loadsensing

WORLDSENSING

WIRELESS MONITORING SYSTEM

loadsensing

WORLDSENSING

THE CONNECTED INFRASTRUCTURE SOLUTION
MONITORING HOW STRUCTURES EVOLVE

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.

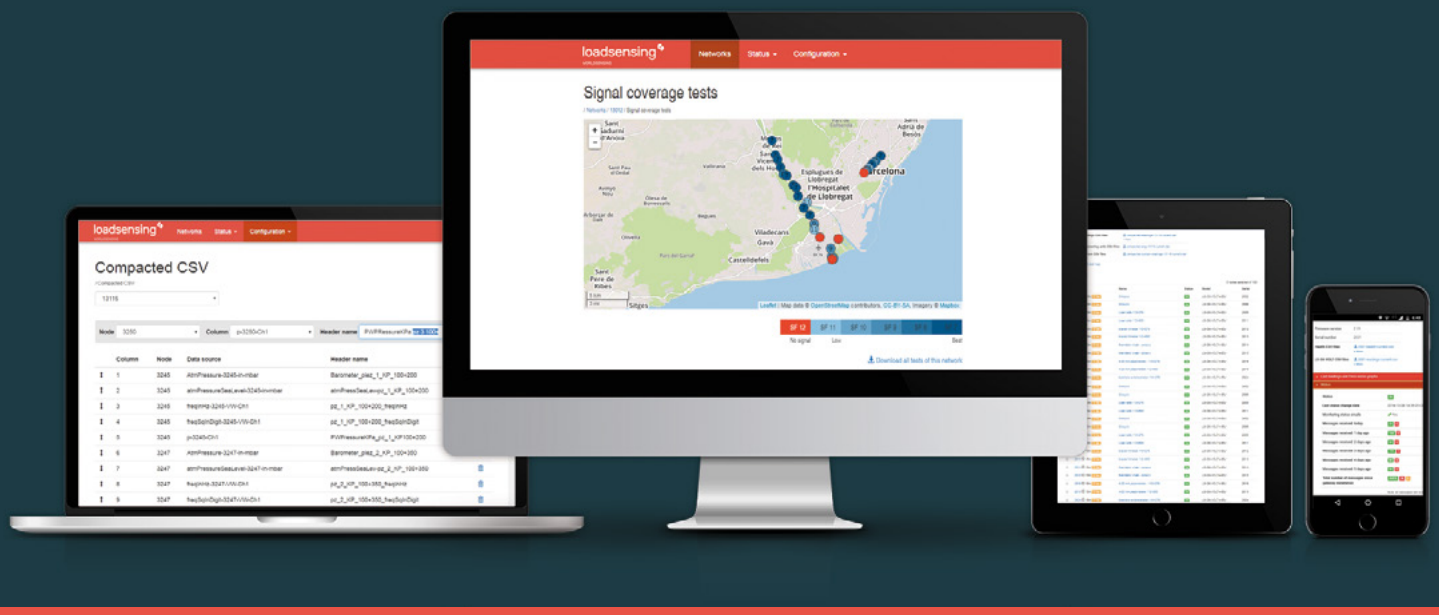
Mining and construction companies and operators of bridges, tunnels, dams, railways and many other inaccessible assets can now work with reliable data. Having access to this information and real-time insights enables operators to anticipate needs, manage their workforce, diminish risks, and even prevent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

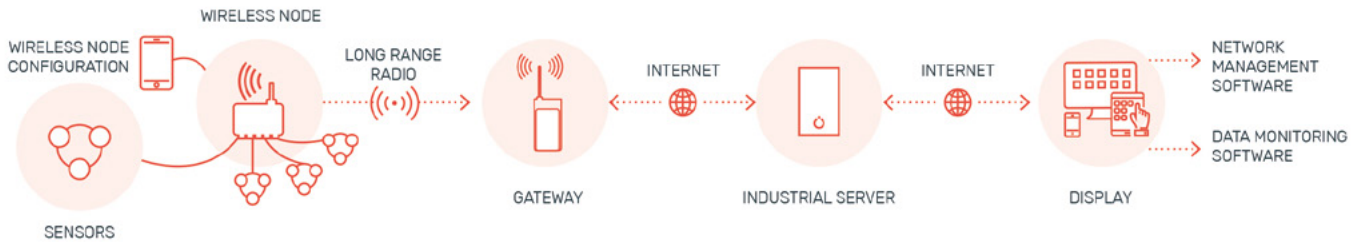


SOFTWARE SUITE

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.

NODE: LS-G6-INC15
BOX DIMENSIONS (WxLxH): 100x100x61 mm
OVERALL DIMENSIONS: 150x120x61 mm (excluding antenna)
EXTERNAL ANTENNA: 100 mm length (including connector)
HOUSING MATERIAL: Aluminium alloy
Internal C-size 3.6 V High power batteries, from 1 up to 2 batteries

NODE: LS-G6-VW-1P (POLYCARBONATE)
BOX DIMENSIONS (WxLxH): 151x80x60 mm
OVERALL DIMENSIONS: 160x85x60 mm
INTERNAL ANTENNA
RADIO COVERAGE: 60 % of the achieved with the external antenna
WITHOUT GROUNDING
HOUSING MATERIAL: Polycarbonate
Internal C-size 3.6 V High power batteries, 1 battery

WIRELESS TILTMETER
LS-G6-INC15

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:	0.17% FS / 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

SAMPLING RATE	Barcelona temperature profile*	Singapore temperature profile*
5 min	1.2 years	1.1 years
1 h	5.8 years	4.7 years
6 h	8.3 years	6.4 years

* Estimations for 2 x saft LSH 14 batteries

VIBRATING WIRE 1ch and 5ch NODES
LS-G6-VW-1P, LS-G6-VW-1M, LS-G6-VW-5

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):	±0.12 hPa

BATTERY LIFE ESTIMATION Vibrating wire nodes

CHANNELS & SAMPLING	BATTERIES*	BATTERY LIFE ESTIMATION*
1 CH 5 min	1 cell	3 years
1 CH 30 min	1 cell	7 years
5 CH 5 min	1 cell	1,5 years
5 CH 5 min	4 cell	5 years
5 CH 30 min	1 cell	4 years
5 CH 30 min	4 cell	>10 years

* Nominal capacity of each battery: 5,8 Ah.
Considering laboratory conditions

Specifications are subject to review and change without notice

Nodes: LS-G6-ANALOG-4, LS-G6-DIG-2 and LS-G6-VW 5 ch
BOX DIMENSIONS (WxLxH): 100x200x61 mm
OVERALL DIMENSIONS: 140x220x61 mm
(excluding antenna)
EXTERNAL ANTENNA: 114 mm length (including connector)
HOUSING MATERIAL: Aluminium alloy
Internal C-size 3.6 V High power batteries, from 1 up to 4 batteries

NODE: LS-G6-VW-1M (ALUMINIUM)
BOX DIMENSIONS (WxLxH): 100x100x61 mm
OVERALL DIMENSIONS: 140x120x61 mm (excluding antenna)
EXTERNAL ANTENNA: 114 mm length (including connector)
HOUSING MATERIAL: Aluminium alloy
Internal C-size 3.6 V High power batteries, 1 battery

ANALOG NODE
LS-G6-ANALOG-4

ANALOG NODE 4ch
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 +85°C): +/- 0.05 % FS
CURRENT LOOP (2-3 wires)
Measuring range: 4-20 mA
Accuracy (0 to +50°C): 0.05 % FS
POTENTIOMETER (POT)
Accuracy (0 to +50°C): +/- 0.02 % FS
FULL WHEATSTONE BRIDGE (FWB)
Accuracy (0 to -50°C): +/- 0.1 % FS
THERMISTOR
Accuracy (0 to +50°C): +/- 0.2°C
PT 100
Accuracy (20°C): +/- 0.8°C

Channels & Sampling	BATTERY LIFE ESTIMATION **				
	Current @12V@24mA	Current @24V@24mA	Voltage @12V@24mA	FWB@5V@0.7 kΩ	Pot@5V@1.5 kΩ
Warm up time	1 second	1 second	1 second		
1 CH 5 min	6 months	4 months	5 months	1.5 years	1.5 years
1 CH 6 hours	>10 years	>10 years	>10 years	8.5 years	>10 years
4 CH 5 min	1.5 months	39 days	2 months	1.5 months	7 months
4 CH 6 hours	8 years	6.5 years	>10 years	8.5 years	>10 years

** Estimations for 4 x saft LSH 14 batteries.
Considering laboratory conditions

DIGITAL NODE
LS-G6-DIG-2

DIGITAL NODE
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
Supported sensors: RTS, Sisgeo and Geosense digital inclinometers

BATTERY LIFE ESTIMATION **
RST and Sisgeo chains of Inclinometers

Number of sensor	Sampling rate		
	6 hours	30 minutes	3 minutes
10 (RST)	>10 years	2.5 years	4 months
30 (RST)	5.2 years	4 months	26 days
10 (SISGEO)	4 years	5 months	30 days

SHARED SPECIFICATIONS

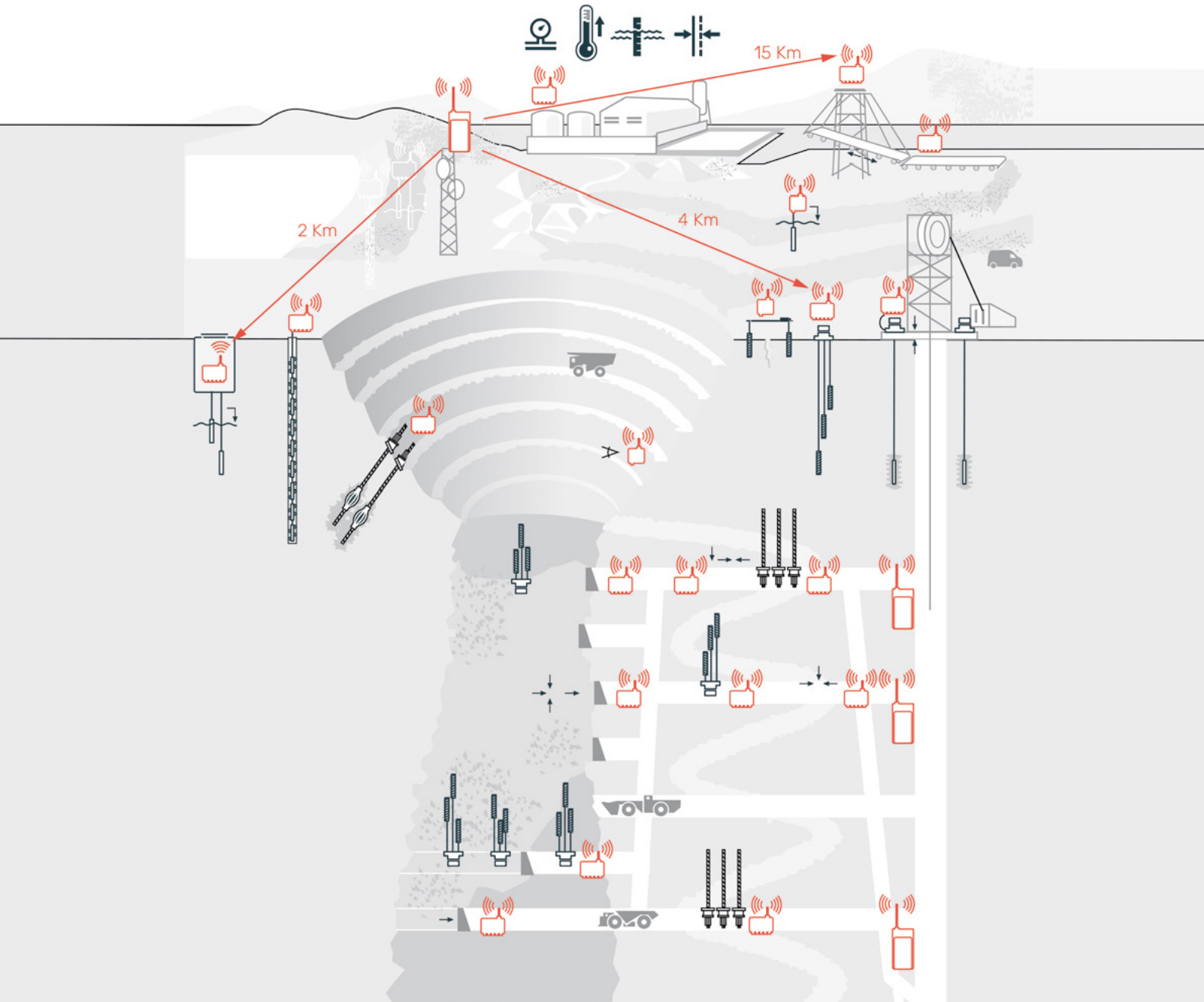
INTERNAL DATA STORAGE
Up to 72,500 readings including time and 5 sensors
Up to 200,000 readings including time and 1 sensor
Sampling rate: 30 seconds to 1 day
Time synchronization by radio: Time discipline better than ± 10 seconds
Operating temperature: -40ºC to 80ºC (-40ºF to 175ºF)
Weather protection: IP67

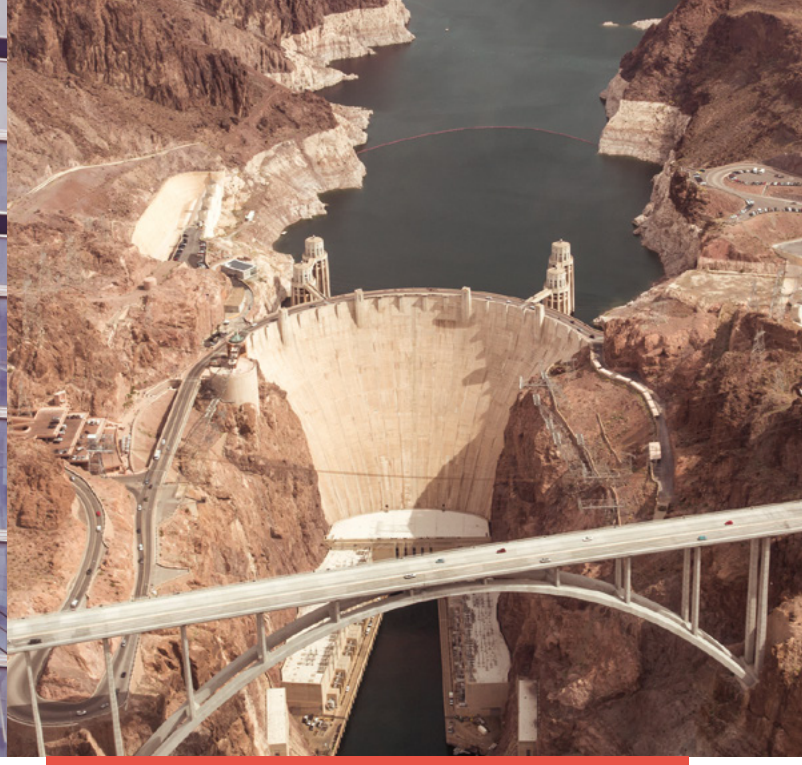
ACCESSORIES

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





CONFIGURATION APP

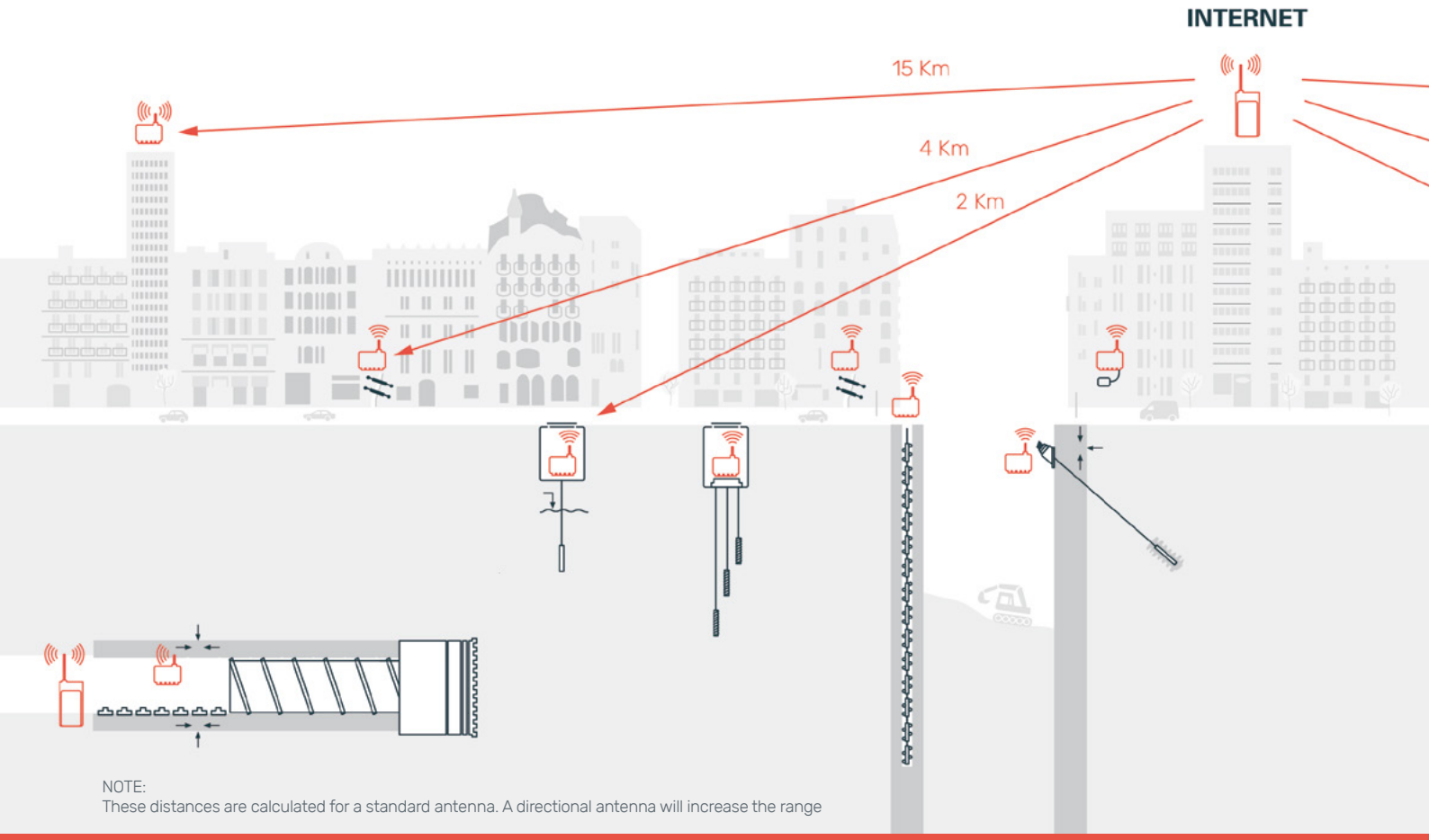
DLOG APP
Simple and fast connection to wireless node
Runs on Android devices
Easy sensor configuration: ID, sampling rate, frequency sweep, interface type, etc.
Checks radio signal coverage
Records coordinates (GPS)
Downloads data from wireless node and sends by e-mail or saves it on the Android device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

HOW IT WORKS IN CITIES



NOTE:
These distances are calculated for a standard antenna. A directional antenna will increase the range

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

WORLD SENSING
CONNECTED OPERATIONAL INTELLIGENCE

Aragó 383, 4th floor
08013 Barcelona, Spain
[+34] 93 418 05 85
sales@worldsensing.com
www.worldsensing.com

Visit our website:

NEW PRODUCT

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Wireless Tiltmeter

For long-range, remote readings in geotechnical monitoring

Measuring inclinations with tiltmeters is essential for the success of many projects: from controlling building response during a tunneling project, over analyzing settlements, to tracking changes in the inclination of structures such as bridge piers or historical monuments and dams, to monitoring landslides including berms in open pits.

The Loadsensing Tiltmeter is a low-power long-range wireless datalogger and inclinometer in a single, compact box. It measures tilt in two (biaxial) perpendicular axes in the plane of the base. It combines a highly precise MEMS sensor plus the radio transmission network by Loadsensing, Worldsensing's leading connected infrastructure solution. One gateway can support several nodes in the same network.

Its ability to provide accurate measures with long-range wireless communication and extended battery life sets this inclinometer apart from other comparable products in the market.

The tiltmeter can also be used as a standalone logger for manual monitoring and can be easily configured and connected with a USB cable and an Android phone.

APPLICATIONS
Remote tilt monitoring from retaining and building walls
Landslide monitoring
Bridge pier monitoring
Structural load monitoring
Ground subsidence
FEATURES
HARDWARE
Datalogging and tilt monitoring in a compact box
High accuracy and repeatability
Long battery life (> 5 years @ 1h sampling rate)
-40°C to 80°C (-40°F to 175°F) operating range
Reduced size (140 x 120 x 61 mm)
SOFTWARE
User-friendly Android configuration app at no extra cost
Web browser software
Standard CSV download, FTP push and API access
ADVANTAGES
Highly accurate and reliable biaxial tilt sensor
Long-range communications (up to 15km/9miles)
Low-power, long battery life (over 5 years)
Robust, small and weather proof box for harsh environments
Easy configuration

The wireless tiltmeter features a range of up to 15km/9miles and over 5 years battery life in line with the rest of Loadsensing datalogger family.

LS-G6-INC15 Wireless Tiltmeter

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/ Specifications

SPECIFICATIONS		
GENERAL		
Battery life – sampling rate 5 min	> 1 years	Life time estimations based on a model considering Barcelona temperature profile
Battery life – sampling rate 1 h	> 5 years	
Battery life – sampling rate 6 h	> 8 years	
Battery type	2 x 3.6V C-Size (recommended Saft LSH 14)	
Sampling rate	30 seconds to 1 day	
Configuration software	Android App	
SENSOR		
Type	MEMS (Micro-Electro-Mechanical) Inclinometer	
Range	± 15º	
Accuracy (± 5º)	0.03% FS / 0.004º	
Accuracy full range	0.17% FS / 0.025º	
Resolution	0.001°	
Repeatability	0.005°	
Axes	Two (biaxial)	
Temperature sensor resolution	0.1 ºC	
Temperature sensor accuracy	±0.5 ºC	
MEMORY		
Reading capacity	200,000 readings	
MECHANICAL		
Box dimensions (WxLxH)	100x100x61 mm	
Overall dimensions	150x120x61 mm (excluding antenna)	
Operating temperature	-40ºC to 80ºC (-40ºF to 175ºF)	
Weather protection	IP67	
External antenna	100 mm length (including connector)	
Box material	Aluminium alloy	
RADIO		
Range open sight	15km	
Range with obstacles	> 1km	
Maximum link budget	151 dB	
Configuration	Star (no repeaters needed)	

WORLD SENSING

www.worldsensing.com
sales@worldsensing.com
(+34) 93 418 05 85

Aragó, 383 4th floor
08013 Barcelona
Spain

Regulatory Information Canada

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Les changements ou modifications non expressément approuvés par la partie responsable de la conformité pourraient annuler l'autorisation de l'utilisateur d'utiliser l'équipement.

This device complies with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions: (1) This device may not cause interference; and (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR de l'ISDE applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

RF exposure safety

This device is a radio transmitter and receiver.

It is designed not to exceed the emission limits for exposure to radio frequency (RF) energy set by the ISED.

The antenna must be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le modèle est un émetteur et un récepteur radio.

Il est conçu pour ne pas dépasser les limites d'émission pour l'exposition à l'énergie radiofréquence (RF) établie par l'ISDE.

L'antenne doit être installé de façon à garder une distance minimale de 20 cm entre la source de rayonnements et votre corps.

L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenneou autre émetteur.

Permitted Antenna

This radio transmitter model, IC: 21260-LSG6INC15 has been approved by the ISED to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Type	Max Gain
External antenna: Wellshow AR017 GSM Quad Band Antenna	+2 dBi

Le présent émetteur radio modèle, IC: 21260-LSG6VW1M a été approuvé par ISDE pour fonctionner avec les types d'antenne énumérés ci-dessous et ayant un gain admissible maximal.

Les types d'antenne non inclus dans cette liste, et dont le gain est supérieur au gain maximal indiqué, sont strictement interdits pour l'exploitation de l'émetteur.

Type	**Max Gain**
External antenna: Wellshow AR017 GSM Quad Band Antenna	+2 dBi

CAN ICES-3 (B)/NMB-3(B)

This Class *B* digital ap*par*atus complies with Canadian ICES-003

Cet appareil numérique de clase B est conforme à la norme Canadienne ICES-003

Regulatory Information USA

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Class B device notice

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

—Reorient or relocate the receiving antenna.

—Increase the separation between the equipment and receiver.

—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

—Consult the dealer or an experienced radio/TV technician for help.

RF exposure safety

This device is a radio transmitter and receiver.

It is designed not to exceed the emission limits for exposure to radio frequency (RF) energy set by the Federal Communications Commission.

The antenna must be installed and operated with minimum distance of 20 cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Permitted Antenna

This radio transmitter model, FCC ID: 24HN4-LS-G6-INC5 has been approved by FCC to operate with the antenna types listed below with the maximum permissible gain indicated. Antenna types not included in this list, having a gain greater than the maximum gain indicated for that type, are strictly prohibited for use with this device.

Type	Max Gain
External antenna: Wellshow AR017 GSM Quad Band Antenna	+2 dBi

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DE

Allgemeine Warnhinweise

- Vorsicht! Explosionsgefahr, wenn die Batterie durch eine andere Batterie des falschen Typs ausgetauscht wird. Entsorgen Sie leere Batterien entsprechend den Anweisungen.
- Die Batterien und Betriebsmittel, die über den Datenanschluss verbunden werden, müssen die Bestimmungen aus Abschnitt 2.5 der Norm EN 60950-1 erfüllen.
- Betriebsmittel, die in zugangsbeschränkten Bereichen installiert werden.

Symbole

Symbol	Beschreibung
	Vorsicht! Fahren Sie nicht fort, bevor Sie die Anweisungen vollständig verstanden haben und alle erforderlichen Voraussetzungen erfüllt sind.
	Lesen Sie vor der Benutzung aufmerksam die Gebrauchsanweisung.
	Vorsicht: Heiße Oberfläche!
	Die Abfallprodukte müssen getrennt entsorgt werden.

EN

General warnings

- Caution. Risk of explosion if the battery is replaced with an incorrect type. Dispose of used batteries according to the manufacturer's instructions.
- Batteries and equipment to be connected via the data port must comply with clause 2.5 of the EN 60950-1 standard.
- Equipment to be installed in restricted access areas.

Symbols

Symbol	Description
	Caution. Do not proceed until the instructions are clearly understood and all required conditions are met.
	Read the instructions for use carefully before using.
	Caution, hot surface.
	Waste should be collected separately.

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ES

Advertencias generales

- Precaución. Riesgo de explosión en caso de sustitución de la batería por una de tipo incorrecto. Deshágase de las baterías usadas de acuerdo con las instrucciones.
- Las baterías y los equipos destinados a conectarse mediante el puerto de datos deben cumplir con el capítulo 2.5 de la Norma EN 60950-1.
- Equipo destinado a instalarse en zonas de acceso restringido.

Símbolos

Símbolo	Descripción
	Precaución. No continúe hasta que las instrucciones se hayan comprendido con claridad y se cumplan todas las condiciones requeridas.
	Lea atentamente las Instrucciones de uso antes de utilizarlo.
	Precaución, superficie caliente.
	Los residuos deben ser recolectados en forma diferenciada.

FR

Avertissements généraux

- Attention ! Risque d'explosion si la batterie est remplacée par un type de batterie inapproprié. Jetez les batteries usagées conformément aux instructions.
- Les batteries et le matériel conçus pour se connecter par l'intermédiaire du port de données doivent être en conformité avec le chapitre 2.5 de la Norme EN 60950-1.
- Cet équipement doit être installé dans des zones d'accès restreint.

Symboles

Symbole	Description
	Attention ! N'utilisez pas cet équipement avant d'avoir parfaitement compris les instructions et vérifié que toutes les conditions requises étaient réunies.
	Veuillez lire attentivement les Instructions d'utilisation avant d'utiliser cet équipement.
	Attention ! Surface chaude.
	Les déchets doivent être collectés séparément.

IT

Avvertenze generali

- Attenzione. Rischio di esplosione in caso di sostituzione della batteria con una di tipo non conforme. Smaltire le batterie usate secondo le istruzioni.
- Le batterie e i dispositivi progettati per il collegamento tramite la porta dati devono essere conformi alla sezione 2.5 della norma EN 60950-1.
- Dispositivo destinato all'installazione in zone ad accesso limitato.

Simboli

Simbolo	Descrizione
	Attenzione. Non procedere finché non sono state comprese chiaramente le istruzioni e non sono state soddisfatte tutte le condizioni richieste.
	Leggere attentamente le Istruzioni per l'uso prima di utilizzare il dispositivo.
	Attenzione, superficie calda.
	I rifiuti devono essere raccolti in modo differenziato.

NO

Generelle advarsler

- Forsiktig. Fare for eksplosjon hvis batteriet byttes ut med feil type batteri. Brukte batterier skal avhendes i henhold til produsentens instruksjoner.
- Batterier og utstyr som skal kobles til via dataporten må overholde klausul 2.5 i EN 60950-1-standarden.
- Utstyr som skal installeres i områder med begrenset adgang.

Symboler

Symbol	Beskrivelse
	Forsiktig. Gå ikke videre før du har forstått instruksjonene og alle obligatoriske krav er oppfylt.
	Les bruksanvisningen nøye før bruk.
	Forsiktig, varm overflate.
	Avfall skal innsamles separat.

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PL

Ogólne ostrzeżenia

- Ostrzeżenie. Zagrożenie wybuchem w przypadku wymiany na baterię niewłaściwego typu. Zużytych baterii należy pozbywać się zgodnie z instrukcjami producenta.
- Baterie i sprzęt podłączany za pośrednictwem portu danych muszą być zgodne z paragrafem 2.5 normy EN 60950-1.
- Sprzęt przeznaczony do instalowania w miejscach o ograniczonym dostępie.

Symbole

Symbol	Opis
	Ostrzeżenie. Nie należy kontynuować bez dokładnego zapoznania się z instrukcjami i spełnienia wszystkich wymaganych warunków.
	Przed użyciem należy dokładnie przeczytać instrukcje użytkowania.
	Ostrzeżenie, gorąca powierzchnia.
	Odpady należy wyrzucać do oddzielnych pojemników.

SV

Allmänna varningar

- Var försiktig. Det finns risk för explosion om batteriet ersätts med fel typ. Kassera förbrukade batterier enligt tillverkarens anvisningar.
- Batterier och utrustning som ansluts till dataporten måste uppfylla klausul 2.5 i standarden EN 60950-1.
- Utrustningen ska installeras i områden med begränsad åtkomst.

Symboler

Symbol	Beskrivning
	Var försiktig. Utför inte installationen förrän du har förstått samtliga anvisningar och alla nödvändiga villkor uppfylls.
	Läs bruksanvisningen noggrant före användning.
	Var försiktig, ytan är mycket varm.
	Avfall bör samlas in separat.