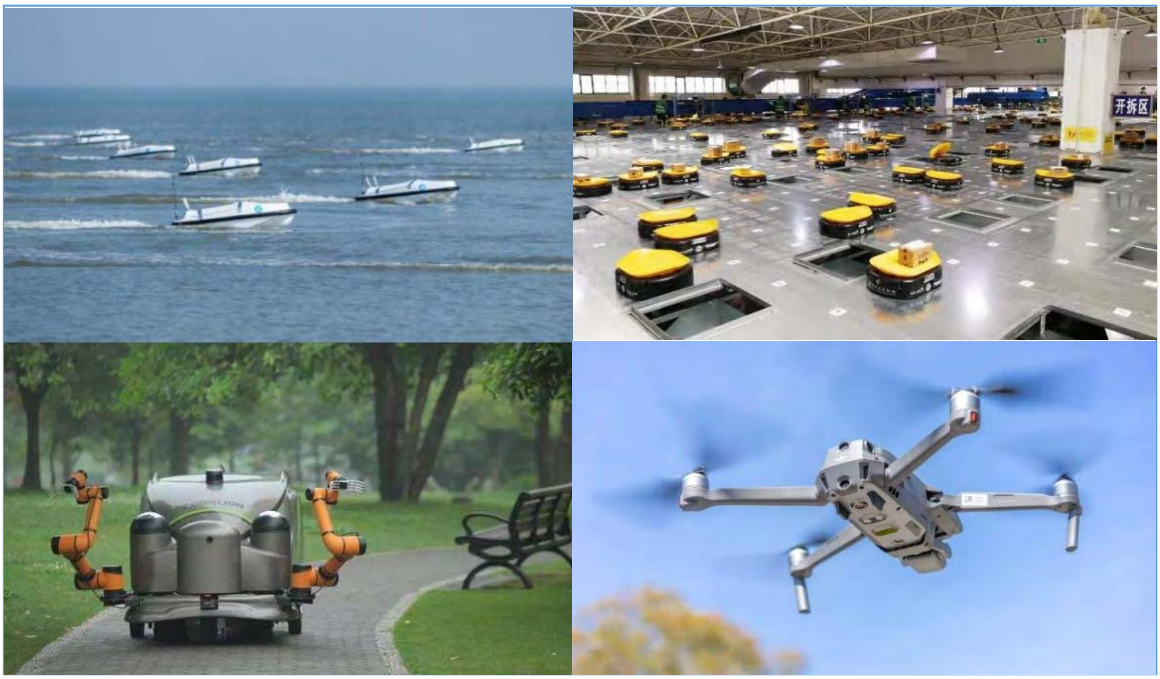
BW-AH325 Series

Low-cost CAN Bus
Attitude and heading reference

Technical Manual

V3.0

BW-AH325
Low-cost CAN Bus attitude and heading reference system



Introduction

BW-AH325 is a low-cost Attitude and heading reference system independently developed and produced by Bewis Sensing. Built-in a cost-effective accelerometer, gyroscope and magnetometer, it provides reliable heading and roll angles for the moving carrier through a multi-sensor fusion algorithm, pitch angle, angular velocity, acceleration and other information. The attitude data deviation is estimated by the 6-state Kalman filter with appropriate gain, which is suitable for the navigation, positioning and dynamic attitude measurement of unmanned vehicles. BW-AH325 uses high-quality and reliable MEMS devices, and uses temperature compensation and zero-drift correction algorithms to ensure measurement accuracy. At the same time, the sealing design and strict production process ensure that the product can still work reliably in harsh environments. BW-AH325 has a digital interface and can be easily integrated into the user's system. This product is widely used in assisted driving, unmanned vehicles, unmanned aerial vehicles, robots, and underwater equipment.

Feature

- Heading accuracy：0.8°
- Dynamic static measurement
- Small size： L60 x W59 x H29 （mm）
- CAN Bus output optional
- Wide temperature ： -40 ℃ ~ +85 ℃ ， Temperature compensation
- Inclination accuracy：0.3°

Application

- Satellite tracking
- Unmanned car
- Stable platform
- ROV underwater robot navigation
- Drilling equipment measurement and control
- Ocean Surveyor
- Robot control
- Unmanned aircrafts

Electrical index

Power supply	9-36V DC
Working current	30mA （40mA max)
Operating temperature	-40~85℃
Storage temperature	-55~100℃

Performance index

Attitude parameter	Pitch, Roll accuracy	0.3°
	Heading accuracy	0.5°
	Inclination range	Pitch±90°，Roll±180°
Gyro	Resolution	0.01°/sec
	Range	±400°/sec
	Bias stability in full temperature	15°/h（10s,1σ)
	ARW	< 0.1 °/√h
	Scale factor non-linearity	≤100ppm（1σ)
	Scale factor repeatability	≤100ppm（1σ)
	Bandwidth	100Hz
Accelerometer	Range: X, Y, Z	±3.6 g
	Bias stability	0.001mg（25℃，100s，1σ) 0.01mg（25℃，10s，1σ)
Interface characteristics	Communication mode	CAN
	Maximum output frequency	100Hz
MTBF	≥90000 h/time	
EMC	According to GBT17626	
Insulation resistance	≥100 MΩ	
Impact resistance	2000g，0.5ms，3 times/axis	
Weight（with cable)	280g	

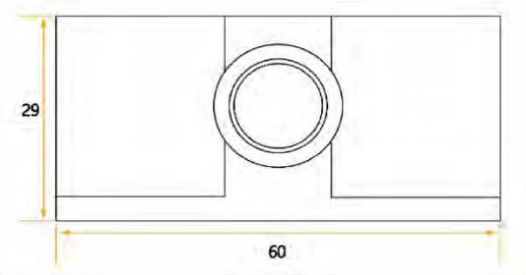
Resolution: The smallest change value of the measured value that the sensor can detect and distinguish within the measurement range.
Accuracy: The root mean square error of the actual angle and the sensor measuring angle for multiple (≥16 times) measurements.

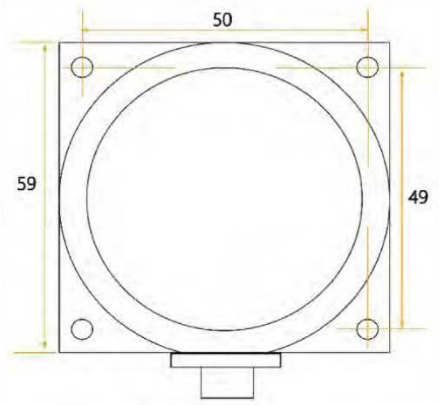
Mechanical properties

Connector	Metal joint（cable 1.5m)
Protection level	IP67
Shell material	Magnesium aluminum alloy anodizing
Installation	Four M4 screws

Product package size

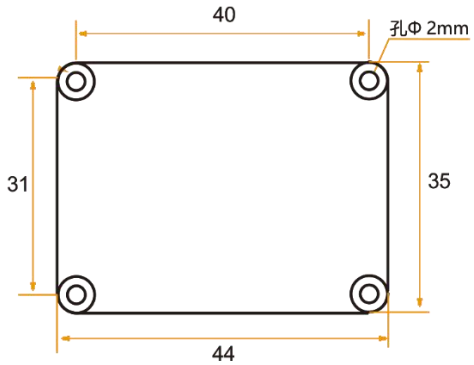
Product size：L60*W59*H29（mm）





PCBA size

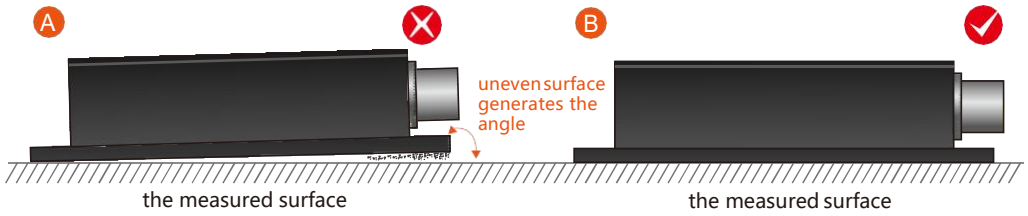
Product size：L44*W35*H11（mm） The length and width may have an error of ±1mm, please refer to the actual product

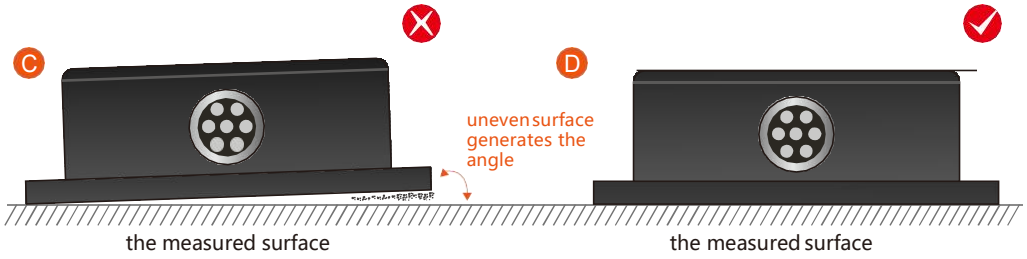


Installation

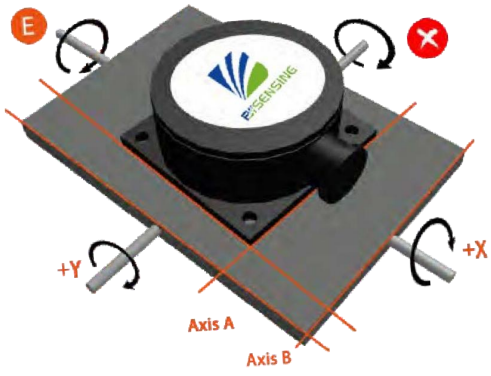
The correct installation method can avoid measurement errors. When installing the sensor, please do the following:

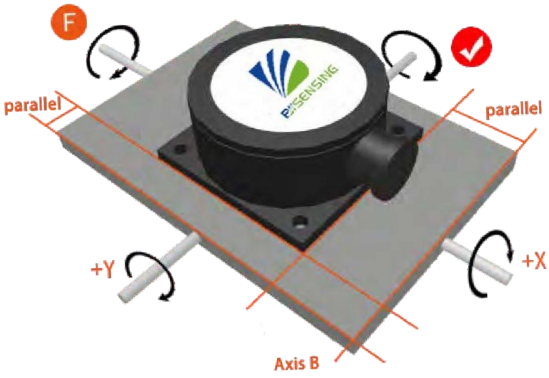
First of all, make sure that the sensor mounting surface is completely close to the measured surface, and the measured surface should be as level as possible. There should be no included angles as shown in Figure A and Figure C. The correct installation method is shown in Figure B and Figure D.





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.

Measurement installation

Although the AH325 can compensate for magnetic interference, users should choose an environment with the least magnetic interference to install and use. As far as possible, choose to place AH325 away from iron, nickel, magnets, motors and other magnetic materials.

Be sure to strictly avoid strong magnetic materials such as magnets and motors from approaching the product, which may cause irreversible degradation of the product's measurement accuracy.

Each AH325 provides a 1.5-meter cable, and the length of the cable is optional. The magnetic field environment of each installation location is different, and the user must evaluate the feasibility of installation in this operating environment.

The test method we recommend is to install the AH325 on a vertically erected aluminum (or other non-magnetic material) pole to measure the heading accuracy (the rotating pole is perpendicular to the rotating platform, and try to avoid large external magnetic field interference).

Calibration

The product has been calibrated in the factory. In places where the magnetic field environment has little influence, there is no need to perform environmental calibration during use, and it can be used directly. In actual use, it is recommended to calibrate.

Azimuth calibration steps:

Method 1——Plane calibration

1. Connect the product to the system and place the product in a horizontal state;
2. Open the serial port debugging assistant, send 77 04 00 11 15, and return to 77 05 00 91 00 96 to start plane calibration;
3. Rotate the product in the horizontal plane (both pitch and roll angles are within ±5°) around the z-axis (z-axis is the vertical direction), and rotate 2-3 times. The rotation process should be as slow and close as possible Rotate at a constant speed, and the time for one revolution is controlled between 10 seconds and 15 seconds;
4. Rotate the compass around the X-axis or Y-axis. The rotation process can be slow and nearly uniform. It rotates 2-3 times around each axis, and the time for one rotation is about 15 seconds;
5. After completing the calibration, send 77 04 00 12 16 to save the calibration, and return to 77 05 00 92 XX SUM (the data field is meaningless), the calibration is successful.

Method 2-multi-faceted calibration

1. Fix the product in the use environment, and try not to carry magnetic objects such as keys and mobile phones during calibration;
2. Place the product in a horizontal state (within ±5°);
3. Send the following calibration command in hexadecimal format: 77 04 00 08 0C, the return value is 77 05 00 88 00 8D;
4. The product is placed in a horizontal state, the front is facing upwards (both pitch and roll are within ±5°), the myopia rotates one circle at a constant speed, and it takes more than 10 seconds to rotate one circle;
5. The product is placed in a horizontal state, the installation surface is facing upwards (the pitch is within 0±5 degrees, the roll is within 180±5 degrees), the myopia rotates one circle at a constant speed, and it takes more than 10 seconds to rotate one circle;

6. The product is placed in a vertical state, with the smooth side of the shell facing down (pitch within 0±5 degrees, roll within 90±5 degrees), and the myopia rotates one circle at a constant speed, and it takes more than 10 seconds to rotate one circle;

7. The product is placed in a vertical state with the other smooth side of the shell facing downwards (pitch within 0±5 degrees, roll within -90±5 degrees), and the myopia rotates one circle at a constant speed, and it takes more than 10 seconds to rotate one circle;

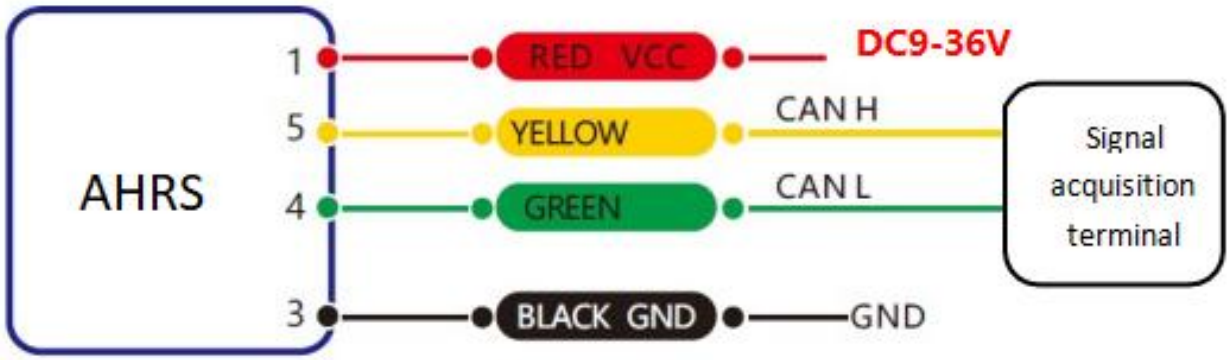
Among them, step 4.5.6.7 can be exchanged;

8. After the four faces are rotated, send the hexadecimal command 77 04 00 09 0D to save the calibration and return to 77 05 00 89 XX YY. Where XX represents the calibration error coefficient, the smaller the value is, the better, less than 10 is ideal, FF represents the calibration failure, YY is the checksum of the command;

9. The calibration is complete.

Electrical interface

Wiring definition					
Wire color	RED	BLUE	BLACK	GREEN	YELLOW
	1	2	3	4	5
function	VCC DC 9-35V	NC	GND	CAN L	CAN H



CAN Bus Wiring Diagram

Order information

Product model	Communication mode	Package situation
BW-AH325-CAN	CAN	IP67 package/ metal joint

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

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