



LoRaWAN LWHD-WM410
Long-distance wireless inclinometer
Technical Manual



Introduction

LoRaWAN LWHD-WM410 long-distance wireless transmission inclinometer is designed for structural health monitoring (SHM). It can be used for up to 10 years (In condition of sending data every hour). Data can be uploaded through the LoRaWAN G500 gateway (optional accessory) connected to TTN or Chirpstack and APP server.

All modules are designed with ultra-low power consumption, the sleep current is lower than $4\mu\text{A}$, and have timed wake-up and motion detective wake-up functions. Working temperature is $-40\text{ }^{\circ}\text{C} \sim +85\text{ }^{\circ}\text{C}$.

Main Feature

- Accuracy: 0.01°
- LoRaWAN Wireless network, star network
- Battery life up to 10 years*
- 4PCS NdFeB strong magnetic screws (optional) Can be quickly installed on any iron surface to start work
- Resolution 0.001°
- Dual axis inclination measurement, range $\pm 90^{\circ}$
- More user-friendly design, more in line with actual deployment requirements on site

Functions

- Working frequency 868/915/923, etc MHz for optional
- Built-in ROM to automatically save time-stamped data in case of poor signal
- The built-in ROM can save up to 60,000 sets of data (20Bytes per set of data)
- Automatic sleep
- Small size, light weight, easy installation
- It can be connected to an Android phone through OTG USB Type-C, and using the APP for parameter configuration and data reading
- Temperature output
- Timed wakeup, Vibration wakeup

Note: * means under laboratory conditions

Application

- Dangerous housing monitoring
- Bridge tower inclination measurement
- Dam monitoring
- Slope disaster prevention
- Ancient building protection monitoring
- Tunnel monitoring
- Foundation pit monitoring
- Tower tilt monitoring

Product Feature



Mechanical Index

Connector	Aviation connector
Protection level	IP68 (1m underwater, 24h)
Shell material	Magnesium aluminum alloy anodizing
Installation	Four M6 screws



Performance Index

Measuring range(°)	0~±90	
Measuring axis	X-Y	
Accuracy(°)	At room temperature	0.01
Resolution(°)	Completely stationary	0.001
Zero temperature drift(°/°C)	-40°C ~ +85°C	±0.001
Cross-axis error(°)	At room temperature	0.008
Output frequency (Hz)	Up to 10 (Connect Android Phone or PC via cable), Up to 0.1 (via LoRaWAN)	
Auto-sleep mode	Support	
Timed Wake-up	Support	
Movement Detected Wake-up	Support	
Mean Time Between Failure	100,000 hours	
Electromagnetic compatibility	Accordance to GBT17626	
Insulation resistance	≥100 MΩ	
Impact-resistant	2000g, 0.5ms, 3Times/axis	
Size (mm)	L109*W88*H63mm (without antenna)	L109*W88*H131mm (with radome)
Weight (g)	550 (±10) (with two batteries)	

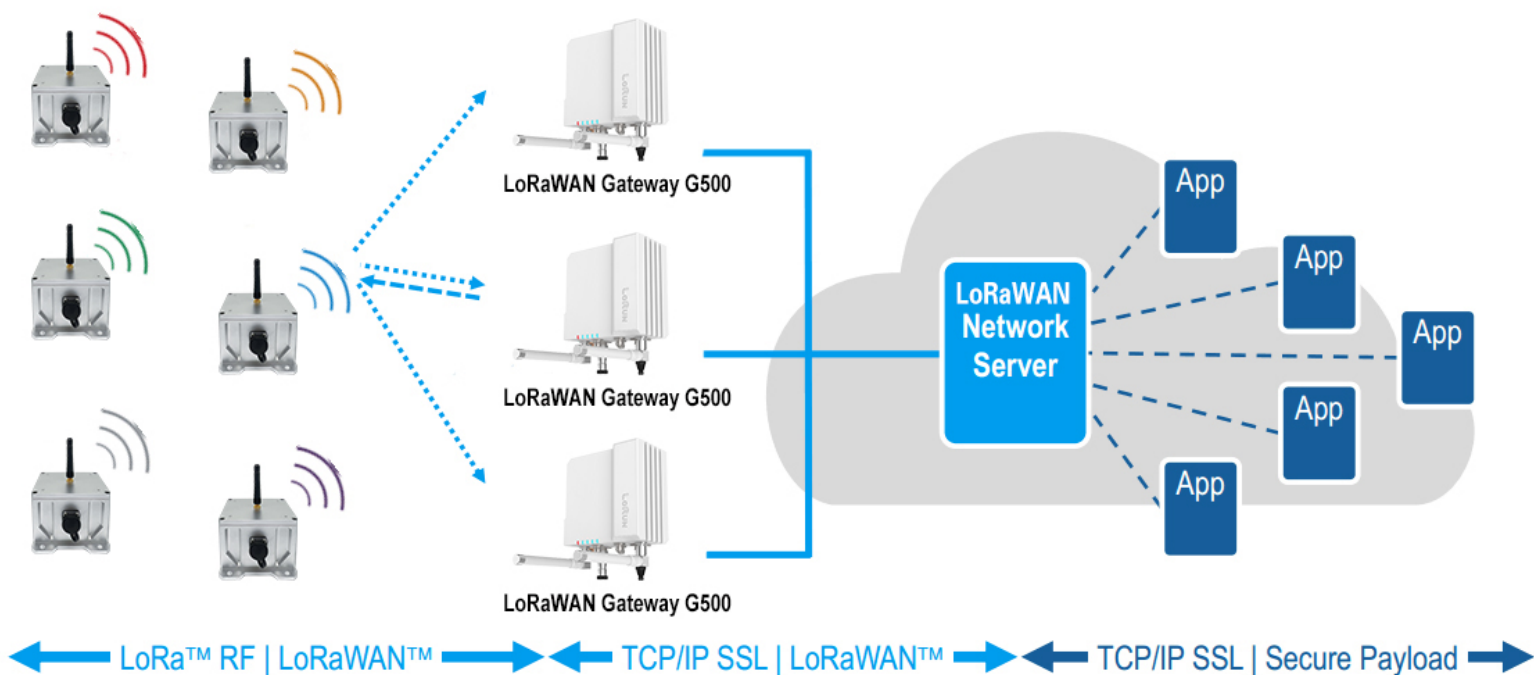
Resolution: The smallest change value of the measured value that the sensor can detect and distinguish within the measurement range.

Accuracy: The root mean square error of the actual angle and the sensor measuring angle for multiple (≥ 16 times) measurements.

Electrical Index

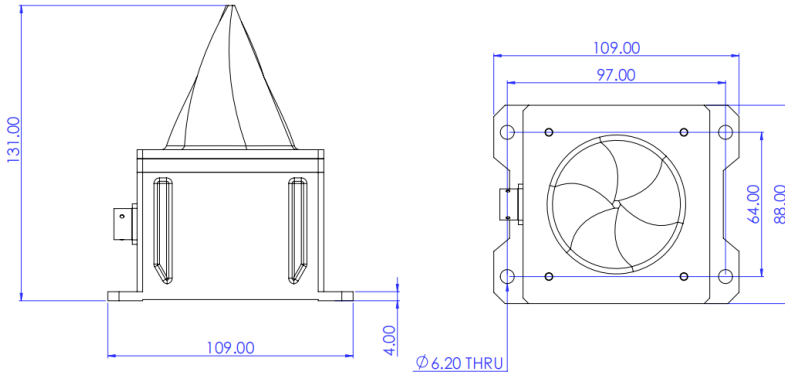
Power	Power voltage	3.6VDC~5VDC
	Working current	100mA (Peak)
	Stand-by current	4 μ A
	Battery capacity	3.6V 8500mAh*2 / 3.6V 7700mAh*2(Optional)
Communication distance	Maximum: 15Km	
Data frame	20Bytes or 36Bytes(extra included three-axis acceleration)	
Reliability	The mean time between failures (MTBF) is not less than 100,000 hours Ultra-low power consumption design, including automatic sleep mode, timing wake-up, sports wake-up	

Network topology

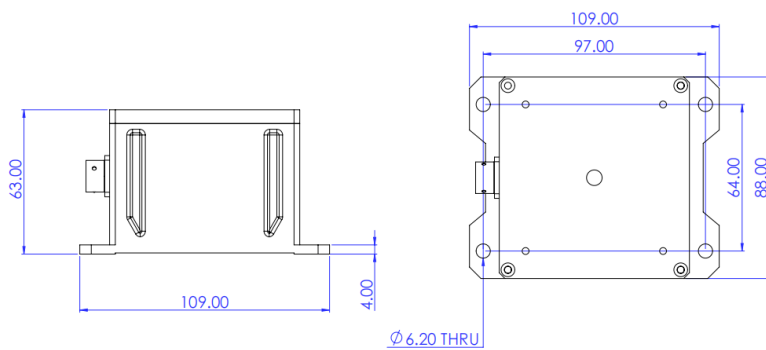


Package product size

Product size: L109*W88*H131mm (with radome)



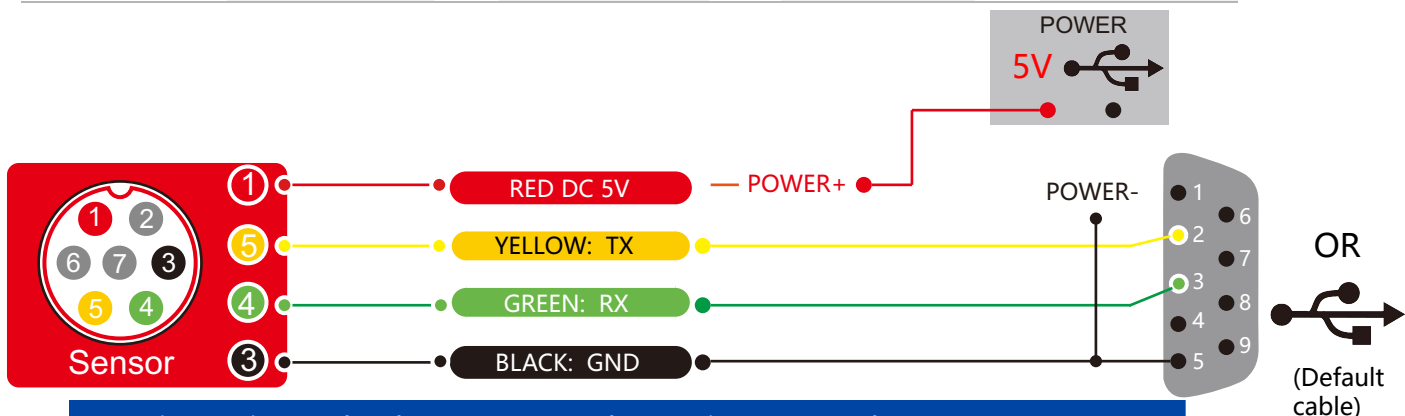
Product size: L109*W88*H63mm (without antenna)



Electrical Interface

Aviation plug wiring definition

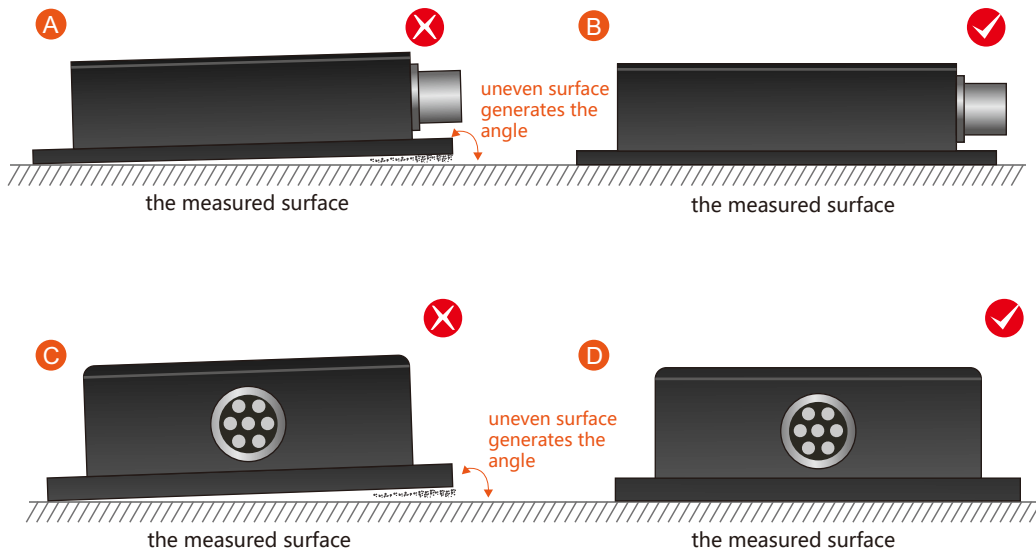
Wire color & function	RED	BLACK	GREEN	YELLOW
	1	3	4	5
	5VDC	GND ground	Receive RXD	Send TXD



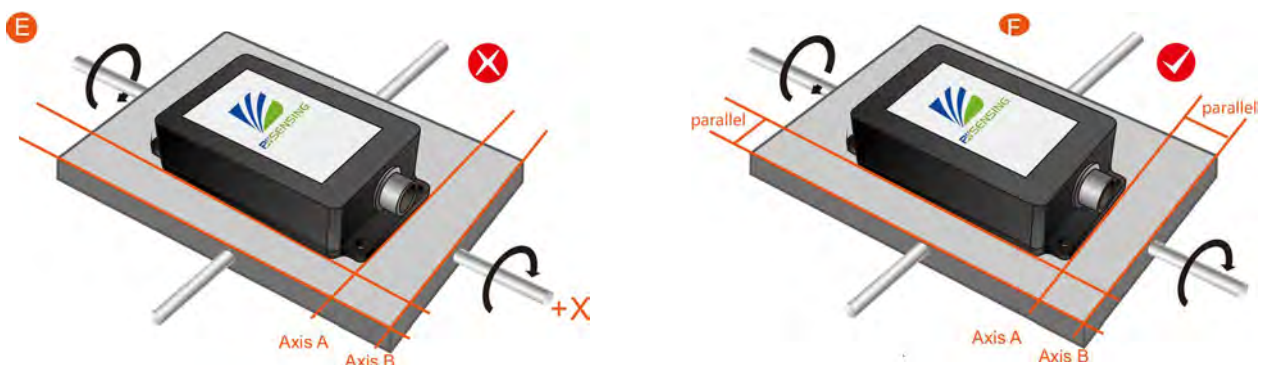
Installation

This series of products can only be installed vertically (pendulum type measurement), not horizontally. The correct installation method can avoid measurement errors. The following points should be done when installing the sensor:

First of all, make sure that the sensor mounting surface is completely close to the measured surface, and the measured surface should be as level as possible, and there should be no included angles as shown in Figure A and Figure C. The correct installation method is shown in Figure B and Figure D.



Secondly, the bottom line of the sensor and the axis of the measured object cannot have an angle as shown in Figure E, and the bottom line of the sensor should be kept parallel or orthogonal to the axis of rotation of the measured object during installation. This product can be installed horizontally or vertically (vertical installation needs to be customized), and the correct installation method is shown in Figure F.



Finally, the mounting surface of the sensor and the surface to be measured must be tightly fixed, smooth in contact, and stable in rotation, and measurement errors due to acceleration and vibration must be avoided.

Packing list



LWHD-WM400 *1PC



EVE ER26500 *2PCS



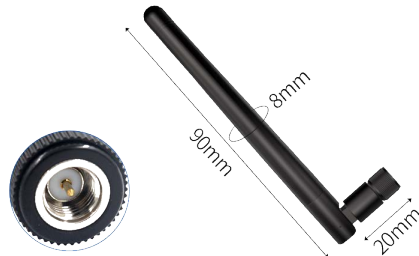
SAFT ER26500 *2PCS
(Optional)



3D printed radome *1PC
(Optional)



5cm 2dBi antenna *1PC Two types of antennas can be chosen to meet the needs of frequency band switching (848-888MHz) or (895-935MHz)



9cm 2.5dBi antenna *1PC(Optional)
Two types of antennas can be chosen to meet the needs of frequency band switching (848-888MHz) or (895-935MHz)



Aviation plug-USB Power&Data 2in1 cable *1PC



NdFeB strong magnetic screws *4PCS
(Optional)



OTG USB Type-A to Type-C *1PC

Executive standard

- Enterprise Quality System Standard: ISO9001:2015 Standard (Certificate No.064-21-Q-3290-RO-S)
- CE certification (certificate number: M.2019.103. U Y1151)
- ROHS (certificate Number: G 190930099)
- GB/T 191 SJ 20873-2003 General specification for inclinometer and level
- GBT 18459-2001 The calculation method of the main static performance index of the sensor
- JJF 1059.1-2012 Evaluation and expression of measurement uncertainty
- GBT 14412-2005 Mechanical vibration and shock Mechanical installation of accelerometer
- GJB 450A-2004 General requirements for equipment reliability
- GJB 909A Quality control of key parts and important parts
- GJB899 Reliability appraisal and acceptance test
- GJB150-3A High temperature test
- GJB150-4A Low temperature test
- GJB150-8A Rain test
- GJB150-12A Sand and dust experiment
- GJB150-16A Vibration test
- GJB150-18A Impact test
- GJB150-23A Tilt and rock test
- GB/T 17626-3A Radio frequency electromagnetic field radiation immunity test
- GB/T 17626-5A Surge (impact) immunity test
- GB/T 17626-8A Power frequency magnetic field immunity test
- GB/T 17626-11A Immunity to voltage dips, short-term interruptions and voltage changes
- GB/T 2423.22-2012 Environmental Test Part 2: Test Method Test N: Temperature Change (IEC 60068-2-14:2009, IDT)
- GB/T 10125-2012 Artificial atmosphere corrosion test Salt spray test (ISO 9227:2006, IDT)

LoRaWAN Series

Long-distance wireless
transmission inclinometer

Wuxi Bewis Sensing Technology LLC

Add: Building 30, NO. 58, Xiuxi Road, Binhu District,

Wuxi City, Jiangsu Province, China

Tel: +86 18921292620

Mail: sales@bwsensing.com

Web: www.bwsensing.com