

SATEVIS® INCLINOMETER SENSORS

PRODUCTS PRESENTATION

V1.6

06.01.2025

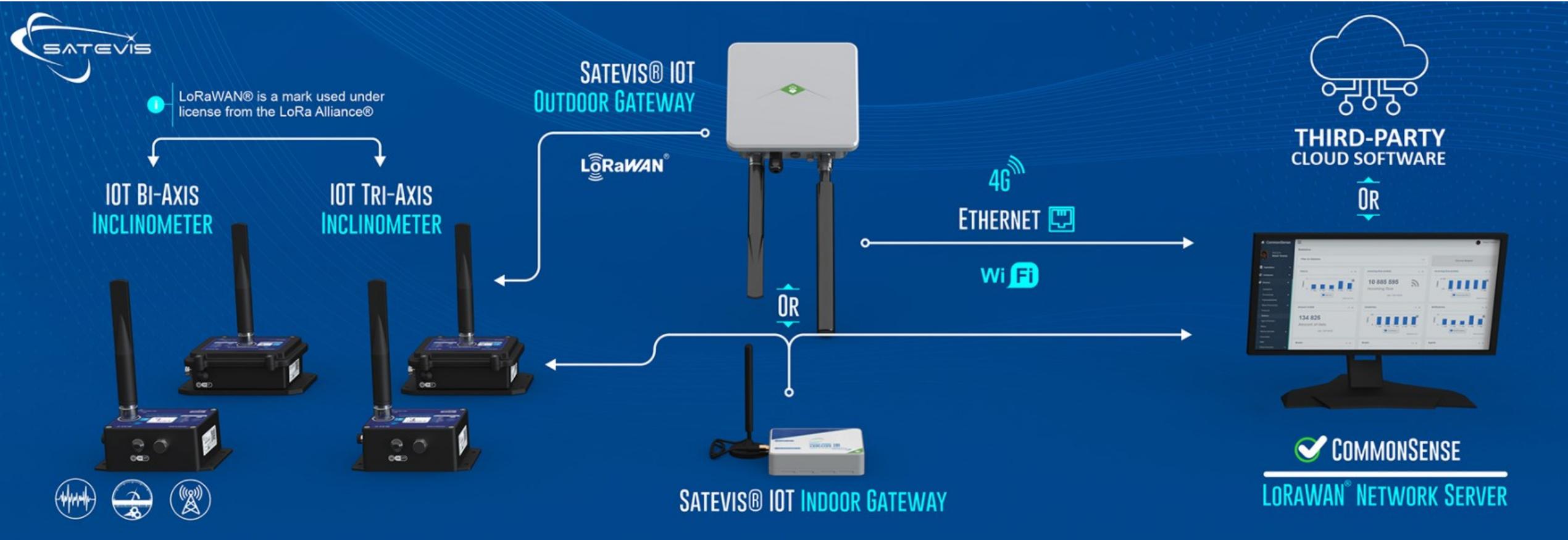
Mathias

GRUEMAN



WWW.SATEVIS-SYSTEMS.COM





Kompakt Version



 Works with 1 Lithium Thionyl Primary cell (D Size) -19Ah 3.6VDC

Longer Battery Life for long-term monitoring



 Works with primary cell pack (3S1P Configuration) – 6.5Ah for each cell



Two versions of Inclinometers: Tri-Axis up to $\pm 85^\circ$ or Bi-Axis up to $\pm 55^\circ$



LoRaWAN® Protocol: 15km* Radio Range



MEMS inclinometer with scalable measuring range ($\pm 10^\circ/85^\circ$ or $\pm 30^\circ/55^\circ$)



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



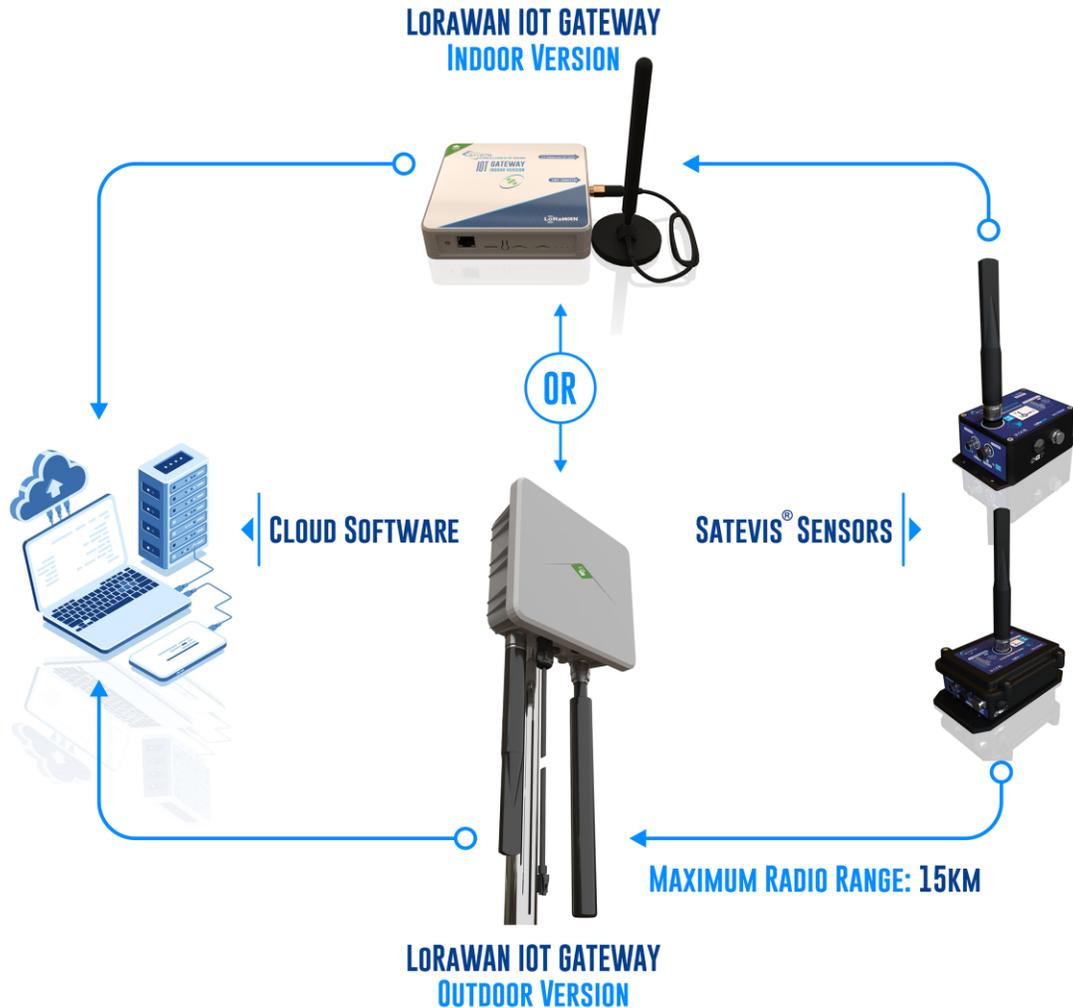
-136.5dBm sensitivity for SF12 with 125KHz BW



Two versions : Lithium Primary cell or Primary Cell Pack

Features	Satevis® Alpha-Inc Bi-axis version 30/55	Tri-Axis version 10/85
Number of axis	2	3
Measuring range	user-seletctable range $\pm 30^\circ$ or $\pm 55^\circ$	user-seletctable range $\pm 10^\circ$ or $\pm 85^\circ$
Noise density	0.0009 °/√Hz	for $\pm 10^\circ$ range : 0.0007 °/√Hz on Y Axis, 0.008 °/√Hz on X, Z Axis for $\pm 85^\circ$ range : 0.0012 °/√Hz on all axis
Sensor Resolution	0.00183° for $\pm 30^\circ$ range 0.00366° for $\pm 55^\circ$ range	0.0055 °
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	$\pm 0.01^\circ$ for $\pm 10^\circ$ measurement range $\pm 0.02^\circ$ for $\pm 85^\circ$ measurement range
Sensor Accuracy (full scale, @ 25°C)	$\pm 0.005^\circ$ for $\pm 30^\circ$ range $\pm 0.01^\circ$ for $\pm 45^\circ$ range $\pm 0.02^\circ$ outside $\pm 45^\circ$ range	$\pm 0.015^\circ$ for $\pm 10^\circ$ range $\pm 0.02^\circ$ for $\pm 45^\circ$ range $\pm 0.04^\circ$ outside $\pm 45^\circ$ range

Features	Satevis® Alpha-Inc Tri-Axis/Bi-Axis	Satevis® Alpha-Inc Kompakt Tri-Axis/Bi-Axis
Tx Radio Power	Low Power Radio +14Dbm or High Power radio +22dBm	Low power radio +14 dBm
Default Mounting base	Screw and Magnetic	Screw Mounting (Magnetic mounting can be purchased separately)
Battery	3 x C Size Cell 6.5Ah in Series	1x D Size Cell 19Ah
Casing size (without antenna)	151 x 130 x55 mm	115 x90 x55 mm
EMI GASKET	Yes	No
Weight	950 g	700g



- Satevis® sensors can be connected to a Lorawan® Gateway with '**Packet Forwarder**' function;
- Lorawan® gateway will forward Uplink/Downlink packets to a **LNS (Lora Network Server)**;
- The LNS can be integrated to the cloud software (ex: CommonSense®, TTN, ThingsPark) or Embedded inside the Lorawan gateway (ex: Chirpstack);
- Users with Expertise in cloud software can use our Uplink/Downlink specification document and our free Javascript source codes for fast integration.
- Users looking for effortless deployment can choose our Cloud software CommonSense®.

BRIDGE



RAILWAY SLEEPERS



TUNNEL



CRANE



STRUCTURAL HEALTH MONITORING

CONDITION MONITORING

TEST AND MEASUREMENT

LAND SURVEYING

CARGO SHIP



DAM



ANTENNA BASE STATION



CONSTRUCTION SITE



Satevis® device Radio configuration	L.O.S.* (Line of Sight)	Urban Environment (Density of Berlin City Center) with 8 buildings between the sensor and the Gateway	Ground to Underground (U-Bahn Berlin)
High Power Radio +22dBm + 5dBi Antenna	15km	1-2km	200-500m
High Power Radio +22dBm and 2dBi Antenna	12km	1-2km	100-150m
Low Power Radio +14dBm and 5dBi Antenna	10km	500m-1km	200-300m
Low Power Radio +14dBm and 2dBi Antenna	8km	500m-1km	50-100m

*L.O.S. was tested in open-field with a LoraWan Gateway installed on a mast with 25 meters height

Several Regions are covered (Region code must be mentioned during ordering):

AS923 : Asia - 920-923 MHz

AU915: Australia

US915 : USA /Canada 902-928 MHz

KR920: South Korea 920-923 MHz

EU868 : Europe 863-870 MHz

IN865: India 865-867 MHz



During ordering , your **Satevis®** device will be configured with your Region Frequency Plan.

It will be provided with an antenna adapted to your Region.

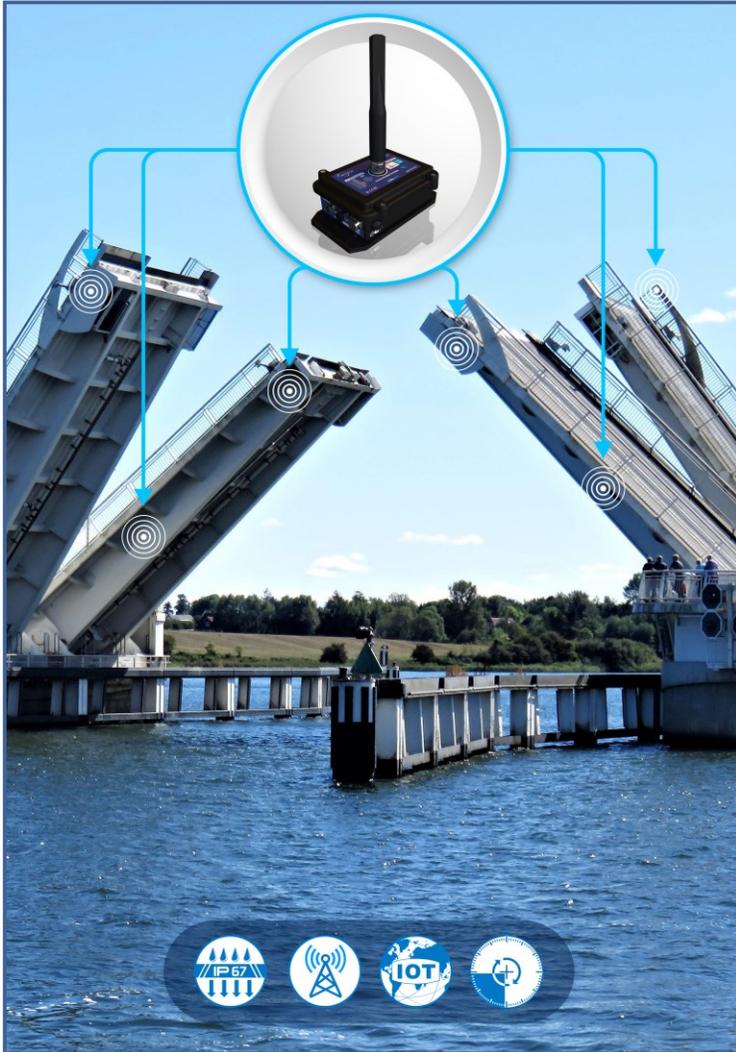
If user decide to change region, it can easily be modified from Satevis® Link software, just make sure you Antenna is compatible with.

+5 dBi Antenna N-Type



+2 dBi Antenna N-Type





Several sensor range configuration are available :

Static Measuring Range:

$\pm 10^\circ$ for static Infrastructure, provides best precision $\pm 0.01^\circ$

$\pm 85^\circ$ for dynamic Infrastructure, offers higher range with $\pm 0.02^\circ$ precision

Automatic Range is adapted for structure transiting between static/dynamic

Automatic Low range $\pm 10^\circ$: sensor starts with lower range $\pm 10^\circ$ and moves to higher range $\pm 85^\circ$: if the structure is moving with high inclination $> \pm 10^\circ$ (Example: vertical/Folding Bridge, Vessel)

Automatic Wide range $\pm 85^\circ$: sensor starts with High Range $\pm 85^\circ$ and moves to lower range $\pm 10^\circ$ if the structure is moving with low inclination

These configurations can be changed dynamically with Downlink messages.

Inclinometer Sensor is Temperature compensated and factory-calibrated for both $\pm 10^\circ$ and $\pm 85^\circ$ range.



Satevis devices are certified Lorawan®:

- Lorawan 1.0.2 stack
- Easy integration with any type of Lorawan® Gateway (with Packet Forwarder function) and Lorawan® network Server (LNS). Example of source codes are already available for TTN (Javascript source codes)
- Users can also use CommonSense®, our LNS developed with Vertical M2M (a French IOT company specialized in Industrial IOT)
- Lorawan Vs NB-IOT:
 - **Benefits of Lorawan® are explained on this blog :** <https://blog.semtech.com/title-10-things-about-lorawan-nb-iot>

Multi-Sensors device

Our hardware is designed to seamlessly integrate with external sensors, empowering users to connect their sensor networks with their own A.I. models. This integration enables them to accurately predict potential damage, malfunctions, or failures in their structures and equipment.

- Example:**
- External Temperature/Humidity sensors :** Impact of environment on structure/equipment movement
 - External IR temperature Sensor :** Impact of surface temperature on structure /equipment movement
 - External water-flow sensor:** Predict Bridge scour due to fast water-flow



Currently we have Temperature and Humidity sensors,
IR temperature, Q1-2025
Pressure and Water flow sensor are planned for Q2-2025



Looking for other external sensors to Integrate ?
Please contact us .

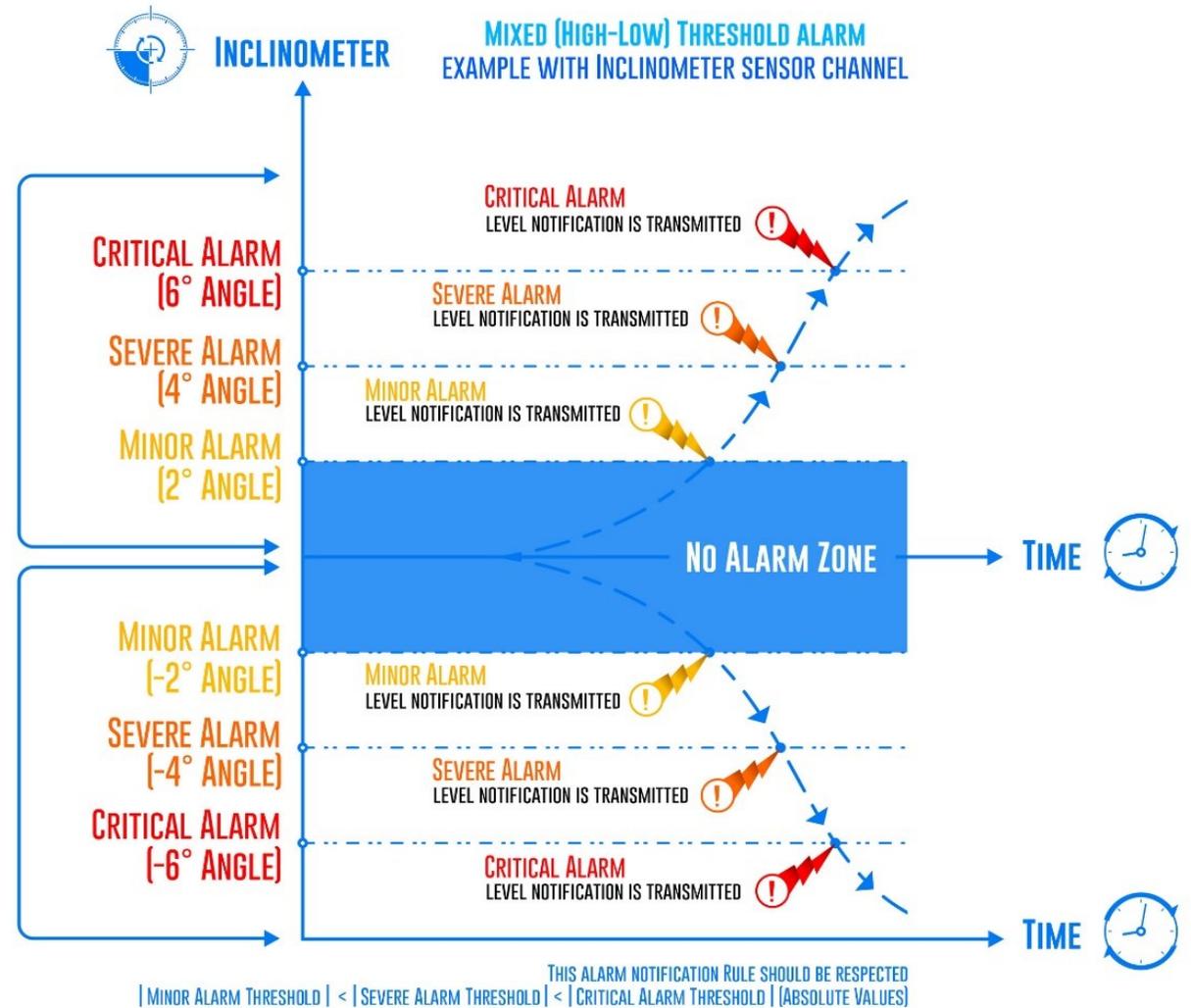
Build your own Alarms Rules

1. Independent alarms Thresholds for each measurement channel with AND/OR logical connection are available.
2. Three level of Alarms can be specified : Critical Alarm (Highest) / Severe Alarm / Minor Alarm, helping users to create an event (email/SMS transmission/ activate relay) based on the criticality of alarm notification .

Example:

With AND logical connection, If an Alarm Threshold is reached for both Temperature and Inclination Axis a notification is transmitted to the LNS.

With the OR logical connection, the notification is transmitted if a threshold is reached on one of the sensor channel





Satevis® Alpha-Inc comes with a mounting base adapted for both screw and magnetic mounting



All the functions needed for fast deployment are easily accessible to field operator

An optional button shield is provided to avoid misoperation

Non-contact 'button' for Sensor zeroing and checking Sensor Operation (Hello)

External waterproof ON /OFF Button , for easier power cycling. No need to open the casing to power on the device .

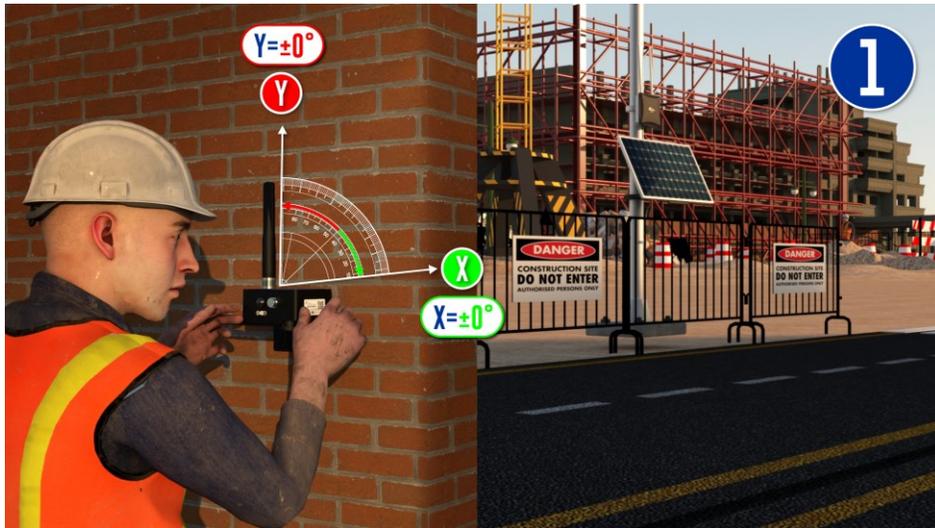
USB connection for easy sensor commissioning to Lora Network



Any doubt about sensor operation ?

“Hello” function helps field operator to check sensor installation and configuration without stopping or holding the ongoing monitoring process.

By Holding the magnet on “Hello” label, the device transmits a ‘Hello Message’ to cloud software which can be immediately viewed by the field operator.



“Sensor Zeroing” simplifies sensor installation by automatically Zeroing Satevis Inclinator. Field operator need to hold magnet on sensor zeroing label and sensor zeroing is smoothly done by the device

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

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

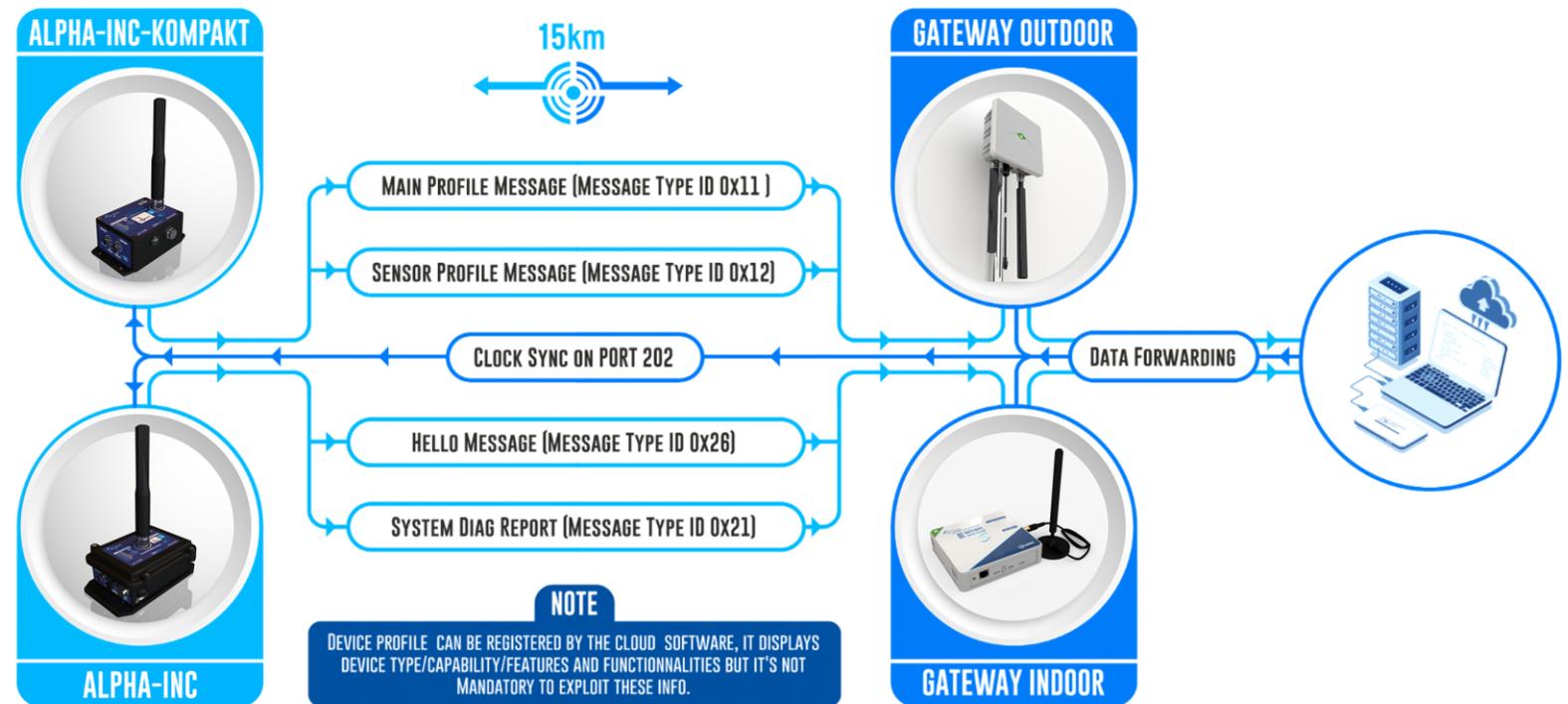
Humidity and Pressure Vent



IP68 is reachable if the following conditions are met: All M8 Connector cap mounted, self-fusing tape is used around antenna connector,

A dedicated Portal is accessible to developers:

- Can be directly integrated into user LNS (LoraWan® Network Server)
- Uplink and Downlink messages are fully specified
- Examples of Javascript source codes are available on TTN (The Things Network)



Main Page: [Click here](#)



• Main features

- **Support Multiple LNS** : Compatible with multiple LNS like AWS, TTN, ChirpStack, etc. via using the Packet Forwarder / Basics™ Station mode
- **Built-in Local Console for Configuration**: Provides a simple setup experience to configure the device on Web UI through Wi-Fi AP and Ethernet
- Integrates Lorawan, WIFI, Ethernet and 4G connectivity(optional)
- Using SX1302 Semtech Chipset
- Outdoor Gateway IP66
- POE Power supply External
- Option for High Gain FiberGlass Lora Antenna 8dbi

Indoor version, for more info : [Click Here](#)

Outdoor version, for more info: [Click Here](#)



- **Main features**
- **Same Features with than Satevis Indoor/Outdoor gateway , plus :**
 - Integrated MPPT solar controller with remote control and monitoring via Bluetooth (VictronConnect App)
 - Lorawan® and 4G connectivity
 - **Integrated Battery** : LifePO4 18Ah with 2000 charges cycles at 100% or Valve Regulated Lead-Acid (VRLA) 14Ah
 - Compatible with Solar panel Up to 100W
 - Option for different kind of FiberGlass Antenna

For more info : [Click Here](#)

Features	Satevis® IOT Indoor Gateway	Satevis® IOT Outdoor Gateway	Satevis® Solar IOT Gateway
Available Connectivity	LoraWan® V1.0.3 Class A/Class B/Class C ,Ethernet/LAN, 4G(optional)	LoraWan® V1.0.3 Class A/Class B/Class C , 4G (optional), Ethernet/LAN	LoraWan® V1.0.3 Class A/Class B/Class C , 4G, Ethernet/LAN
Solar Energy	No	No	MPPT Solar Power Manager with battery monitoring tool (via Bluetooth)
Mains power	DC 12V – 2A or PoE (IEEE 802.3 af), 40V-57V DC	PoE (IEEE 802.3 af), 40V-57V DC	PoE (IEEE 802.3 af), 40V-57V DC
Backup Battery	No	No	Yes , 18Ah LifePO4 battery or 14Ah Lead-Acid battery
Waterproof	No	Yes, IP66	Yes IP66
Casing Size (without connectors)	144x135x34mm	255*275*92mm	300x300x155 without solar panel
Weight	300 g	2kg	09-11kg



Where to find Documents ?

WWW.SATEVIS-SYSTEMS.COM

Catalog of products:

<https://www.satevis-systems.com/files/Satevis-Wireless-IOT-Sensors-Products-Catalog-2024-Edition.pdf>

Products Webpage:

<https://www.satevis-systems.com/products.html>

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