



BW-MINS610 Series

**High-precision
micro-inertial navigation system**

Technical Manual

V3.0



Introduction

BW-MINS610 is an ultra-high-precision micro-mechanical electromechanical inertial navigation system developed and produced by Bewis. Without relying on external signal input, it can automatically calculate the azimuth and horizontal angle of the measured carrier through acceleration and angular velocity information. Roll angle, pitch angle, angular velocity, acceleration, Euler angle, quaternion information, suitable for inertial attitude measurement under various states of motion, vibration or static.

BW-MINS610 uses highly reliable MEMS accelerometers and gyroscopes. The attitude information data deviation is estimated by the 6-state Kalman filter with appropriate gain, and the measurement accuracy is ensured by the algorithm. The attitude motion parameters are nonlinearly compensated and orthogonal. Compensation, temperature compensation and drift compensation, etc. can greatly eliminate errors and improve product accuracy. This product has a digital interface, which can be easily integrated into the system.

Feature

- Dynamic accuracy: 0.05°
- Static accuracy: 0.03°
- Special offset tracking algorithm eliminates drift
- RS422 Interface output
- Wide temperature range : -40 °C ~ +85 °C, Temperature compensation
- Small dimension : L44.8 * W38.6 * H21.5 (mm)

Application

- Unmanned boats and underwater vehicles
- Robots
- Stable platform
- Large ship
- AGV
- Special vehicles
- Unmanned aerial vehicle

Product Features



Performance Index

Attitude	Dynamic accuracy ⁽¹⁾	0.05°		
	Static accuracy	0.03°		
	Measurement range	Pitch ± 90°, Roll ± 180°		
	Accuracy of azimuth motion ⁽²⁾	0.2°/ 60s		
	Cross-coupling	<0.02%		
	Linearity	<0.05%		
Gyro	Resolution	0.00006°/s		
	Range	±500°/s		
	Natural temperature stability (10S smooth)	<1 °/h		
	Normal temperature bias repeatability	<0.5 °/h		
	Angle Random Walk (ARW) at Room Temp	0.05°/ √h		
	Full-temperature Zero-g Offset (Uncompensated)	10°/h		
	Full-temperature Zero-g Offset (Temperature Compensated)	<1 °/h		
	Scale factor nonlinearity	< 150ppm		
	Bandwidth	200Hz		
Accelerometer	Range	±20g	±5g	±50g
	Resolution	25ug	12.5ug	100ug
	Zero-g Offset Stability at Room Temp (10s Smoothing)	15ug	8ug	50ug
	Zero-g Offset Stability at Room Temp (ALLAN)	5ug	2ug	10ug
	Zero-g Offset Repeatability at Room Temp	10ug	5ug	20ug
	Bandwidth	150Hz	150Hz	150Hz
	Scale Factor Nonlinearity	1500ppm	1500ppm	3000ppm
	Noise Density	25 μg/√Hz	12.5μg/√Hz	100μg/√Hz
Maximum output	500Hz			
Start-up delay	200ms			

- (1) Turntable test, single-axis swing, the experimental parameters are 2 degrees 1Hz, 3 degrees 0.5Hz, 5 degrees 0.3Hz, 5 degrees 0.5Hz. The errors are kept within ± 0.05 degrees;
- (2) Turntable test, rotate 60S at a certain rate; the error between the azimuth angle and the turntable angle is less than 0.1 degree.



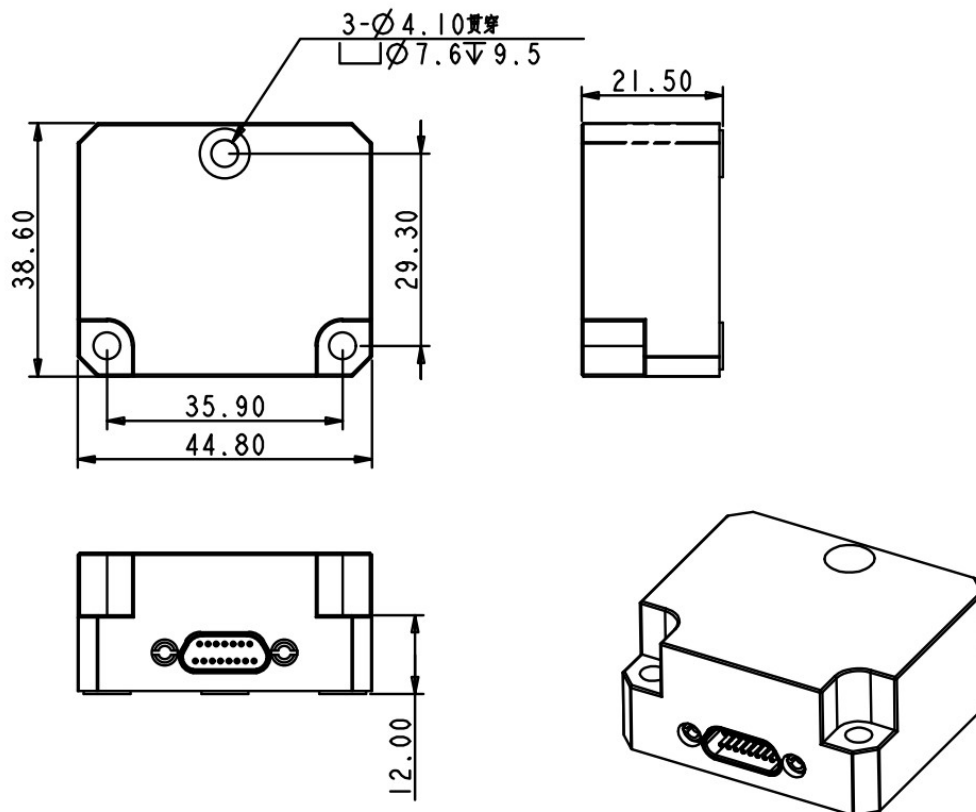
Mechanical properties

Connector	J30J-15TJL (30cm)
Protection Level	IP65
Shell material	Magnesium aluminum alloy oxidation
Installation	Three M4 screws



Package product size

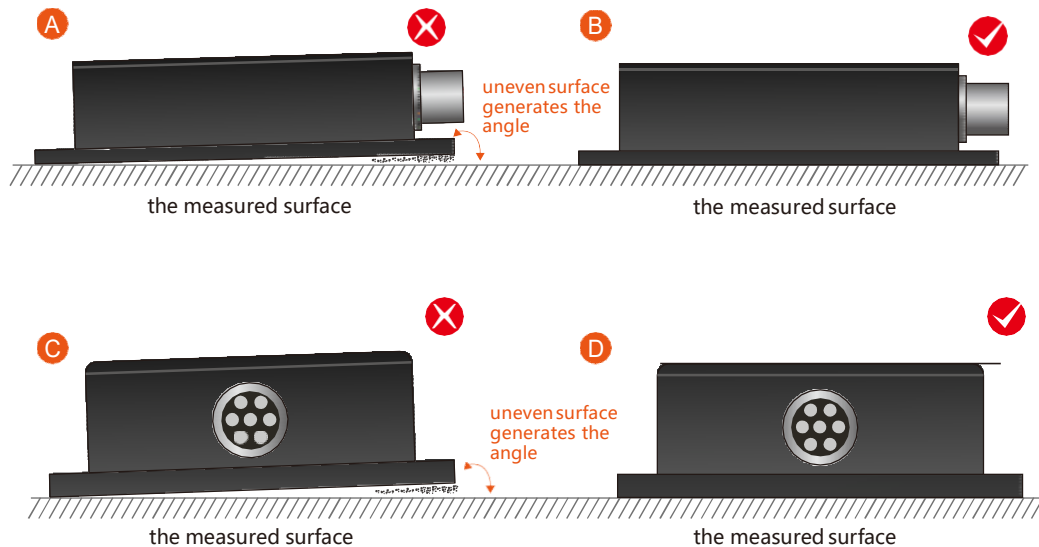
Product Size: L44.8 * W38.6 * H21.5 (mm)



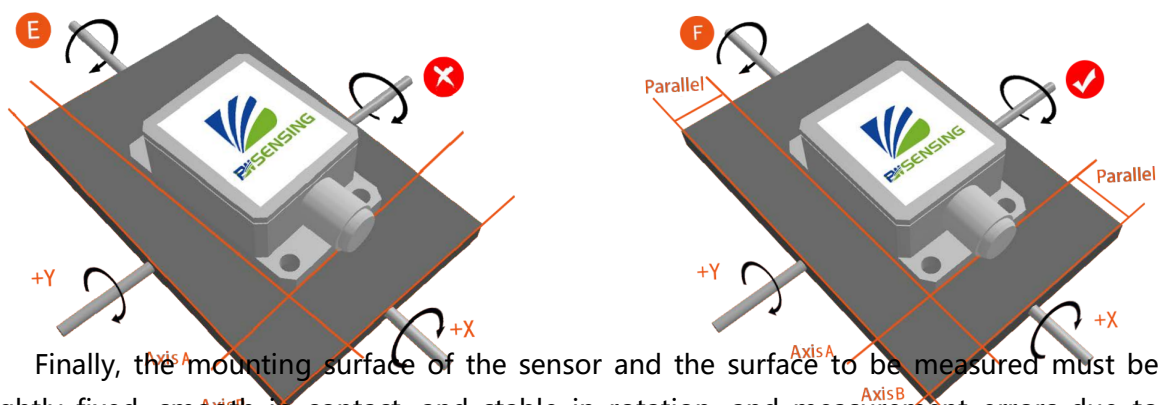
Installation

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.

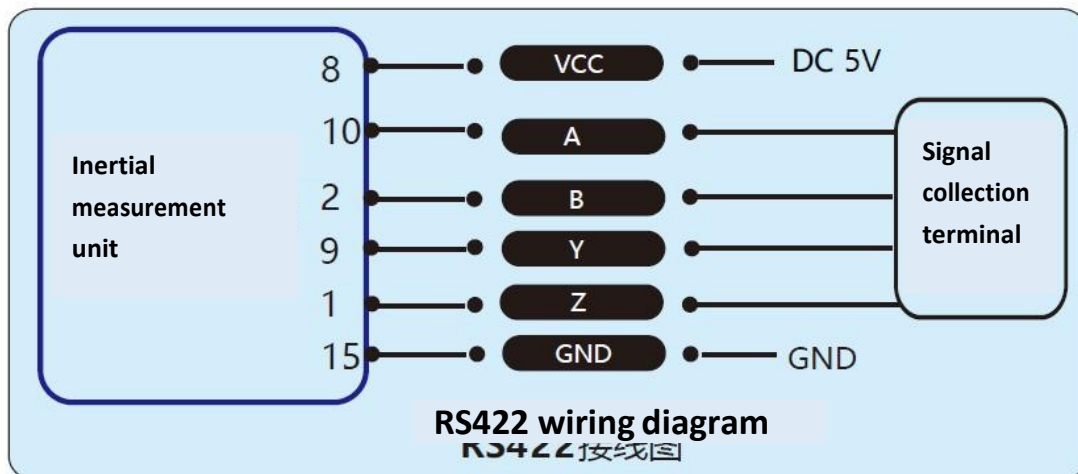


Finally, the mounting surface of the sensor and the surface to be measured must be tightly fixed, smooth in contact, and stable in rotation, and measurement errors due to acceleration and vibration must be avoided.

Electrical Interface

Wiring definition

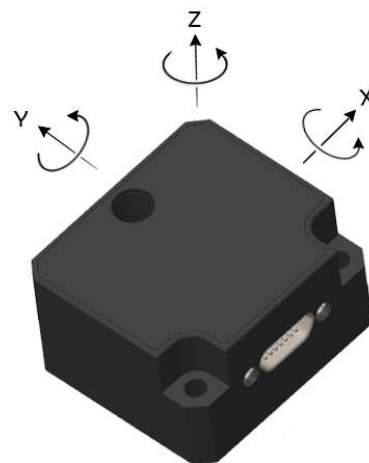
Line color	8	15	2	10	1	9
function	VCC DC 5V	GND	Receive RXD- (B)	Receive RXD+ (A)	Send T/R- (Z)	Send T/R+ (Y)



Axial definition

Three-axis attitude, gyroscope, acceleration data axis

All comply with the right-hand rule.



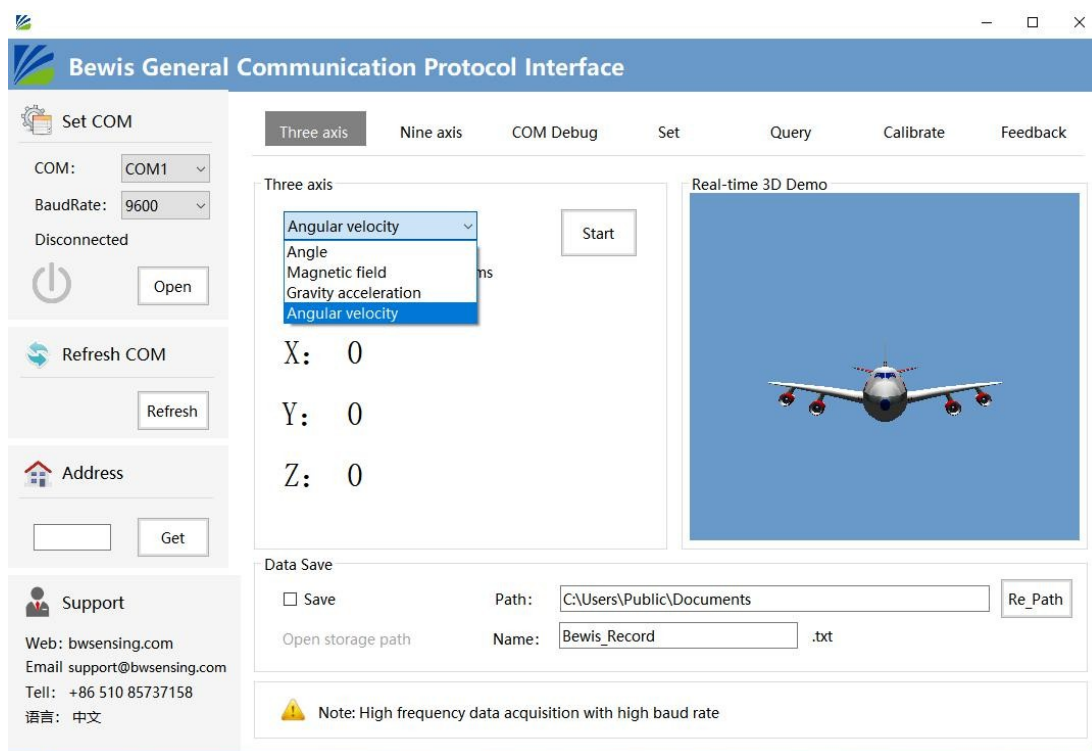
Testing software

Users can directly download the serial debugging assistant from the official website (Technical Services -> Download Area). Alternatively, a more convenient and intuitive host computer software is also available.

The dedicated serial debugging software for BW-MINS610 allows users to connect the inclinometer to a PC for real-time angle display. The software debugging interface is shown in the figure below. Using this host software, users can conveniently display the current tilt angles in both the X and Y directions, as well as modify and configure other parameters.

Step:

- ① Connect the serial port hardware of the inclinometer correctly, and connect the power supply.
- ② Select computer serial port and baud rate and click connect serial port.
- ③ Click the start button and the current inclination Angle of the incliner in X and Y directions will be displayed on the screen.



Order information

Model	Communication mode	Package situation
BW-MINS610-422	RS422	IP65/Metal interface

Executive standard

- National Standard for Static Calibration Specification of Dual-axis Inclinationmeters (Draft)
- GB/T 191 SJ 20873-2003 General Specifications for Inclinationmeters and Horizonmeters

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