

AHRS IMU Sensor | BS-IWH9053-485

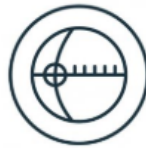
The Robust Acceleration, Angular velocity, Angle & Magnetic field Detector

BS-IWH9053-485 integrates high-precision gyroscope, accelerometer, MMC3630 magnetic field sensor, and uses high-performance microprocessor. And advanced dynamics calculation and Kalman dynamic filter algorithm, can quickly solve the module's current real-time motion pose state.

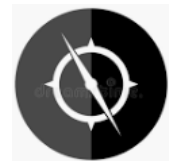
BUILT-IN SENSORS



Accelerometer



Gyroscope



Magnetometer

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1 Overview

- The use of advanced digital filtering technology can effectively reduce measurement noise and improve measurement accuracy.
- The module integrates an attitude solver, with the dynamic Kalman filter algorithm, can accurately output the current attitude of the module in a dynamic environment, the attitude measurement accuracy is 0.001° (BS-IWH9052 is 0.01°), the stability is extremely high, and the performance is even better than a certain Some professional inclinometers!
- The module has its own voltage stabilization circuit, and the working voltage is 5V~36V.
- Support 485 interface. It is convenient for users to choose the best connection method. The serial port rate is adjustable from 4800bps to 921600bps.
- 4-layer PCB board technology, thinner, smaller and more reliable.

2 Features

- The default baud rate of this device is 9600 and could be changed.
- The interface of this product only leads to a serial port
- The module consists of a high precision gyroscope, accelerometer, geomagnetic field and barometer sensor. The product can solve the current real-time motion posture of the module quickly by using the high-performance microprocessor, advanced dynamic solutions and Kalman filter algorithm.
- The advanced digital filtering technology of this product can effectively reduce the measurement noise and improve the measurement accuracy.

3 Parameter index

3.1 Accelerometer parameters

Parameter	Condition	Typical value
Range		$\pm 2g$
Resolution	$\pm 2g$	0.0000039(g/LSB)
Static zero drift	Placed horizontally	$\pm 25 \text{ mg}$
Temperature drift	$-40^{\circ}\text{C} \sim +125^{\circ}\text{C}$	$\pm 0.1\text{mg}/^{\circ}\text{C}$
Bandwidth		5~256Hz

3.2 Gyroscope parameters

Parameter	Condition	Typical value
Range		$\pm 2000^{\circ}/s$
Resolution		0.061($^{\circ}/s$)/(LSB)
RMS noise	Bandwidth = 100Hz	0.028~0.07($^{\circ}/s$)-rms
Static zero drift	Placed horizontally	$\pm 0.5 \sim 1^{\circ}/s$
Temperature drift	$-40^{\circ}\text{C} \sim +85^{\circ}\text{C}$	$\pm 0.005 \sim 0.015$ $(^{\circ}/s)/^{\circ}\text{C}$
Bandwidth		5~256Hz

3.3 Magnetometer parameters

Parameters	Condition	Typical value
Measuring range	Loop count value (200)	-800uT to +800 uT
Linearity $\pm 200\mu\text{T}$	Loop count value (200)	0.6%
Resolution	Loop count value (200)	13nT/LSB

3.4 Pitch and roll angle parameters

Parameter	Condition	Typical value
Range		X: $\pm 180^\circ$
		Y: $\pm 90^\circ$
Inclination accuracy		0.001°
Resolution	Placed horizontally	0.001°
Temperature drift	-40°C ~ +85°C	$\pm 0.15^\circ$

3.5 Heading angle parameter

Parameter	Condition	Typical value
Range		Z:±180°
Heading accuracy	9-axis algorithm, magnetic field calibration, dynamic/static	1° (without magnetic field interference) 【1】
	6-axis algorithm, static	0.5° (Dynamic integral cumulative error exists) 【2】
Resolution	Placed horizontally	0.0055°

Note:

【1】 Please perform magnetic field calibration in the test environment before use to ensure that the sensor is familiar with the magnetic field in this environment. When calibrating, please keep away from magnetic interference

【2】 In some vibration environments, there will be cumulative errors, and the specific errors cannot be estimated. The actual test shall prevail.

3.6 Module parameters

Basic parameters

Parameter	Condition	Minimum	Default	Maximum
Communication Interface	UART	4800bps	9600bps	230400bps
	CAN	3K	250K	1M
Output content		On-chip time, 3-axis acceleration, 3-axis angular velocity, 3-axis magnetic field, 3-axis angle, quaternion		
Output rate【1】		0.1Hz	10Hz	200Hz
Start Time				1000ms
Operating temperature		-40℃		85℃
Storage temperature		-40℃		100℃
Shock proof				20000g
Degree of protection				IP67

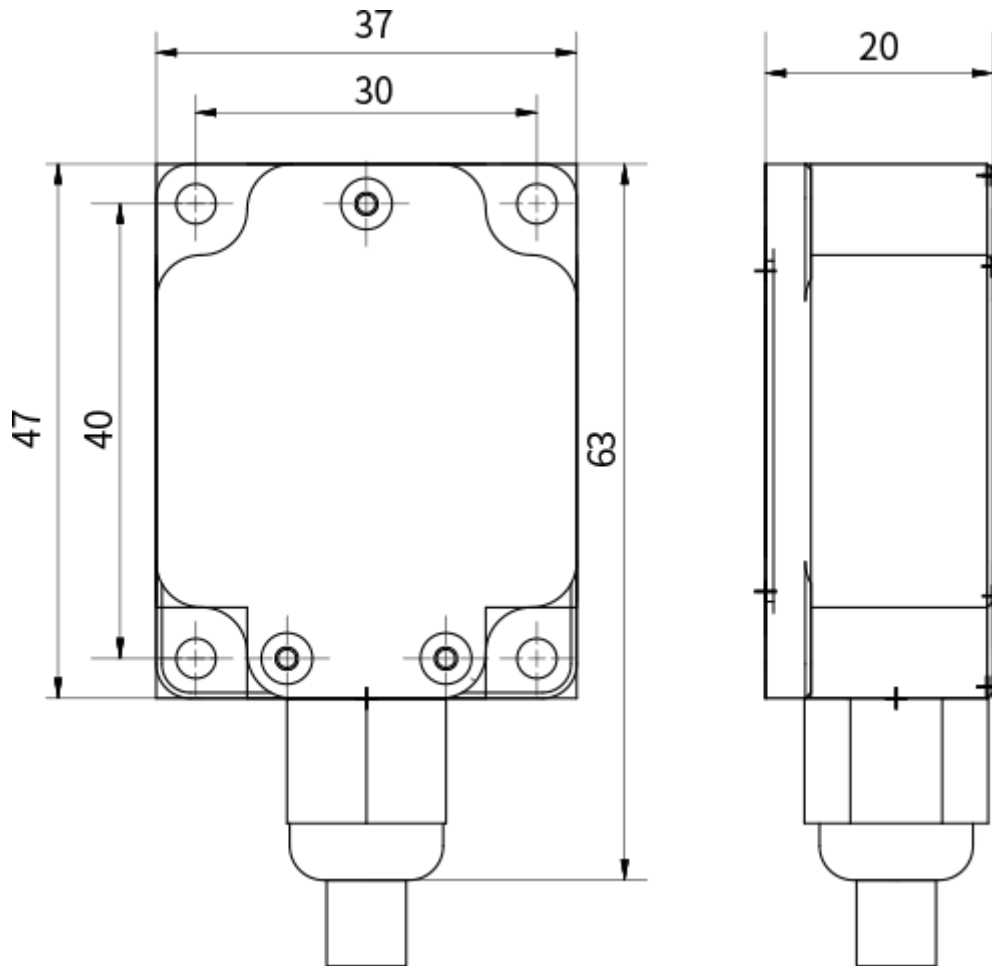
Note:

[1] The 485 product is Modbus protocol, master-slave mode, determined by the number of read content and the read rate of the user.

Electrical parameters

Parameter	Condition	Minimum	Default
Supply voltage		5V	12V
Working current	Work (12V)		8.3mA (485) 13mA (CAN)

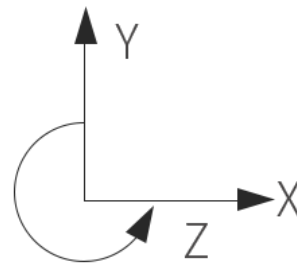
3.7 Size



Parameter	Specification	Tolerance	Comment
Length	47	± 0.1	Unit: millimeter
Width	37	± 0.1	
Height	20	± 0.1	
Weight	52.8	± 1	Unit: gram

3.8 Axial Direction

The coordinate system used for attitude angle settlement is the northeast sky coordinate system. Place the module in the positive direction, as shown in the figure below, direction right is the X-axis, the direction forward is the Y-axis, and direction upward is the Z-axis. Euler angle represents the rotation order of the coordinate system when the attitude is defined as Z-Y-X, that is, first turn around the Z-axis, then turn around the Y-axis, and then turn around the X-axis.



4 PIN Definition



PIN	Color	Function
➤ VCC	RED	Input Supply RS485 :powered by 5V-36V
➤ B	GREEN	RS485 : B
➤ A	YELLOW	RS485 : A
➤ GND	BLACK	Ground GND

5 MODBUS Communication Protocol

Level: RS485 level

Baud rate: 4800, 9600 (default), 19200, 38400, 57600, 115200, 230400, 460800, 921600, stop bit 1, check bit 0. The command sent is the HEX code.

BS-IWH9053-485 module can be accessed entirely through RS485, the default address is 0x50, can be changed by serial port instruction or MODBUS write address.