

WIRELESS IOT BI-AXIS INCLINOMETER

USER GUIDE



QUICK START



MECHANICAL DRAWING



STEP FILE



1 MAIN FEATURES



Sensor resolution: (0.00183° for ±30° range, 0.00366° for ±55° range)



LoRaWAN® Protocol: 15km Radio Range



Scalable Measuring Range: ±30° and ±55°



IP67 | Nema 6 / IP68 (M8 Connector cap mounted , self-fusing is used around antenna connector)

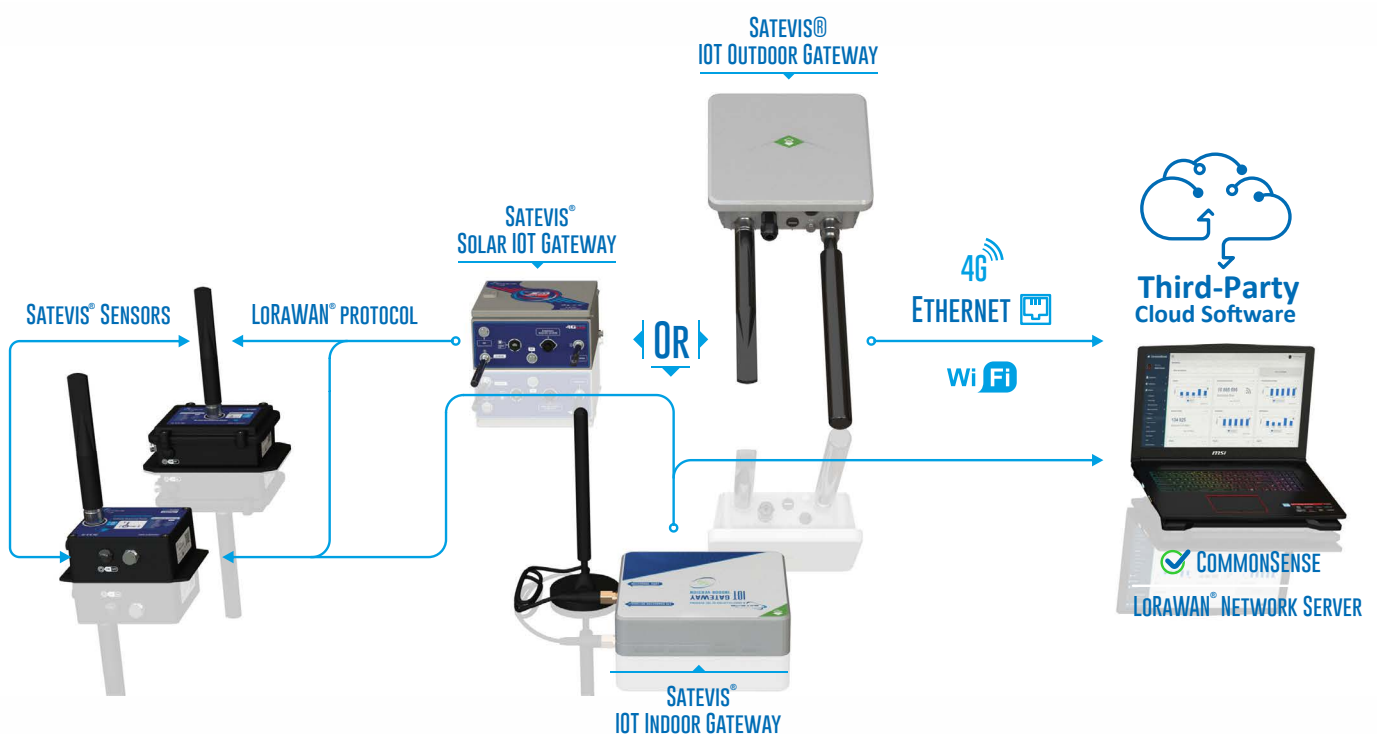


Excellent radio link.



Integrated battery pack

2 HOW IT WORKS ?



3 APPLICATIONS

BRIDGE



RAILWAY SLEEPERS



CRANE

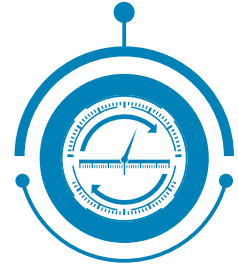


TUNNEL

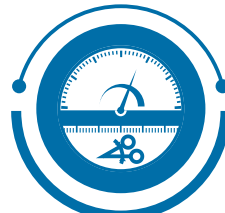
CONDITION MONITORING



LAND SURVEYING



STRUCTURAL HEALTH MONITORING

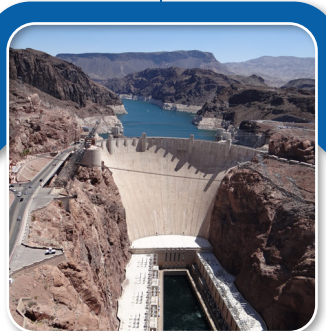


TEST AND MEASUREMENT

CARGO SHIP



DAM



ANTENNA BASE STATION



CONSTRUCTION SITE



4 NON-CONTACT BUTTONS AND LEDS DESCRIPTION

“HELLO!” FUNCTION HELPS THE FIELD OPERATOR TO CHECK THE SENSOR INSTALLATION & CONFIGURATION



Caption1: After installing the [Alpha-Inc inclinometer](#), the field operator can check at any moment if the sensor is working properly.



Caption2: By Holding the magnet on the ‘Hello!’ label for more than 10s, the sensor wakes-up and transmits to the Lorawan network the data measurement followed by the system diagnostic (battery status and network quality).

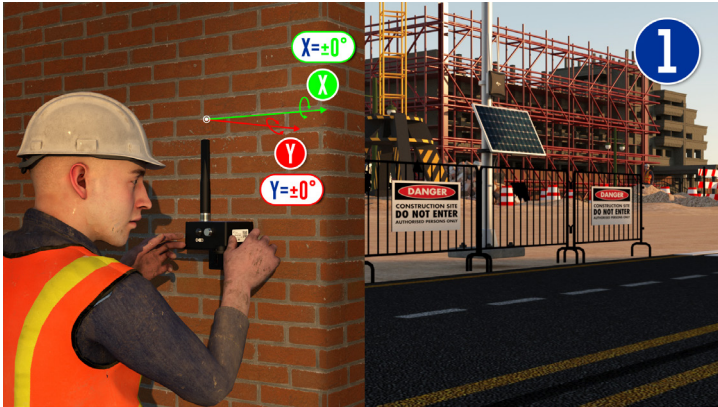


Caption3: The Activity Led blinks in **green color**, confirming that a data measurement is transmitted to the Lorawan network.



Caption4: The field operator can check on [Satevis® Cloud software](#) (or a third-party cloud software) if his sensor is working properly.

SENSOR ZEROING FUNCTION SIMPLIFIES THE SENSOR INSTALLATION



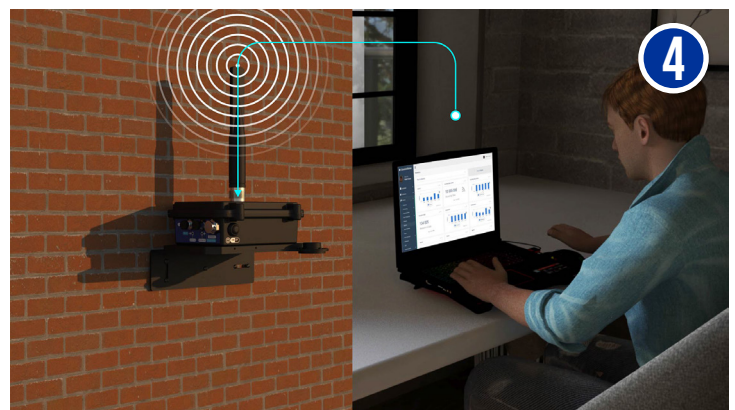
Caption1: Even if an angle bracket is used, it's sometimes difficult to bring a zero-offset on both X and Y axis. In some cases, the field operator can not spend too much time on this task.



Caption2: To enable the sensor zeroing function, hold the magnet on 'Sensor Zeroing' Label for more than 10s.



Caption3: The Activity LED blinks in blue, the sensor zeroing starts on both X and Y axis. When this process is done, the Activity led will blink again in blue color and transmits a data measurement to the Lo-rawan® network. If the sensor zeroing process is not done correctly (the device is moving) the Activity Led will blink in Red color.



Caption4: The Sensor-zeroing process can be also done remotely from the cloud software.

5 TECHNICAL SPECIFICATIONS

PRODUCT REFERENCE

SATEVIS-LORA-ALPHA-INC-MR-PS-RP-AG

MR - Measurement Range:
30B : Bi-axis $\pm 30^\circ/\pm 55^\circ$

PS - Power supply :

BP3S : Battery Pack with 3 Primary Cell in series (3 x 6.5Ah , 3S1P configuration) - Non Rechargeable battery pack

RP - Radio Power

HP - High Power Transmission
+22dBm

LP - Low Power Transmission
+14dBm

AG - Antenna Gain

AG-2dBi-868: 2dBi Antenna for EU/IND Regions (Europe /India)

AG-5dBi-868: 5dBi Antenna for EU/IND Regions (Europe /India)

AG-2dBi-915: 2dBi Antenna for US/KR/AS/AU Regions (USA/KOREA/ASIA/AUSTRALIA)

AG-5dBi-915: 5dBi Antenna for US/KR/AS/AU Regions (USA/KOREA/ASIA/AUSTRALIA)

Example 1: SATEVIS-LORA-ALPHA-INC-30B-BP3S-LP-AG-2dBi-868

Wireless Inclinometer with LoraWan connectivity, Bi-axis inclinometer with $\pm 30^\circ/\pm 55^\circ$ measurement range, Powered from Battery Pack 3S, Low Power Radio +14dBm, 2dBi Antenna for EU/IND regions

Example 2: SATEVIS-LORA-ALPHA-INC-30B-BP3S-HP-AG-5dBi-915

Wireless Inclinometer with LoraWan connectivity, Bi-axis inclinometer with $\pm 30^\circ/\pm 55^\circ$ measurement range, Powered from Battery Pack 3S, High Power Radio +22dBm, 5dBi Antenna for US regions

DATALOGGER / RECORDER

Datalogger Size

If 3 sensors Channels (Bi-Axis Inclinometer, 1 Internal Temperature) :

380 000 Log sessions per sensor channel

If 5 sensors Channels (Example: Tri-Axis Inclinometer, 1 Internal Temperature, External Temperature, External Humidity) :

279 000 Log sessions per sensor channel

Logged Information

UTC Clock

Data Measurement

Monitoring Mode

Remote configuration from LNS

DataLogger Start/Stop/Erase

Download Method

From USB with Hyperterminal Software, CSV format

CONFIGURABLE SETTINGS FROM CLOUD SOFTWARE

Javascript formatter code

Free Javascript formatter code to accelerate the integration of Satevis sensors in your own cloud software :

- Downlink formatter code (Alarm Threshold, Measurement mode....)

- Uplink formatter code(Data measurement)

Data Acquisition mode

Different measurement mode are available:

Low Duty Cycle Data Acquisition (LDCDA), Measurement heartbeat 20s to 24 hour

Alarm measurement mode, Measurement heartbeat 10s to 24 hour

Alarm Threshold

Three levels of Alarm Thresholds **Minor Alarm** / **Severe Alarm** / **Critical Alarm**

Scalable Measurement Range

$\pm 30^\circ$, $\pm 55^\circ$

INCLINOMETER SENSOR

Inclinometer Technology	MEMS Technology
Scalable Measuring Range	user-selectable range $\pm 30^\circ$ or $\pm 55^\circ$, with automatic range adjustment depending on the application
Sensor resolution	0.00183° for $\pm 30^\circ$ range 0.00366° for $\pm 55^\circ$ range
Noise density	0.0009 °/√Hz
Sensor Precision/Repeatability (full scale, 25°C)	$\pm 0.00183^\circ$ for $\pm 30^\circ$ range $\pm 0.00366^\circ$ for $\pm 55^\circ$ range
Sensor Accuracy (full scale, @ 25°C)	$\pm 0.005^\circ$ for $\pm 10^\circ$ range $\pm 0.01^\circ$ for $\pm 45^\circ$ range $\pm 0.02^\circ$ outside $\pm 45^\circ$ range
Offset temperature dependency (temperature range -25°C to +85°C)	$\pm 0.002^\circ/\text{°C}$
Offset LifeTime Drift (@25°C)	$\pm 0.05^\circ$
Sensor frequency Response (-3 dB)	DC to 10 Hz for $\pm 30^\circ$ measurement range DC to 40 Hz for $\pm 55^\circ$ measurement range
Calibration	Factory calibrated on 9 references point : 0° absolute, $\pm 5^\circ$, $\pm 10^\circ$, $\pm 30^\circ$ and $\pm 45^\circ$ with calibration settings backed up on the sensor Flash memory. Calibration method used : Back-to-back calibration with an accurate reference sensor.
Sensor Zeroing function	Sensor zeroing can be done after Satevis Sensor installation. User need to hold a magnet on the label " sensor zeroing" for approx. 10s, zero-offset is the performed on all sensor axis X/Y

POWER SUPPLY

Integrated battery pack	Non-Rechargeable Battery Pack (3S1P configuration) - Lithium Thionyl Chloride Capacity 6.5Ah , Max Voltage 10.8Volts
Current consumption @ 3,3V	<ul style="list-style-type: none"> · During data acquisition : 15 to 20 mA · During Radio transmission : 80 mA for +22 dBm , 35 mA for +14dBm · During Battery Saver Mode : < 15 μA
External power supply	USB Power 5VDC. When the device is powered from USB, the internal battery pack is disconnected from the power path.

5 TECHNICAL SPECIFICATIONS

SATEVIS SENSOR CONFIGURATOR (FROM USB)

Configuration	Frequency Plan, Device EUI, AppEUI, AppKey
Firmware Upgrade	Firmware upgrade through the USB
Sensor calibration	Calibrations Points setup and Quick calibration

RF SPECIFICATIONS

LoRaWAN® Stack	LoRaWAN® V1.0.2 REVB CLASS A
Activation Mode	OTAA
LoRaWAN® Frequency Plan	<p>Frequency Plan can be configured from USB:</p> <ul style="list-style-type: none"> - Europe 868MHz - USA: 915MHz - Australia 915MHz - Asia 923MHz - Korea 920MHz - India 865Mhz <p>Important : Depending on the destination region, Satevis Device will be delivered with Antenna for 868MHz Frequencies (Europe/India), or 915MHz frequencies (USA/KOREA/ASIA/Australia)</p>
TX Power	<p>HP - High Power Transmission +22dBm</p> <p>LP- Low Power Transmission +14dBm</p>
Receiver Sensitivity	-136.5dBm sensitivity for SF12 with 125KHz BW
Link Budget	158dB
Maximum Radio Range	<ul style="list-style-type: none"> - 15 Km in L.O.S. / Rural Environment - 2 Km in NLOS/ Urban Environment
Antenna	<p>Waterproof N-Type Omni Antenna, Gain 5 dBi or 2dBi / VSWR ≤ 2.0</p> <p>Frequency range for AG-2dBi-868 and AG-5dBi-868 : 863-870 MHz</p> <p>Frequency range for AG-2dBi-915 and AG-5dBi-915 : 902-928 MHz</p> <p>Dimensions Ø22 x 64 mm for 2dBi</p> <p>Dimensions Ø22 x 180 mm for 5dBi</p>

5 TECHNICAL SPECIFICATIONS

ENVIRONMENTAL AND MECHANICAL

Casing	Aluminum & Waterproof casing Dimensions in mm (LxWxH): 151x130x55 mm Weight : 950g
IP NEMA Rating	IP67 Nema 6 / IP68 (M8 Connector cap mounted , self-fusing is used around antenna connector)
Shock resistance	100g during 50 ms
Mounting base	Screw mounting & magnetic mounting
Operating Temperature	-40°C to +75°C Sunshield should be used if the device is exposed to sun radiation from +68°C
Shielding	EMI SHIELDING GASKET
Relative Humidity	0 to 98 %RH
Norms & Radio certifications	·CE Labelling Directive R&TTE (Radio) ETSI EN 300 328 ·FCC (North America) ·ARIB STD-T66 Ver 3.6 HS Code: 9031.80.20 EAR99 ROHS - Directive 2002/95/EC

INCLUDED ACCESSORIES

- 1 x Battery Pack 3 x C-Size Cell - 6,5Ah (3S1P configuration)
- 1x Magnet for Sensor-Zeroing & Hello functions
- 2x M8 Cap for Power Supply & external optional sensor
- 1 x USB to M8 cable adapter, 2 meters length
- 1 x Self-amalgamating tape (25cm length)
- 1 x LoRaWAN® Antenna (see antenna options on reference builder)
- 1x Button Shield

AVAILABLE FUNCTIONS

ON/OFF	Mechanical latching Push button
Hello	Transmits Data on user request , works with a magnet pointing to Hello label
Sensor Zeroing	sensor zeroing on user request , works with a magnet pointing to sensor zeroing label
Multi color LED	<p>Green: network connection, data transmission</p> <p>Blue: Sensor zeroing successful/Hello Message Transmitted successfully</p>

OPTIONAL ACCESSORIES AND SERVICES

90° Bracket Mounting	90° Bracket mounting (with integrated eyelet) with 4 x M5 screws + Locknut Ref: SAT-BRACK-MNT
External Sensors	External Temperature and Humidity Sensor
Calibration certificate	Calibration certificate provided by Satevis A static calibration method is used on a granite surface plate DIN876 Ref: CERT-SATEVIS-INCLINOMETER

OPTIONAL EXTERNAL SENSORS

Temperature and Humidity sensor	Ref: B-TH-01-150-M8
Industrial Pressure sensor	Ref: SAT-EXT-TIR (available Q1-2025)
Industrial Water Level Sensor	Ref: SAT-EXT-WATER-LEVEL (available Q2-2025)

BATTERY LIFE WITH FOR DIFFERENT MEASUREMENT MODE

Measurement Cycle every minute	
Measurement Cycle every 5 minutes	
Measurement Cycle every hour	
Measurement Cycle every 4 hours	

6 MOUNTING OPTIONS



ON/OFF BUTTON-SHIELD

SCREW AND MAGNETIC MOUNTING BASE



OPTION

90° BRACKET + WITH BULLSEYE

7 DESIGNED FOR HARSH ENVIRONMENT FROM COLD TO TROPICAL COUNTRIES

All Satevis® sensors designed with a Rugged and Waterproof (IP67) Aluminum casing and integrate a Protective Vent, with Humidity and Pressure compensation.



EMI SHIELDING GASKET

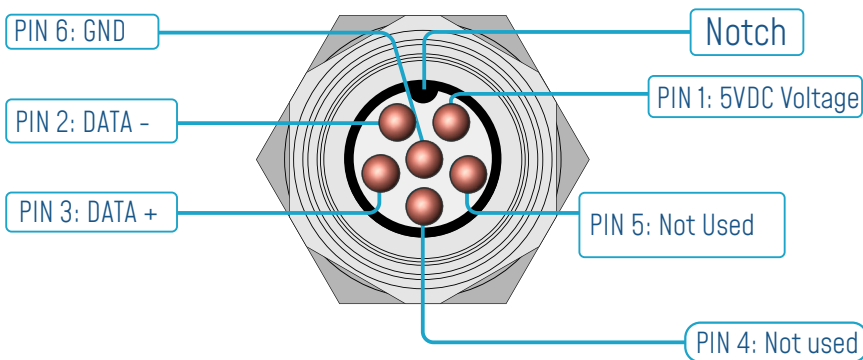
SILICONE GASKET (INGRESS PROTECTION)

Satevis® Alpha-Inc comes with 2 levels of protection:

- IP67 Aluminum alloy casing.
- Electromagnetic protection with Shielded gasket on the lid.
- Ruggedized and ultra-low-power electronic design -40°C to +75°C.
- Humidity and Pressure Vent.

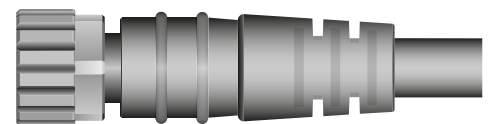
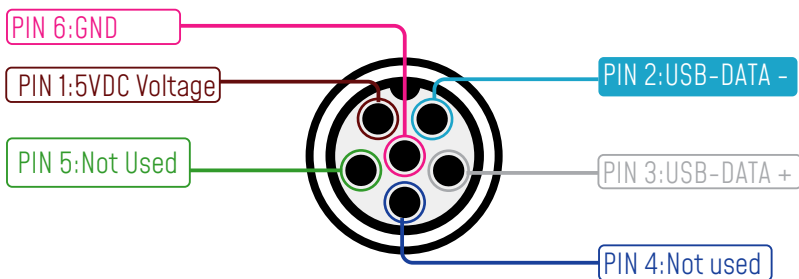
8 POWER SUPPLY

M8 6pin Socket (MALE, A-CODING)- Pin assignation



Interface Name	M8 Pin assignation
5VDC Voltage	PIN 1
DATA -	PIN 2
DATA +	PIN 3
Not used	PIN 4
Not Used	PIN 5
GND	PIN 6

M8 6pin Plug (FEMALE, A-CODING)- Pin assignation



M8-6Pins Plug

Interface Name	5VDC Voltage	USB DATA -	USB DATA +	Not used	Not Used	GND
M8 Pin assignation	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5	PIN 6
Wire Color (A-coding)	BROWN	WHITE	GREY	BLUE	GREEN	PINK

9 DIFFERENT ANTENNA VERSIONS

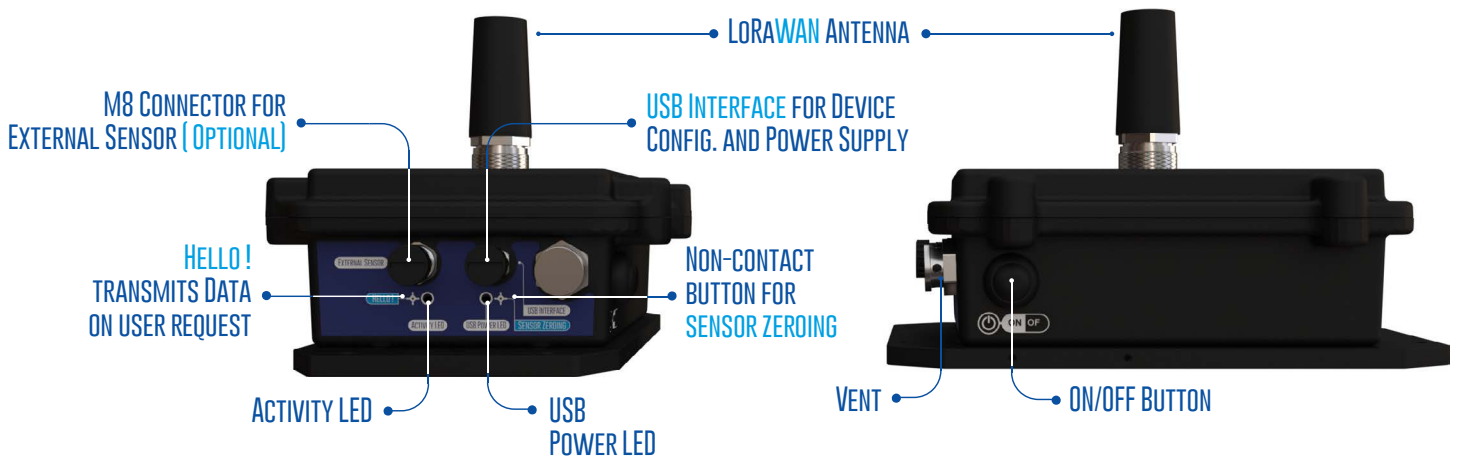


HIGH GAIN ANTENNA 5DBI



SMALL FORM FACTOR ANTENNA 2DBI

10 OVERVIEW



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