loadsensing
WORLDSENSING

WIRELESS MONITORING SYSTEM

GATEWAY
SOFTWARE SUITE

WIRELESS DATA UNIT
WIRELESS TILTMETER
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
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**

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.
**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:** ± 15°  
**Accuracy (± 5°):** 0.03% FS / 0.004°  
**Accuracy full range:** 0.17% FS / 0.025°  
**Resolution:** 0.001°  
**Repeatability:** 0.005°  
**Axes:** Two (biaxial)  
**Temperature sensor resolution:** 0.1°C  
**Temperature sensor accuracy:** ±0.5°C

**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

**VIBRATING WIRE NODE 1ch and 5ch**

**VIBRATING WIRE**

Measurement method: Embedded algorithms increasing immunity to noise  
Excitation wave: ±/− 5 V  
Measurement range: 300 to 7,000 Hz  
Resolution (-40 to +85°C): 0.12 Hz  
Accuracy (-40 to +85°C): 0.018% FS

**THERMISTOR**

Measurement range: 0 ohm to 4 Mohm  
Resolution: 1 ohm  
Accuracy (20°C): 0.05°C (0.04% FS)

**BAROMETER**

Pressure Range: 300 to 1,100 hPa  
Relative Accuracy (950 to 1,050 hPa at 25°C): ±0.32 hPa

**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>3 years</td>
</tr>
<tr>
<td>1 CH 30 min</td>
<td>1 cell</td>
<td>7 years</td>
</tr>
<tr>
<td>5 CH 5 min</td>
<td>1 cell</td>
<td>15 years</td>
</tr>
<tr>
<td>5 CH 5 min</td>
<td>4 cell</td>
<td>5 years</td>
</tr>
<tr>
<td>5 CH 30 min</td>
<td>1 cell</td>
<td>4 years</td>
</tr>
<tr>
<td>5 CH 30 min</td>
<td>4 cell</td>
<td>&gt;10 years</td>
</tr>
</tbody>
</table>

* Nominal capacity of each battery: 5.8 Ah. Considering laboratory conditions

Specifications are subject to review and change without notice
**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 range: [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): ±0.01 % 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>Warm up time</th>
<th>1 CH 5 min</th>
<th>1 CH 6 hours</th>
<th>4 CH 5 min</th>
<th>4 CH 6 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 second</td>
<td>6 months</td>
<td>&gt;10 years</td>
<td>1.5 months</td>
<td>8 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 second</td>
<td>&gt;10 years</td>
<td>39 days</td>
<td>6.5 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 second</td>
<td>&gt;10 years</td>
<td>2 months</td>
<td>&gt;10 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 second</td>
<td>&gt;10 years</td>
<td>15 months</td>
<td>1.5 years</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 second</td>
<td>&gt;10 years</td>
<td>7 months</td>
<td>8 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

Supported for a chain of in-place inclinometers

Modbus RTU RS485

**Battery Life Estimation**

RST and Sisgeo chains of inclinometers

<table>
<thead>
<tr>
<th>Number of sensor</th>
<th>Sampling rate</th>
<th>6 hours</th>
<th>30 minutes</th>
<th>3 minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 (RST)</td>
<td>&gt;10 years</td>
<td>2.5 years</td>
<td>4 months</td>
<td></td>
</tr>
<tr>
<td>30 (RST)</td>
<td>5.2 years</td>
<td>4 months</td>
<td>26 days</td>
<td></td>
</tr>
<tr>
<td>10 (SISGEO)</td>
<td>4 years</td>
<td>5 months</td>
<td>30 days</td>
<td></td>
</tr>
</tbody>
</table>

**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

**Shared Specifications**

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)

Weather protection: IP67

**Specifications are subject to review and change without notice**
HOW IT WORKS IN MINES
### CONFIGURATION APP

**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

### GATEWAY

**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 °C

**NETWORK INTERFACES**
- 10/100 Ethernet WAN (RJ45 PoE)
- Integrated 3G Modem & Antenna (HSDPA, EDGE, GPRS) quad band

**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

RADIO & APPLICATIONS

LONG RANGE RADIO

OPEN FIELD: 15 km
CITY STREET: 4 km
MANHOLE IN A CITY STREET: 2 km
TUNNEL: 4 km

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

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