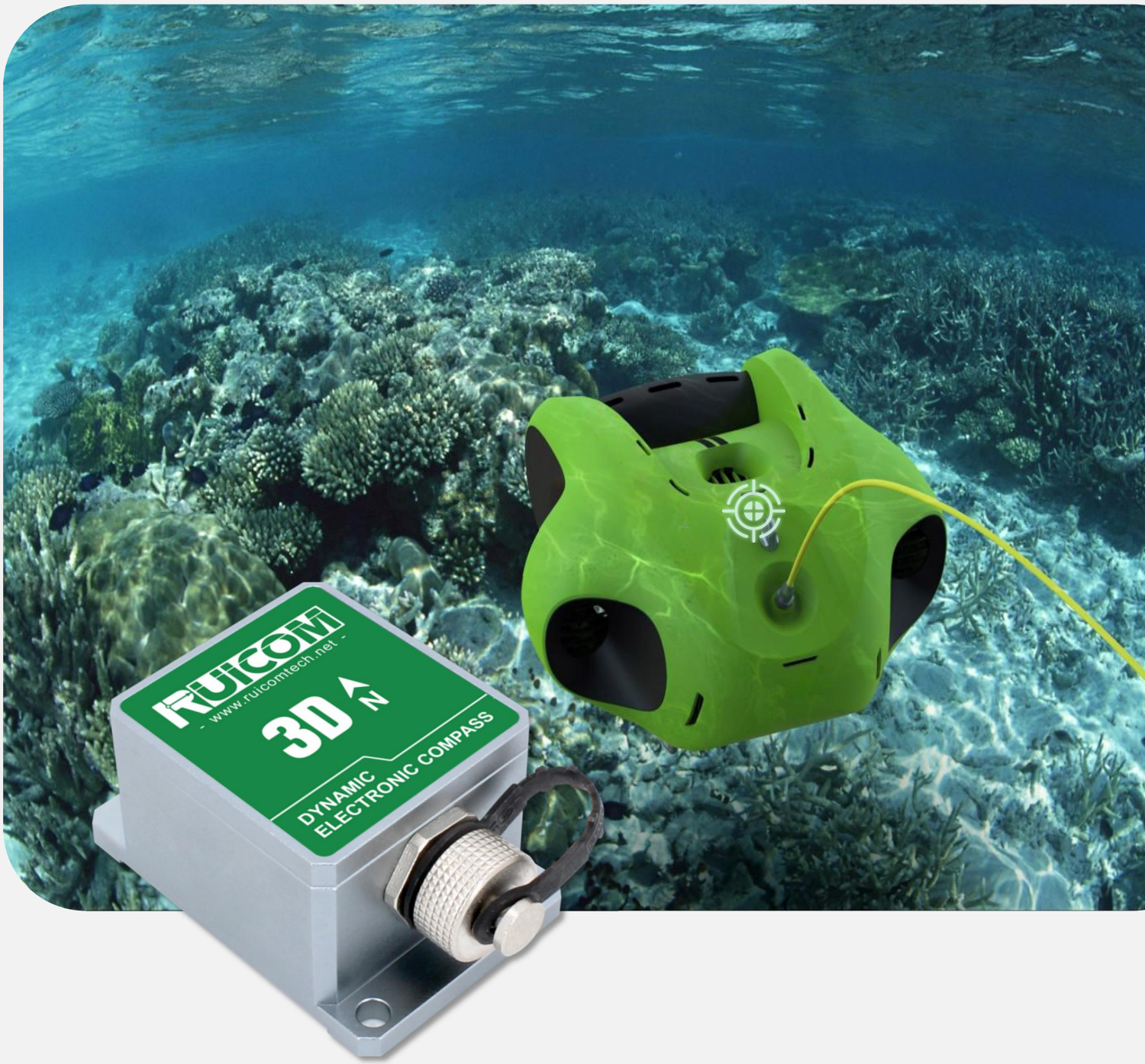


GDM355/GDM365 Dynamic 3D Electronic Compass

Product Manual

V1.1-20241204

Technical Highlights

- Tilt resolution: 0.1°;
- Static tilt accuracy: 0.2°, dynamic accuracy: 0.5°;
- DC 5V power supply;
- Standard RS232/RS485/TTL output interface;
- With hard magnet, soft magnet and tilt compensation.

Product Introduction

The GDM365 is a three-dimensional dynamic electronic compass integrating a 12-axis inertial measurement unit, encompassing three-axis attitude angle measurement, three-axis accelerometer, three-axis gyroscope, and three-axis magnetometer. Utilizing the high dynamic angle response of the gyroscope and the stable attitude output capability of the accelerometer under static conditions, combined with dynamic inertial navigation algorithms, it can calculate the pitch and roll angles in real time during complex attitude changes. For geomagnetic azimuth, the product incorporates hard and soft magnetic calibration algorithms to effectively suppress geomagnetic interference in environments with magnetic field disturbances. The central processing unit calculates the heading in real time and uses dynamic pitch and roll angles to perform dynamic heading compensation for a wide range of magnetic azimuth, ensuring reliable heading output even at tilt angles of ±85°. The compass is equipped with a high-performance DSP processor, supporting standard interfaces such as RS232, RS485, and TTL, and other interfaces can be customized upon request.

The GDM365 features a compact size and low power consumption, making it suitable for applications with high vibration tolerance, such as marine vessels and antenna satellite search. It can also operate stably under harsh environmental conditions, making it suitable for various systems that require high precision in measurement, integration, and control.

Application Scope

- Marine Navigation and Surveying
- Antenna Servo Control
- Laser Ranging Equipment Collaboration
- ROV Underwater Robot Navigation
- Remote Intelligent Systems
- GPS Integrated Navigation System
- Infrared Imager Integration
- Map Completion System Support
- Marine Survey Instrument Support

Performance Parameters

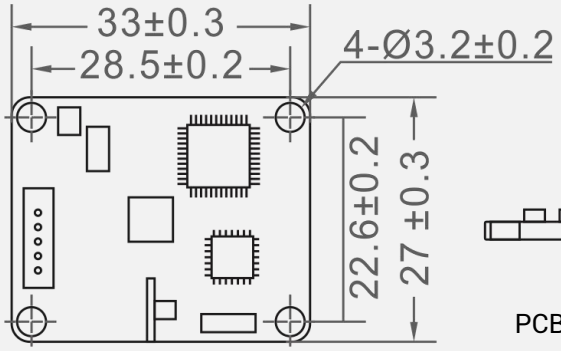
GDM355/365		Parameter Indicator
Compass heading parameters	Heading accuracy	1°
	Resolution	0.1°
	Pitch measurement range	±90°
	Roll measurement range	±180°
	Tilt accuracy	Static 0.2°
		Dynamic 0.5°
	Resolution	0.1°
	Tilt compensation angle range	Roll ±180°
		Pitch < 85°
Three-axis magnetic field	Measurement range	±800uT
Calibration	Hard iron calibration	Yes
	Soft iron calibration	Yes
	Magnetic field interference calibration method	Planar rotation (2D calibration)
Interface characteristics	Startup delay	<50 ms
	Output rate	5~100Hz（adjustable）
	Baud rate	4800 to 115200baud
	Output format	Binary high-performance protocol
Power supply	Supply voltage	（Default）DC +5V
		（Custom）DC 9~36V
	Current (MAX)	45mA
	Ideal mode	35mA
	Sleep mode	TBD
Environment	Operating range	-40℃~+85℃
	Storage temperature	-40℃~+85℃
	Vibration resistance	2500g
Electromagnetic compatibility	Compliant with EN61000 and GBT17626	
Insulation resistance	≥100 megohms	
Shock resistance	100g@11ms, triaxial (half-sine wave)	
Vibration resistance	10grms / 10~1000Hz	
Dimensions	PCBA dimensions: L33×W27×H9mm Case dimensions: L55.5×W37×H24mm	
Cable length/weight	PCBA trace length: 20cm±3cm Case trace length: 200cm±10cm	
Weight	PCBA weight: ≤25g Case package weight: ≤117g (excluding cables)	

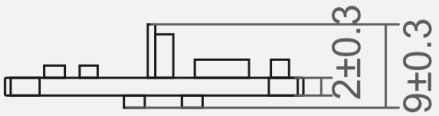
Ordering and Selection

Model	Housing encapsulation			Signal Output	Output Protocol		Installation Orientation
GDM3	5: PCBA Board	5	-	232: RS232	9A: 9 Axis Output Protocol	-	H:Horizontal Installation
	6: Housing encapsulation			485: RS485			V:Vertical Installation
				TTL: TTL			

E.g: GDM355-2329A-H: PCBA single board / RS232 output / 9-axis output protocol / horizontal mounting.

Product Dimensions

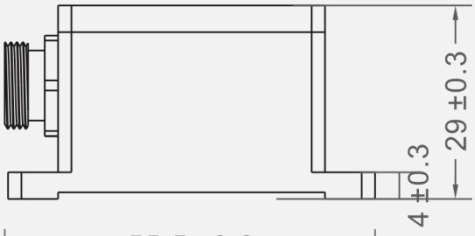


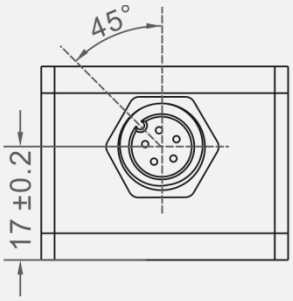


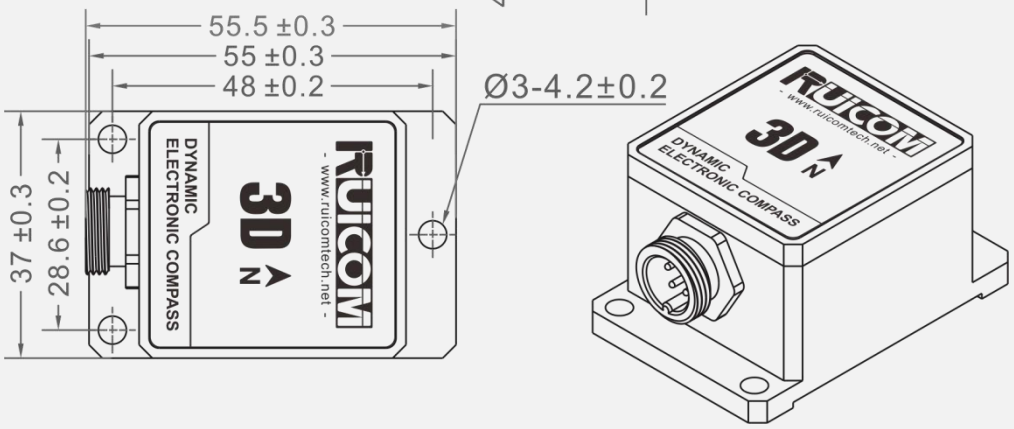
PCBA Dimensions: L33×W27×H9mm

Mounting Dimensions: L28.5×W22.6×H2mm

Recommended Screws: 4 M3 screws**(copper screws)**







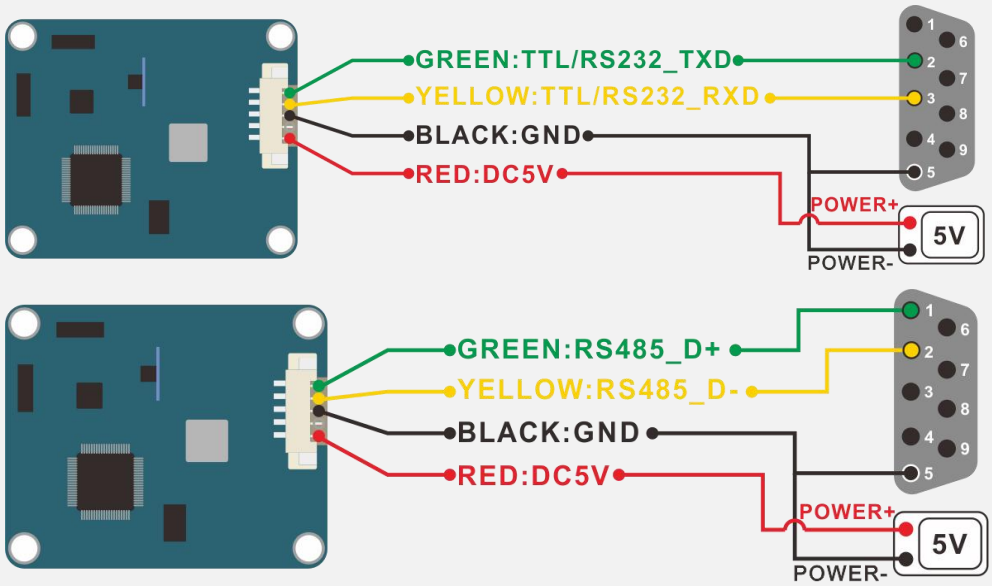
Housing dimensions: L55.5×W37×H29mm

Mounting dimensions: L48×W28.6×H4mm

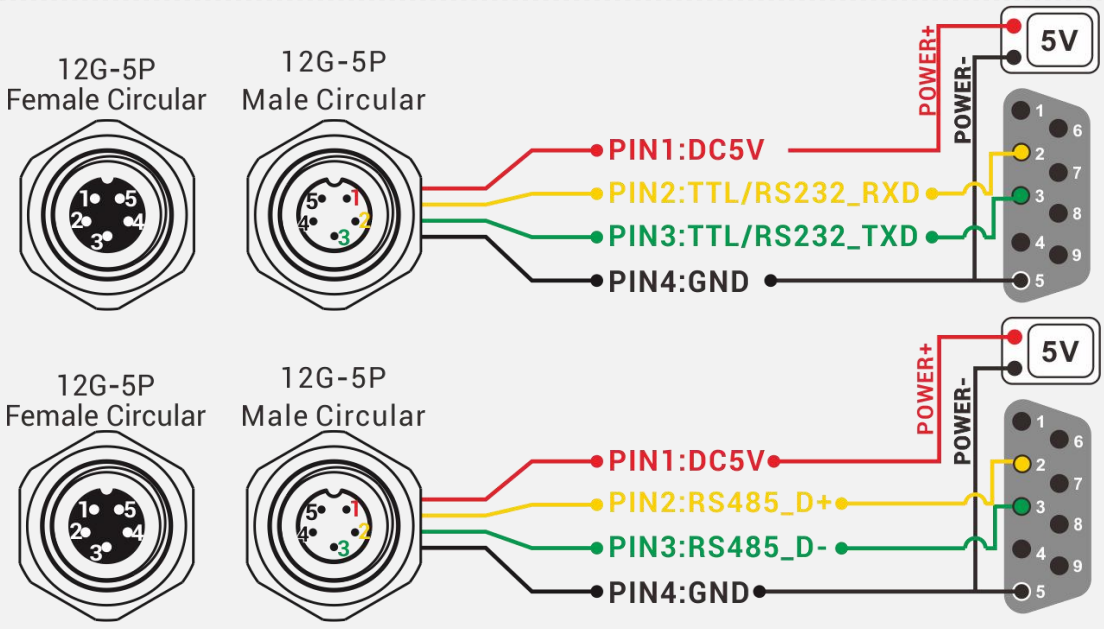
Recommended screws: 3 M4 screws**(copper screws)**

Interface Definition

Pin/Thread Color	PCBA Definition	Description
Black	GND	Negative power supply terminal
Red	DC 5V	Positive power supply terminal
Yellow	TTL/RS232_RXD/RS485_D-	Receive data
Green	TTL/RS232_RXD/RS485_D+	Transmit data



Pin/Thread Color	Enclosure package definition	Description
PIN1/Red	DC 5V	Power supply positive terminal
PIN2/Yellow	TTL/RS232_RXD/RS485_D+	Receive data
PIN3/Green	TTL/RS232_RXD/RS485_D-	Transmit data
PIN4/Black	GND	Power supply negative terminal



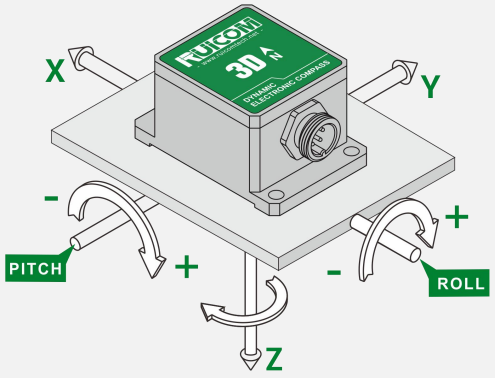
Measurement direction and installation requirements

The azimuth measurement of a 3D electronic compass is based on the principle of geomagnetic induction, and its installation environment must meet strict magnetic interference control requirements. To ensure measurement accuracy, the following installation specifications should be followed:

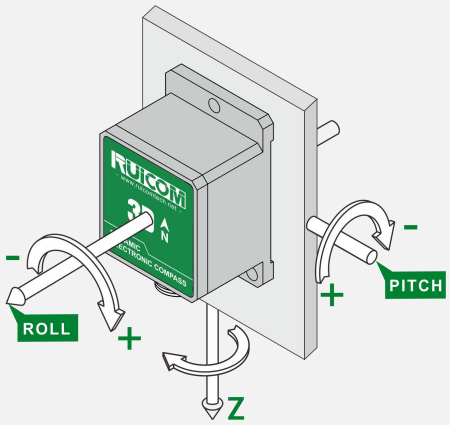
1. Magnetic Environment Requirements: The installation location should be far away from ferromagnetic materials (such as iron products, permanent magnets, etc.) and electromagnetic equipment (such as motors, transformers, etc.); the minimum distance from potential interference sources should be at least 40cm (the specific distance depends on the magnetic field conditions of the interference source).
2. Installation Material Specifications: Copper screws are recommended for installation; aluminum alloy or other non-magnetic materials are recommended for the mounting bracket.
3. Electromagnetic Interference Precautions: The product can compensate for deviations in stable magnetic field environments, but cannot dynamically compensate for changing magnetic interference. Special attention should be paid to time-varying magnetic field interference generated by DC power supply lines; energy storage devices such as batteries should be considered potential dynamic interference sources.
4. Accuracy Verification Method (Laboratory Standard Test Conditions): Use a vertically mounted, non-magnetic material (aluminum alloy recommended) test rod. The test platform should ensure the rotation axis is perpendicular to the ground; minimize the rotation radius of the test device; environmental magnetic field interference must be controlled within allowable limits (under typical interference-free conditions, measured heading accuracy can reach 0.8°).
5. Engineering Application Guidance (On-site magnetic environment assessment is required for actual installation): When installing in a vehicle, it is recommended to position the compass axis perpendicular to the vehicle's direction of movement; a customized installation plan should be developed for specific application scenarios; the feasibility of installation should be assessed for all possible working conditions.

Note: The measurement accuracy of this product is closely related to the installation environment; on-site calibration and verification are recommended in the final application scenario.

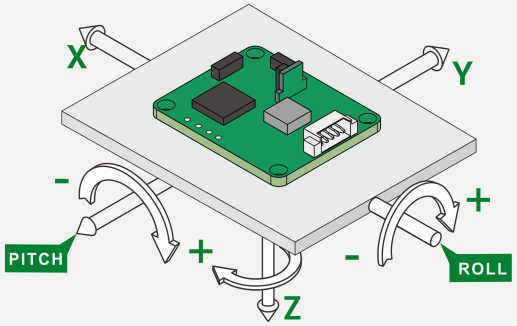
Horizontal installation



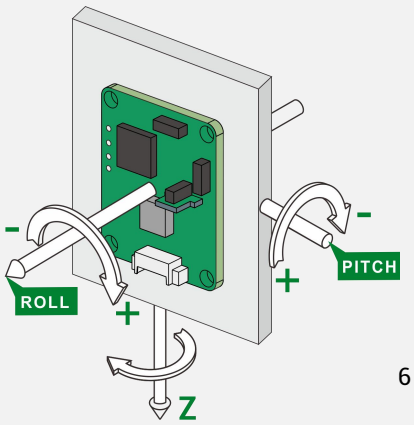
Vertical installation



Horizontal installation



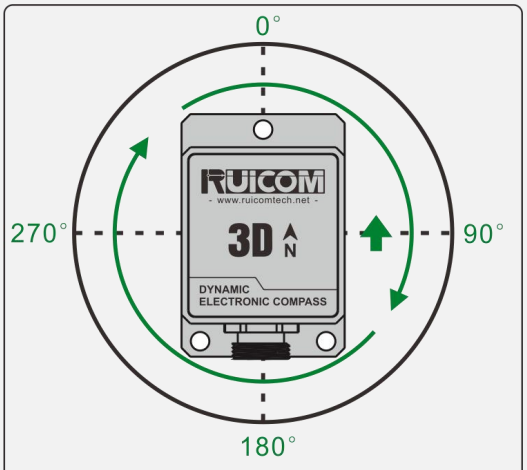
Vertical installation



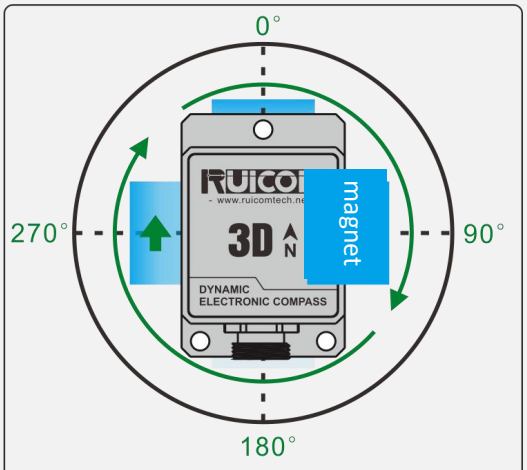
Calibration method

Calibration prerequisites:
1) The compass accuracy does not meet the requirements;
2) If there is a fixed magnetic field interference in the compass installation environment (e.g., installed on ferrous materials), the interference source and the compass must be rotated synchronously for calibration, and their relative positions must be kept fixed during use; otherwise, recalibration is required. If the size or distance of the interference source is not fixed (e.g., a variable iron component), calibration is not possible; a safe installation distance of at least 30cm should be maintained.

1) Place the electronic compass horizontally on a non-magnetic interference-free platform, correctly connect it to the designated communication interface, and turn on the power.
2) Send the calibration start command in hexadecimal format: 68 04 00 08 0C; or click the "CALI-START" button through the 3D debugging software; the device will return a response confirming entry into calibration mode.
3) Rotate the device 360° uniformly along the horizontal plane at a constant angular velocity (≥40 seconds/revolution) to ensure complete acquisition of spatial magnetic field distribution data. Return to the initial 0° position to terminate the calibration.
4) Send the calibration stop command in hexadecimal format: 68 04 00 0A 0E; or click the "CALI-SAVE" button through the 3D debugging software; the system will store the calibration parameters and return a success status.
Installation Notes: For installations on equipment subject to magnetic interference, the electronic compass must be kept relatively fixed to the host device to complete the rotation calibration process together. This operation effectively compensates for the inherent magnetic field interference of the equipment, ensuring that the orientation measurement accuracy meets the technical specifications.

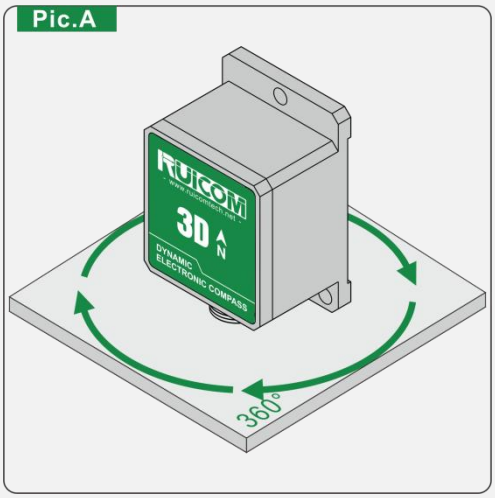


Separate calibration simulation diagram
The starting point can be at any point in 360 °, rotate in place for more than 1 circle and less than 2 circles, and try to rotate at a uniform speed, not too fast!



Calibrate the simulation diagram together with the fixed interference source
The starting point can be at any point in 360 °, rotate in place for more than 1 circle and less than 2 circles, and try to rotate at a uniform speed, not too fast!

Vertical rotation calibration:



1)Connect the compass correctly to the corresponding communication port and turn on the power.
2)Rotate the plane at least 360°: As shown in Figure B. Vertical Calibration Start Command
68 04 00 42 46
Data Field (0 bytes)
Rotate horizontally at a constant speed for at least one full rotation, ensuring the time is at least 20 seconds. Values saved are only valid after 20 seconds; values saved before 20 seconds are invalid.
Vertical Calibration Save Command
68 04 00 52 57
Data Field (0 bytes)
No Data Field Command

Communication Protocol

1. Data frame format: (8 data bits, 1 stop bit, no parity, default rate 9600)

Identifier (1byte)	Data Length (1byte)	Address Code (1byte)	Command Word (1byte)	Data Field	Checksum (1byte)
68h					

Identifier: Fixed at 68H;
Data Length: Length from the data length to the checksum (including the checksum); Address Code: Address of the acquisition module, default is 00; Data Field varies according to the content and length of the command word; Checksum: The sum of the data length, address code, command word, and data field, without considering carry.

2. Command word parsing

Description	Meaning / Example	Description
0X04	Simultaneously read Roll/Pitch/Heading angle commands **68 04 00 04 08**	Data Field (0 bytes) No data field command
0X84	Sensor Response	Data Field See reply on P9 "12-axis data type output"
0X06	Set Magnetic Declination Command **68 06 00 06 02 08 16**	Data Field (2 bytes) SA AB S: Sign 0 positive 1 negative AA: Two-digit integer B: One-digit decimal E.g: 02 08 is +20.8°
0X86	Sensor Response Command E.g: **68 05 00 86 00 8B**	Data Field (1 byte) The number in the data field represents the sensor response result 00 Successful setting FF Failed setting
0X07	Read Magnetic Declination Command **68 04 00 07 0b**	Data Field (0 bytes) No data field command
0X87	Sensor Response Command E.g: **68 06 00 87 02 08 97**	Data Field (2 bytes) The number in the data field represents the sensor response result
0X08	Start Calibration Command **68 04 00 08 0C**	Data Field (0 bytes) No data field command

0X88	Sensor Response Command E.g: **68 05 00 88 00 8D**	Data Field (1 byte) The number in the data field represents the sensor response result 00 Successful setting FF Failed setting
0X0A	Save Calibration Command **68 04 00 0A 0E**	Data Field (0 bytes) No data field command
0X8A	Sensor Response Command E.g: **68 05 00 8A 00 8F**	Data Field (1 byte) The number in the data field represents the sensor response result 00 Successful setting FF Failed setting
0X0B	Set Communication Baud Rate Command **68 05 00 0B 02 12**	Data Field (1 byte) 01 represents 4800 **02 represents 9600 (factory default)** 03 represents 19200 04 represents 38400 05 represents 115200
0X8B	Sensor Response Command E.g: **68 05 00 8B 00 90**	Data Field (1 byte): The number in the data field represents the sensor's response result. 00 Successful setting FF Failed setting
0X0F	Set Module Address Command **68 05 00 0F 01 15**	Data Field (1 byte): Module address, ranging from 00 to EF. Note: Our products use the unified address: FF. If you forget the address you set during operation, you can use the FF address to operate the product, and it will still respond normally.
0X8F	Sensor Response Command E.g: **68 05 00 8F 00 94**	Data Field (1 byte) The number in the data field represents the sensor's response result. 00 Successful setting FF Failed setting
0X0C	Set Angle Output Mode **68 05 00 0C 00 11**	Data Field (1 byte) **00: Question-and-answer mode (factory default)** 01: Auto output mode 5Hz 02: Auto output mode 15Hz 03: Auto output mode 25Hz 04: Auto output mode 35Hz 05: Auto output mode 50Hz 06: Auto output mode 100Hz Note: If the interface is RS485, when the output frequency is greater than 50Hz, the baud rate should be increased to 19200 or higher first.
0X8C	Sensor Response Command E.g: **68 05 00 8C 00 91**	Data Field (1 byte) The number in the data field represents the sensor's response result. 00 Successful setting FF Failed setting setting

Data format description:

SOF	First Item	Second Item	Third Item	Fourth Item
0x68	Length	Address	Load	Checksum

Protocol Item Descriptions:
SOF: Start of Frame (SOF), a fixed value of 0x68;
Length: Total number of bytes for all items except SOF;
Address: Address (0x00~0xFF);
Load: Consists of commands or command content;
Checksum: The sum of the first to third items, a single byte excluding the high-order byte.

12-axis data type output

Attitude angle + 3-axis acceleration + 3-axis gyro angular velocity + 3-axis magnetic field;

SOF	0x68
Length	0x28
Address	0x00
Payload Contents	

Byte Offset	No. Format	name	content	bytes	
0	INT8U	command	0x84	1	
1	INT8U	ROLL	Roll angle	3	**10 50 23**:3 characters represent **-50.23°**
4	INT8U	PITCH	Pitch angle	3	**00 60 00**:3 characters represent **+60.00°**
7	INT8U	YAW	Yaw angle*	3	**01 60 00**:3 characters represent **+160.00°**
10	INT8U	ACC X	X-axis acceleration	3	**00 10 00**:3 characters represent acceleration **+1.000g**
13	INT8U	ACC Y	Y-axis acceleration	3	**10 12 05**:3 characters represent acceleration **-1.205g**
16	INT8U	ACC Z	Z-axis acceleration	3	**00 05 25**:3 characters represent acceleration **+0.525g**
19	INT8U	Gyro-x	X-axis gyroscope	3	**10 50 23**:3 characters represent **-50.23°/S**
22	INT8U	Gyro-y	Y-axis gyroscope	3	**01 50 00**:3 characters represent **+150.00°/S**
25	INT8U	Gyro-z	Z-axis gyroscope	**3**	**10 90 00**:3 characters represent **-90.00°/S**
28	INT8U	Mag X	X-axis magnetic field strength	3	**10 30 23**:3 characters represent **-30.23uT**
31	INT8U	Mag Y	Y-axis magnetic field strength	3	**00 35 05**:3 characters represent **+35.05uT**
34	INT8U	Mag Z	Z-axis magnetic field strength	3	**10 55 25**:3 characters represent **-55.25uT**
37	INT8U	Check sum	Checksum	1	

*The heading angle is the magnetic north heading angle, ranging from 0 to 360°.