on the Android device
- Takes current reading
- Updates wireless node firmware

### BASE STATION

- **ISM Sub 1 GHz band, sensitivity: down to -137 dBm**
- Detachable omnidirectional ½ dipole
- Integrated GPS antenna
- GNSS High Sensitivity GPS module
- **POWER**
  - Power supply: 48 V DC PoE
  - Nominal: 3 Watts
  - DC power supply (ex.: solar panel use): 11 to 30 Volts
- **MECHANICAL**
  - Size: 210 x 310 x 170 mm, including mounting kit
  - Weight: 2 kg including mounting kit
  - IP67 rating
  - Operating range: -20 to +60 ºC
- **NETWORK INTERFACES**
  - 10/100 Ethernet WAN (RJ45 PoE)
  - Integrated 3G Modem & Antenna (HSDPA, EDGE, GPRS) quad band

### GATEWAY

**LS gateways:**
- 868 MHz ISM band
- 915 MHz FCC ISM band
- 915–928 MHz ISM band
NOTE:
These distances are calculated for a standard antenna. A directional antenna will increase the range.

HOW IT WORKS IN CITIES

LONG RANGE RADIO

<table>
<thead>
<tr>
<th>Location</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPEN FIELD</td>
<td>15 km</td>
</tr>
<tr>
<td>CITY STREET</td>
<td>4 km</td>
</tr>
<tr>
<td>MANHOLE IN A CITY STREET</td>
<td>2 km</td>
</tr>
<tr>
<td>TUNNEL</td>
<td>4 km</td>
</tr>
</tbody>
</table>

RADIO SPECS

- ISM sub 1 GHz operating frequency bands adjustable to each territory requirements
- No repeaters needed
- High sensitivity: down to -137 dBm
- Transmission: +14 dBm high efficiency / +20 dBm
- Maximum link budget: 151 dB / 157 dB
- Remote sampling rate change
- Bidirectional communications capabilities

WORLD SENSING

CONNECTED OPERATIONAL INTELLIGENCE

BARCELONA
Viriat 47, Edificio Numancia 1, 10th floor
08014 Barcelona, Spain
(+34) 93 418 05 85

LONDON
9-10 Carlos Place, Mayfair
London W1K 3AT, UK
(+44) 203 807 2495

LOS ANGELES
1900 Avenue of the Stars, Suite 2430
90067 Los Angeles, CA, USA
(+1) 323 395 5120

sales@worldsensing.com
www.worldsensing.com