SATEVIS

BEANAIR® SENSORS BRAND

α·INC

WIRELESS IOT BI-AXIS INCLINOMETER

QUICK START

USER GUIDE

MECHANICAL DRAWING

STEP FILE

ALPHA-INC SK30°

SCALABLE MEASURING RANGE (±30° AND ±55°)

DATASHEET

IOT

IP67

WWW.SATEVIS-SYSTEMS.COM

1 MAIN FEATURES

Bi-Axis Inclinometer Sensors for an easy installation with scalable range ±30° / ±55°

Ultra Long range :
- 8km-10km in L.O.S (Line of Sight)
- 500m-1Km in NLOS (Urban environment)

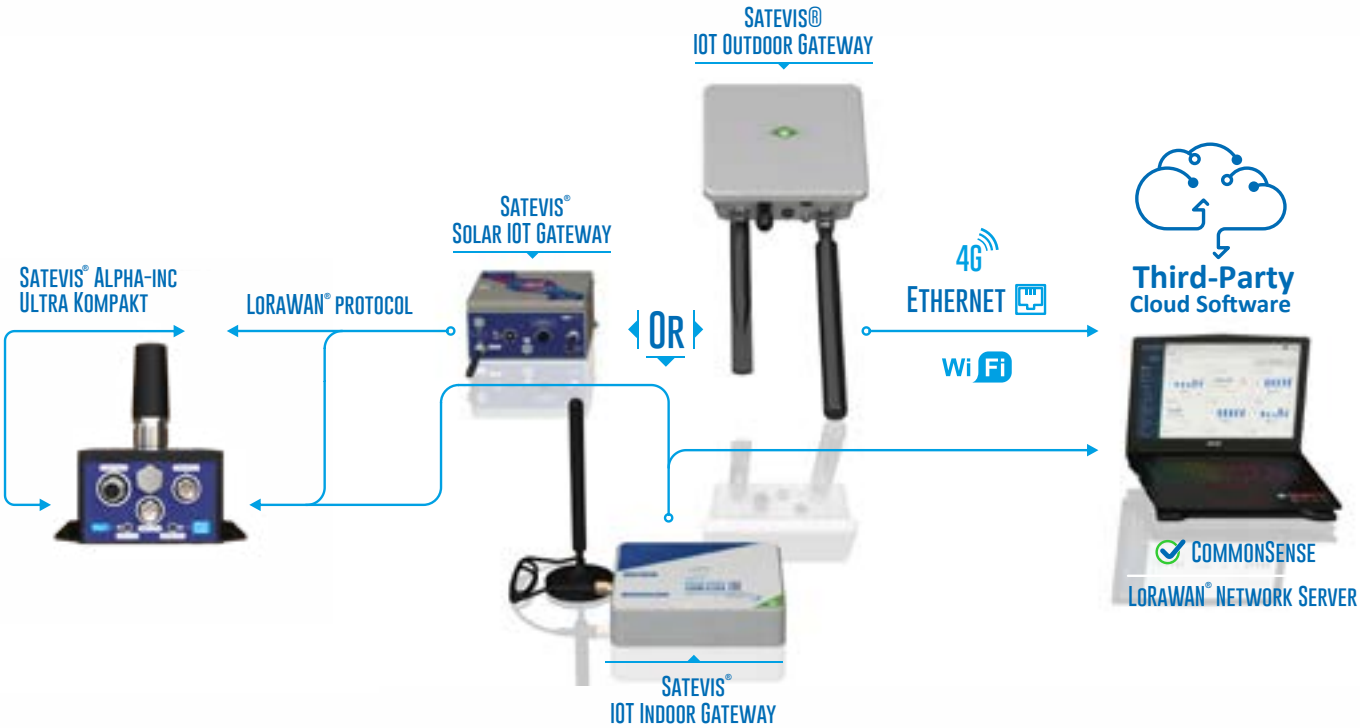
Sensor Precision/Repeatability (full scale, 25°C)
- ±0.00183° for ±30° range
- ±0.00366° for ±55° range

Rugged, Compact & Waterproof Aluminum casing

Open-standard LoraWan® Protocol with different Frequency Plan 868-923MHz

Lithium Primary Cell - D Size Cell 19Ah

2 HOW IT WORKS ?



3 APPLICATIONS

BRIDGE

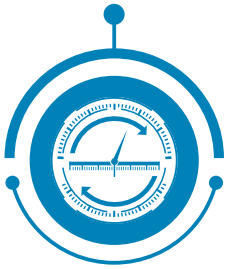
RAILWAY SLEEPERS

CRANE

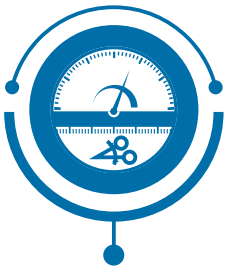
TUNNEL

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

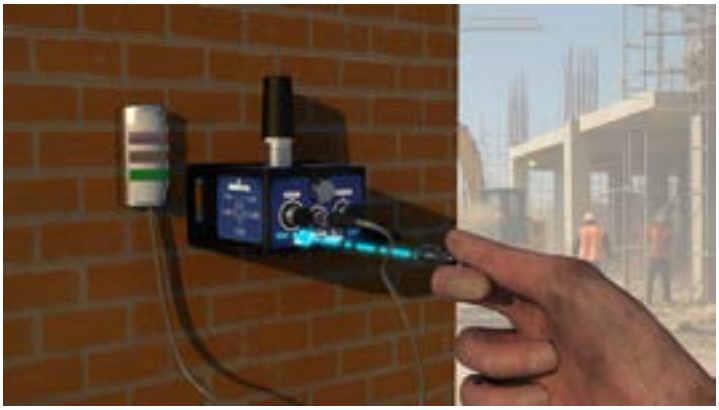
"HELLO!" FUNCTION HELPS THE FIELD OPERATOR TO CHECK THE SENSOR INSTALLATION & CONFIGURATION

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.



Caption 5-6: When your Satevis® Sensor , is integrated with external alarm systems, the Hello function lets you test the connection by sending a short pulse to the alarm output ensuring proper functionality without triggering an actual alarm.

4 EFFORTLESS SENSOR INSTALLATION WITH AUTOMATIC ZEROING

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 Lorawan® 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

SAT-LORA-ALPHA-INC-SK-30B-MR-AG-AO

MR– Measurement Range: 30B : Bi-axis ±30°/±55°	Alarm Output Dry Contact Alarm Output Leave it empty if this option is not requested

AG - Antenna Gain
2dBi-868: 2dBi Antenna for EU/IND Regions (Europe /India)
5dBi-868: 5dBi Antenna for EU/IND Regions (Europe /India)
2dBi-915: 2dBi Antenna for US/KR/AS/AU Regions (USA/KOREA/ASIA/AUSTRALIA)
5dBi-915: 5dBi Antenna for US/KR/AS/AU Regions (USA/KOREA/ASIA/AUSTRALIA)

Example 1: SAT-LORA-ALPHA-INC-SK-30B-2dBi-868, Bi-axis Wireless Inclinometer ±30°/±55° with LoraWan connectivity, 2dBi Antenna 868Mhz

Example 2: SAT-LORA-ALPHA-INC-SK-30B-5dBi-915, Bi-axis Wireless Inclinometer ±30°/±55° with LoraWan connectivity, 5dBi Antenna 915MHz

CONFIGURABLE SETTINGS FROM CLOUD SOFTWARE

Javascript formatter code	Free Javascript fromatter 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 Mesurement Range	±30° , ±55°

SATEVIS LINK SOFTWARE (FROM USB)

Configuration	Frequency Plan, AppEUI, AppKey
Sensor calibration	User Calibration

FIRMWARE UPGRADE (FROM USB)

Firmware Upgrade	Firmware upgrade through the USB with STCubeProgrammer (available on our FTP)

INCLINOMETER SENSOR

Inclinometer Technology	MEMS Technology
Scalable Measuring Range	user-seletctable range ±30° or ±55°, with automatic range adjustment depending on the application
Sensor resolution	0.00183° for ±30° range 0.00366° for ±55° range
Noise density	0.0009 °/√Hz
Sensor Precision/Repeatability (full scale, 25°C)	±0.00183° for ±30° range ±0.00366° for ±55° range
Sensor Accuracy (full scale, @ 25°C)	±0.005° for ±10° range ±0.01° for ±45° range ±0.02° outside ±45° range
Offset temperature dependency (temperature range –25°C to +85°C)	±0.002°/°C
Offset LifeTime Drift (@25°C)	±0.05 °
Sensor frequency Response (-3 dB)	DC to 10 Hz for ±30° measurement range DC to 40 Hz for ±55° measurement range
Calibration	Factory calibrated on 9 references point : 0° absolute, ±5° ,±10°, ±30° and ±45° 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	Non-Rechargeable Lithium Thionyl Chloride D Size Capacity 19h , Max Voltage 3.6 Volts
Current consumption @ 3,3V	· During data acquisition : 15 to 20 mA · During Radio transmission : 35 mA @14 dBm · During Battery Saver Mode : < 11 µA
External power supply	USB Power 5VDC. When the device is powered from USB, the internal battery is disconnected from the power path.

RF SPECIFICATIONS

LoraWan Stack	MACV1.0.2
Activation Mode	OTAA
LoraWan Frequency Plan	Frequency Plan can be configured from USB: - Europe 868MHz - USA: 915MHz - China 779MHz - Australia 915MHz - Asia 923MHZ - Korea 920MHz - India 865Mhz
TX Power	22dBm @868/915MHz
Receiver Sensitivity	-136.5dBm sensitivity for SF12 with 125KHz BW
Link Budget	158dB
Maximum Radio Range	- 15 Km in L.O.S. / Rural Environment - 2Km in NLOS/ Urban Environment"
Antenna	Waterproof N-Type Antenna, Gain 1.08 dBi (868 MHz)/1.15dBi (915MHz)/0.93dBi (920MHz), VSWR 1.64 (864~923MHz)

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 Hypeterminal Software, CSV format

ALARM OUTPUT (OPTIONAL)

Dry Contacts	3 x Dry contacts Output to trigger external Alarm system : Minor Alarm, Severe Alarm , Critical Alarm
Connector Type	M8-5 Pins Male socket

Integrated Temperature sensor

Temperature Range	-40°C to +75°C
Measurement resolution	±0.06°C
Sensor Precision	±1°C

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	Green: nework connection, data tranmsision Blue: Sensor zeroing successful Red: transmission failure

Environmental and Mechanical

Casing	Aluminum & Waterpoof casing Dimensions in mm (LxWxH): 111x64x51 mm (without antenna) Weight : 350g
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
Operating Temperature	-40°C to +75°C Sunshield should be used if the device is exposed to long-term sun radiation from +75°C
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

1x Lithium Primary Cella - D Size Cell 19Ah with battery remover strap
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)

OPTIONAL EXTERNAL SENSORS

Temperature and Humldity sensor	Ref: SAT-EXT-SENS-TH
Industrial Pressure sensor	Ref: SAT-EXT-SENS-PRESS

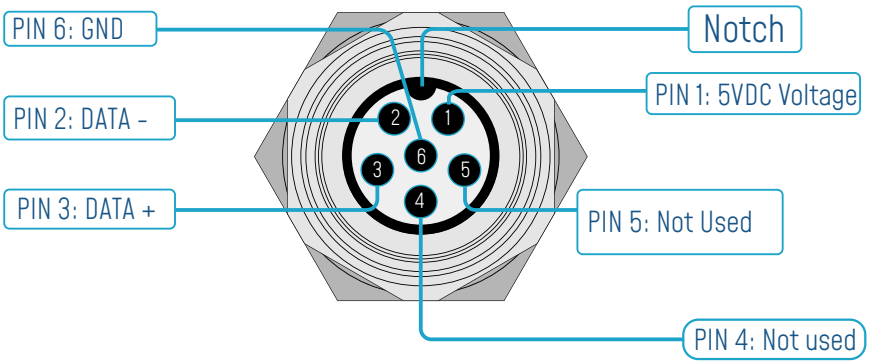
OPTIONAL ACCESSORIES AND SERVICES

Magnetic Mounting	Magnetic Mounting Kit Ref: SAT-MAG-SK-MNT
90° Bracket Mounting	990° Bracket mounting (with integrated eyelet) with 4 x M5 screws + Locknut Ref: SAT-BRACK-SK-MNT
Connector Shield	3D PRINTED PLA MATERIAL Connector shield - REF: SATEVIS-SK-SHIELD
Calibration certificate	Calibration certificate provided by Satevis A static calibration method is used on a granite surface plate DIN876 Ref: CERT-SATEVIS-INCLINOMETER

6 MOUNTING OPTIONS

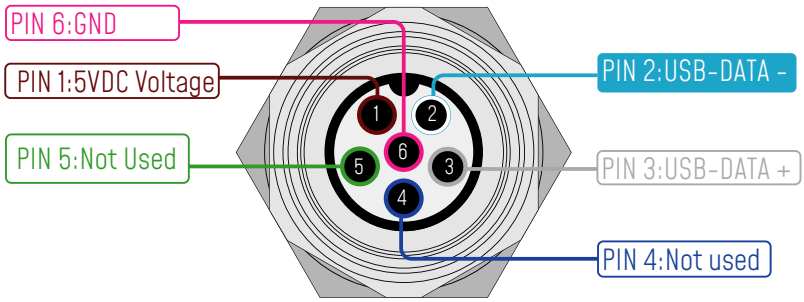
7 POWER SUPPLY

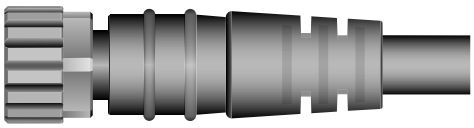
M8 6pin Socket- Pin assignation



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- Pin assignation



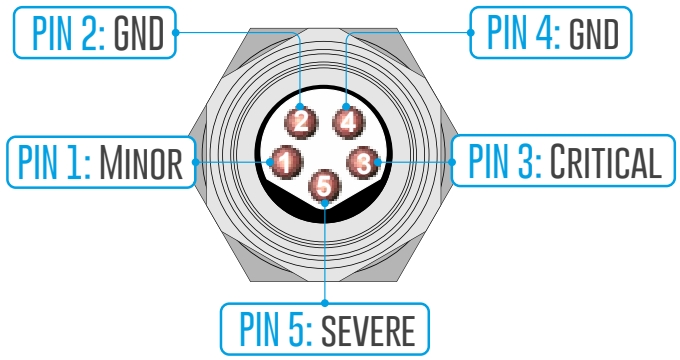


M8-6Pins Plug

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

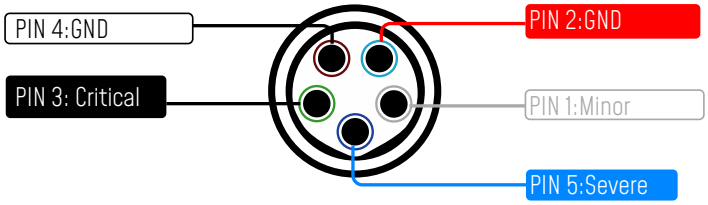
8 ALARM OUTPUT WIRING CODE

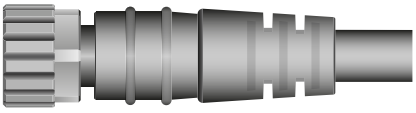
M8 5pin Socket (MALE, A-CODING)- Pin assignation



M8 Pin Assignation	Interface Name
PIN 1	Minor
PIN 2	GND
PIN3	Critical
PIN4	GND
PIN 5	Severe

M8 5pin PLUG (FEMALE, A-CODING)- Pin assignation

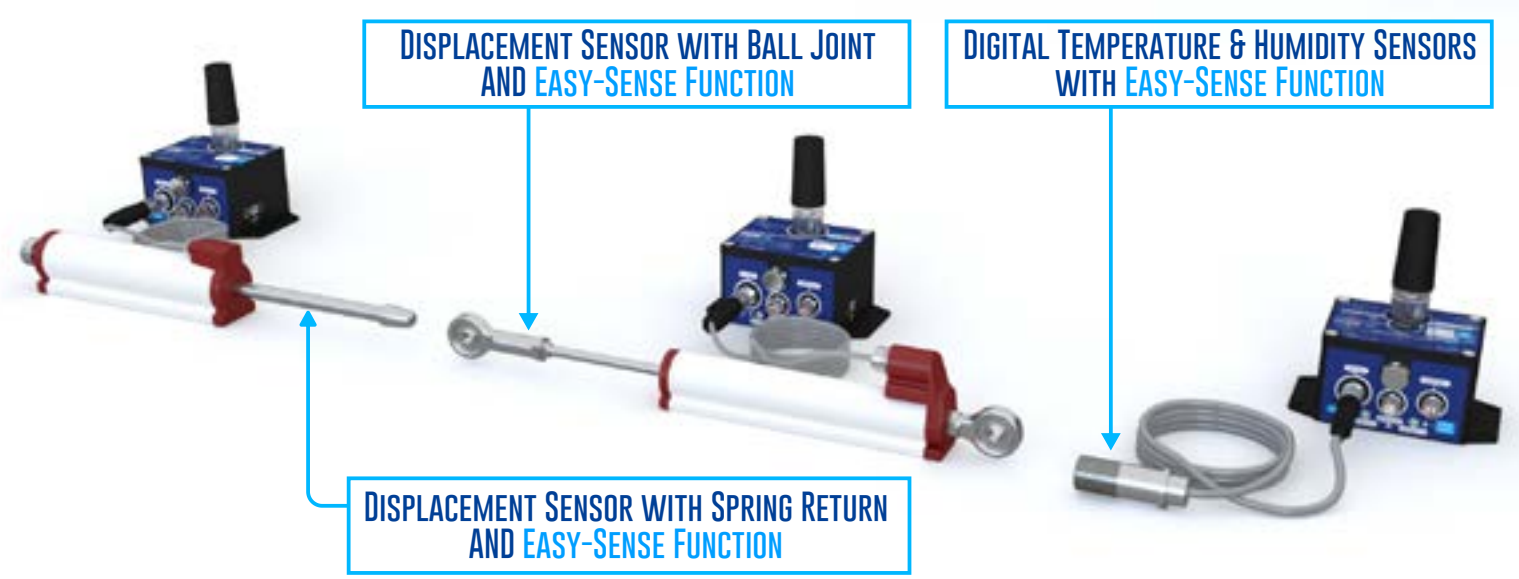




M8-5 Pins Plug

Interface Name	MINOR	GND	CRITICAL	GND	SEVERE
M8 Pin assignation	PIN 1	PIN 2	PIN 3	PIN 4	PIN 5
Wire Color (A-coding)	GREY	RED	BLACK	WHITE	BLUE

9 EASY SENSE



10 DIFFERENT ANTENNA VERSIONS

HIGH GAIN ANTENNA 5DBI

SMALL FORM FACTOR ANTENNA 2DBI

11 OVERVIEW