Loadsensing **G7**

GNSS Meter

Worldsensing's GNSS Meter is a wireless sensor that enables precise automated measurement of surface point movements. It features advanced multi-band Real-Time Kinematic (RTK) technology and innovative edge processing that delivers millimetric precision with great reliability.

LSG7GNS-SXLH

LSG7GNS-SXLH-RAI

Key features

MILLIMETRIC PRECISION

Achieve sub-centimeter precision down to 2 mm with RTK technology, ensuring the most cost-efficient data collection available. Position measurements provided every hour with two levels of aggregation: 6 h and 24 h.

FLEXIBLE CONFIGURATION OPTIONS

The GNSS Meter has flexible configuration options that allow the nodes to function as either a base station or a rover, adapting to various monitoring needs. Check the radio link from the base to the rover using the Worldsensing App.

ADVANCED EDGE DATA-PROCESSING

Statistics related to the quality of the position measurement and the performance of the system, transmitted via radio and available in CMT.

WIRELESS, AUTONOMOUS AND LOW-POWER

The GNSS Meter leverages the excelling capabilities of efficiency of our Loadsensing portfolio. Autonomous, battery powered devices with D-size batteries that can last more than 2.6 years in most cases.

INTEGRATED TILTMETER AND ENVIRONMENTAL SENSORS

The GNSS Meter comes with an integrated tiltmeter to ensure the transmission of measurements even when conditions for precise RTK measurement are not met, and it also allows for the monitoring of changes from vertical in structures and mounting elements.

REPORT DISPLACEMENTS

Calculate vertical, and horizontal (E/W, N/S, absolute) displacements from the initial position within CMT.

Main applications

The GNSS Meter is designed for cross-industry applications, offering millimetric precision in areas such as slope stability, settlement, and subsidence monitoring. It is ideal for dense point monitoring or as a complement to in-ground sensors like inclinometers and extensometers, as well as geospatial techniques like satellite InSAR, ground-based radar, and total stations, enhancing overall data reliability and robustness.

SUBSIDENCE AND HEAVE

Coastal subsidence

Mining and underground excavations

Mine closures

Swelling rocks and expansive soils

Points of control for satellite InSAR, ground-based radar, total stations, and other geospatial monitoring techniques

SLOPE STABILITY

Areas and assets affected by landslides

Open pits and slope stability

Surface points of control for in-place inclinometer strings, extensometers, and settlement systems

SETTLEMENT

Embankments, soil consolidation, and land reclamation projects

Bridge abutments settlement

Foundations settlement

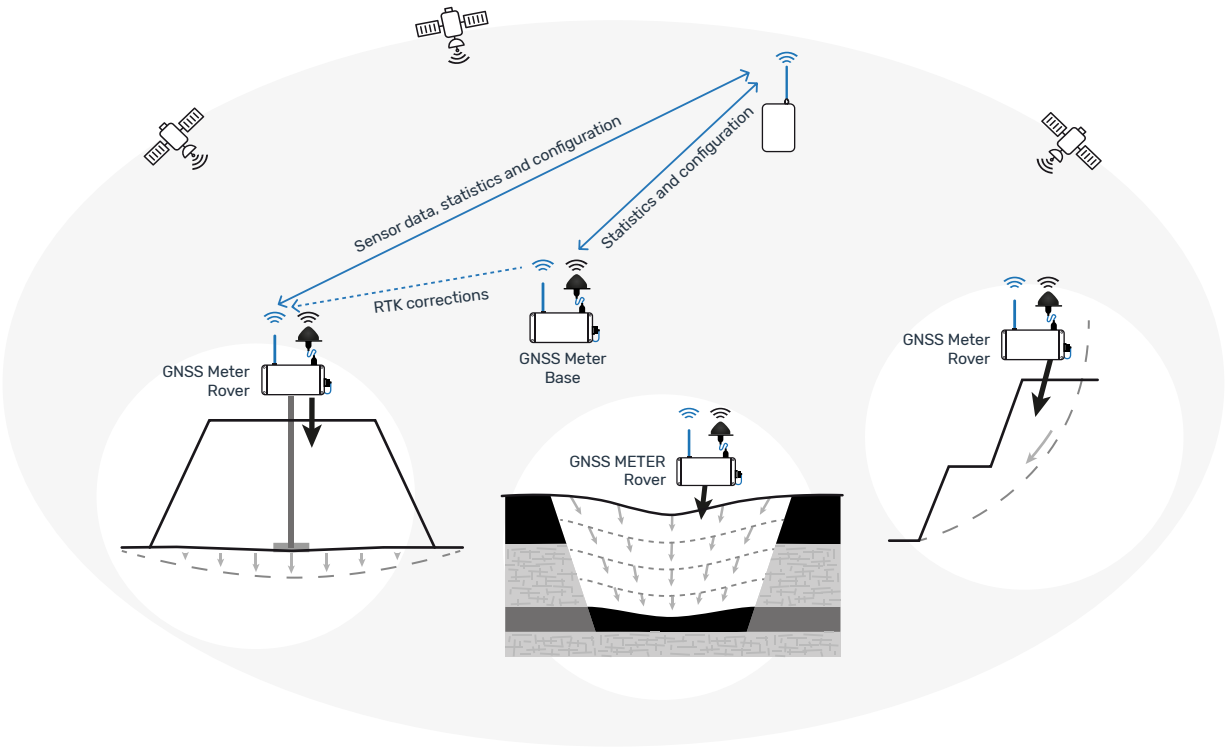

Fig. 1: Illustrates the GNSS Meter's operation. Rovers collect satellite data and receive RTK corrections from a base station via LoRa, which enables precise positioning. The GNSS Meter then transmits sensor data and performance statistics to the Gateway using LoRa. Remote configuration is also possible via CMT through the Gateway, ensuring flexibility and control.

Rail track monitoring

Effective rail track monitoring often requires long-term tracking of 3D displacements at specific points along the track. In areas with a clear view of the sky, the LSG7GNS-SXLH-RAI complements cant and twist measurements captured by tiltmeters installed on sleepers.

KEY CAPABILITIES

Enables comprehensive 3D movement monitoring, providing reliable measurements of:

- Horizontal alignment and lateral displacements
- Vertical alignment and track elevation (settlement/heave)
- Absolute reference points to calibrate or validate other sensors and survey methods

The GNSS Meter for rail track monitoring features a low-profile GNSS antenna with a ruggedized design specifically engineered for the harsh conditions of the railway environment.

READY FOR DEPLOYMENT

Worldsensing also offers a specialized double-plate mounting bracket specifically designed for installing the low-profile GNSS antenna directly on the sleeper.

This custom mount ensures that the antenna remains perfectly stable, even in the high-vibration environments typical of active rail lines.

TECHNICAL SPECIFICATIONS

GENERAL

Sensor type	GNSS
Secondary sensor	Tiltmeter
Environmental sensor	Integrated temperature and humidity sensor
Power source	4 x 3.6 V D-size user-replaceable, high energy density batteries
Reporting period	1 h
Communications	LoRa radio
GNSS time synchronization	Typically better than 50 ms
Reporting format	Geodetic coordinates for: • Last hour sample • 6h short-term aggregate • 24h long-term aggregate
Device configuration	• Worldsensing App • CMT Edge • CMT Cloud

GNSS SENSOR

Correction technology	Real time Kinematic (RTK)
GNSS channels	184
GNSS constellations / frequency bands	Selectable from: • GPS / QZSS: L1C/A, L2 • GLONASS: L1OF, L2O, • Galileo: E1-B/C, E5b • BeiDou: B1I, B2I
GNSS warmup time	Selectable from: • 10 s • 20 s • 30 s

TILTMETER

Sensor	3-axis MEMS accelerometer
Range	±90°
Axes	3-axis inclination measurement with respect to gravity's direction. Reports the two axes of rotation from the horizontal plane in any orientation
Accuracy $f(\theta)$	
+/-2° +/-5° +/-45° +/-85°	+/- 0.003° +/- 0.006° +/- 0.08° +/- 0.23°
Resolution	0.0001°
Repeatability	< 0.0003°
Offset temperature dependency	± 0.002°/°C

TEMPERATURE SENSOR

Range	–40 °C to 80 °C
Resolution	0.1 °C

HUMIDITY SENSOR

Sensor type	Humidity sensor to detect lack of sealing/locking of the enclosure. Statistics of the relative humidity measurements transmitted in the health messages

GNSS PRECISION[1]

		68th percentile (1 σ)			95th percentile (2 σ)		
Distance base to rover		1 h *last sample*	6 h *aggregated*	*24 h aggregated*	*1 h last sample*	*6 h aggregated*	*24 h aggregated*
40 m	Horizontal	4 mm	2 mm	1 mm	9 mm	3 mm	1 mm
	Vertical	7 mm	3 mm	1 mm	20 mm	5 mm	3 mm
4 000 m	Horizontal	8 mm	4 mm	2 mm	21 mm	8 mm	4 mm
	Vertical	13 mm	6 mm	3 mm	31 mm	15 mm	8 mm

[1] Under favorable conditions, in an open-sky environment in the Province of Barcelona.

MECHANICAL		
Box dimensions (W x L x H)	200 x 100 x 61 mm	
Overall dimensions	205 x 120 x 61 mm	
Device variant	**LSG7GNS-SXLH**	**LSG7GNS-SXLH-RAI**
GNSS antenna	• External - TW3929 - TNC connector • 26dB LNA gain • 66.7 mm (dia.) x 76 mm (h.)	• External - TW7929 - SMA connector • 26dB LNA gain • 69 mm (dia.) x 22 mm (h.)
LoRa antenna	• External • −0.3 dBi gain • 110 mm, 101 mm long	
Operating temperature	−40 °C to 80 °C (−40 °F to 175 °F)	
Weather protection	IP68 (at 2 m for 2 h)	
Weight (excluding batteries)	960 g	
External connectors	• GNSS antenna: RP N-type female • LoRa antenna: RP SMA female • USB type-C female	
Mounting options	• Compact vertical mount using anchor rods, on poles up to 50 mm using U-bolts, or on other columns using metal clamps • Compact horizontal mount using anchor rods • Survey pole mount with extended GNSS antenna • Surface mount with extended LoRa antenna • Surface mount with extended GNSS antenna	
Box material	Aluminum alloy	
Battery holder	4 cells, D-size battery holder	

RADIO SPECIFICATIONS	
Radio band	ISM sub 1 GHz
Operating frequency bands	Adjustable
Bidirectional communications	GNSS sensor configuration including mode (base/rover), creation of new base entities, base position, assigning rovers to a specific base, warmup time, sample offset, among others
Maximum link budget	151 dB/ 157 dB
Radio configuration	LoRa / LoRaWAN
Network topology - Node to Gateway	• LoRa Star • LoRa Tree (K20 Edge repeater)
Network topology - Base to Rover	LoRa Star
NODE TO GATEWAY RADIO RANGE[2]	
Range open sight	15 km
Range city street	4 km
Range manhole in a city street	2 km
Tunnel	4 km
BASE TO ROVER RADIO RANGE[2]	
Range open sight	5 km

BATTERY LIFE ESTIMATIONS[3]			
Warmup time	10 s	20 s	30 s
Base	3.1 years	2.7 years	2.4 years
Rover	3.5 years	2.9 years	2.5 years

[2] The distances have been tested by Worldsensing and verified in actual projects using the standard antenna. However, radio range depends on the environment, so these distances are only indicative. Please contact us regarding your specific application.

[3] Battery life estimations using recommended Saft batteries LSH20, and additionally LS33600 for devices with serial number above #168719. Calculations assuming GNSS clear sky visibility default base configuration with a maximum time of 2 minutes to test the radio link between base and rover and 1 hour reporting period. Receiver offset enabled. Typical Europe radio configuration using SF9, radio transmit power 14 dBm. Considering laboratory conditions. Consumption varies depending on environmental and wireless network conditions. Battery life estimations based on the lifetime mathematical model using Barcelona weather profile. Average values provided.

ACCESSORIES: LSG7GNS-SXLH	
LS-ACC-BIG-HVP	Versatile mount plate suitable for horizontal or vertical surface mounting, as well as pole mounting using 35 mm or 50 mm U-bolts or metal clamps.
LS-ACC-ANT-HVP	Versatile mount plate for GNSS antennas. Suited for horizontal or vertical mounting of the GNSS antenna (TW3929). It can be attached to the versatile mounting plate for large nodes or used as a standalone mount on surfaces or poles using 35 mm or 50 mm U-bolts or metal clamps.
LS-ACC-PRS-VP	Vertical mounting plate for prisms. Designed to align the prism with the center of the GNSS antenna. It can be combined with the versatile mounting plate for large nodes (LS-ACC-BIG-HVP) or the versatile mounting plate for GNSS antennas (LS-ACC-ANT-HVP). The complete assembly can be mounted on walls or poles using anchor rods (LS-ACC-ANC-H), 35 mm (WS-ACC-U35) or 50 mm U-bolts (WS-ACC-U50), or metal clamps.
LS-ACC-GNSS-RD	5/8-inch survey pole mount for GNSS antenna. Mount for the GNSS Meter antenna with a 5/8-inch survey pole connection.
LS-ACC-ANT-LORA	Mount bracket for LoRa antenna. Enables horizontal or vertical mounting of the LoRa antenna with cable extension LS-ACC ANTE-G7 or LS-ACC-ANTS-G7. Can attach to LS-ACC-BIG-HVP or be used standalone with anchor rods or clamps.
LS-ACC-ANTE-G7	LoRa antenna cable extension 2.5 m. RP-SMA (male) to RP-SMA (female).
LS-ACC-ANTS-G7	LoRa antenna cable extension 0.45 m. RP-SMA (male) to RP-SMA (female).
LS-ACC-GNSS-CL2	GNSS antenna cable extension 1.5 m. Male N-type RP to TNC male.
LS-ACC-GNSS-CL3	GNSS antenna cable extension 3 m. Male N-type RP to TNC male.
LS-ACC-USBC-IP	Sealed USB-C male to standard USB-C male. 2 m cable for G7 devices equipped with external connector.
WS-ACC-CELL-1D	Saft LSH20 high power density 3.6 V, D-size spiral cell.
WS-ACC-G7-USBC	Mobile phone to device cable USB-C to USB C. Length: 1 m.

Fig. 2: Compact mount with U-bolts. Use the LS-ACC-BIG-HVP versatile mount plate and WS-ACC-U35 35 mm or WS-ACC-U50 50 mm U-bolts to secure the device to a 35 or 50 mm pole. Attach the LS-ACC-ANT-HVP versatile mount plate for the GNSS antenna to the node mount plate for a compact setup. Add the LS-ACC-PRS VP prism mount plate for prism installation. Not recommended for base stations.

Fig. 3: Survey pole mount. Use the LS-ACC BIG-HVP versatile mount plate to secure the device to a pole with metal clamps. Install the GNSS antenna on top of the pole using the LS-ACC-GNSS-RD 5/8-inch survey pole mount and the LS-ACC-GNSS-CL2 or LS ACC-GNSS-CL3 cable extension. Suitable for base stations and rovers.

Fig. 4: Compact horizontal mount. Use the LS-ACC-BIG-HVP versatile mount plate to secure the device to a horizontal surface. Attach the LS-ACC ANT-HVP versatile mount plate for the GNSS antenna to the node mount plate for a compact setup. Use the LS-ACC ANT-LORA versatile LoRa mount plate and the LS-ACC-ANTS-G7 cable extension to position the LoRa antenna vertically.

ACCESSORIES: LSG7GNS-SXLH-RAI	
LS-ACC-ANT-RHP	Double-plate mount for the LP GNSS antenna on railway tracks. Attachment options: anchor rods or glue.
LS-ACC-GNSS-LPL5[4]	5 m cable for low-profile GNSS antenna, N-type (M) RP to SMA (M) (SMA to TNC adapter included).
LS-ACC-GNSS-LPL10[4]	10 m cable for low-profile GNSS antenna, N-type (M) RP to SMA (M) (SMA to TNC adapter included).

[4] The 5 m and 10 m cables for the low-profile GNSS antenna include an SMA to TNC adapter, allowing them to be used with the TW3929 conical antenna supplied with the standard LSG7GNS-SXLH.

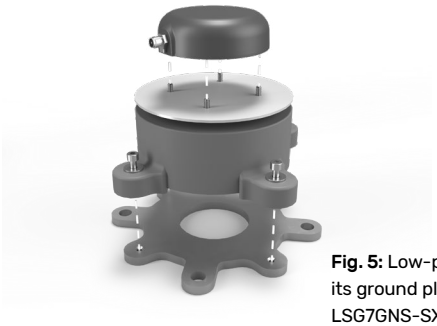

Fig. 5: Low-profile GNSS antenna and its ground plane (both included with the LSG7GNS-SXLH-RAI), installed on the sleeper double-plate mount (LS-ACC-ANT-RHP). The antenna features an SMA female connector, which differs from the TNC female connector used on the conical antenna (refer to previous pages for comparison).

Sky visibility requirements are inherent to GNSS systems. In the case of rail track monitoring installations, it is particularly important to ensure that conditions are suitable, with a minimum of 120º view (see Figure 6).

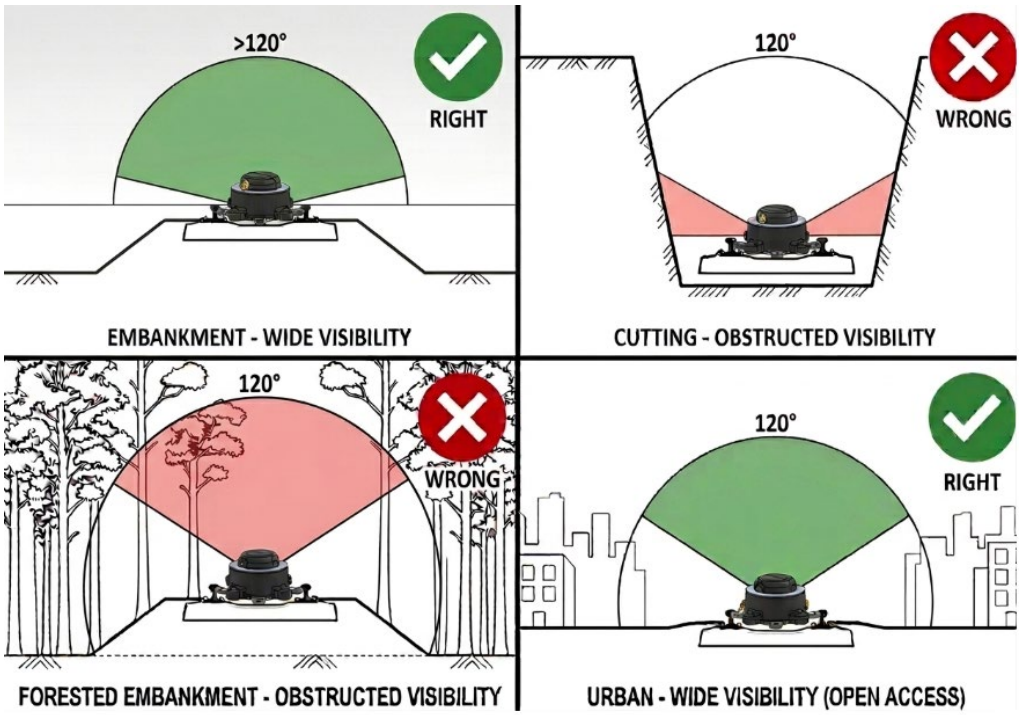

Fig. 6: Typical rail track monitoring scenarios. The GNSS system requires a clear view of the sky for proper operation.

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