



GCM380/GCM385-N

3D Electronic Compass

Product manual

V1.7-20250628

Technical Highlights

- ❖ Measurement range: Roll $\pm 180^\circ$, Pitch $\pm 85^\circ$;
- ❖ Accuracy: Roll/Pitch 0.1° , Heading 0.5° ;
- ❖ Resolution: 0.1° ;
- ❖ Standard RS232/RS485/TTL output interfaces;
- ❖ Includes hard-iron, soft-iron, and tilt compensation.



Product Introduction

The GCM380/GCM385-N is a 3D electronic compass that balances high performance with cost-effectiveness. It utilizes our proprietary, patented calibration technology, ensuring a streamlined and efficient setup process. Equipped with a built-in high-precision accelerometer for tilt compensation, the device delivers stable and reliable heading data across a full 360° roll range ($\pm 180^\circ$). It maintains exceptional measurement accuracy even in the presence of fixed magnetic interference and supports multiple serial communication interfaces—including RS232, RS485, and TTL—facilitating seamless integration into diverse systems.

The unit integrates a 3-axis magnetometer and a 3-axis accelerometer, offering high resolution and robust resistance to environmental noise. It combines stable, reliable performance with a compact form factor and low power consumption, making it ideal for handheld devices, mobile platforms, antenna orientation systems, automotive equipment, and various system integration projects. Customers can choose between a fully enclosed finished product or a standalone circuit board module, allowing for flexible adaptation to specific application requirements.

Application Scope

- | | |
|---|---------------------------------------|
| ❖ Marine Navigation & Surveying/Mapping | ❖ GPS Integrated Navigation Systems |
| ❖ Antenna Servo Control | ❖ Infrared Imager Integration |
| ❖ Laser Ranging Equipment Coordination | ❖ ROV Underwater Robot Navigation |
| ❖ Map Updating/Supplementing System Support | ❖ Unmanned Intelligent Systems |
| ❖ ROV Underwater Robot Navigation | ❖ Marine Surveying Instrument Support |





Performance Parameters

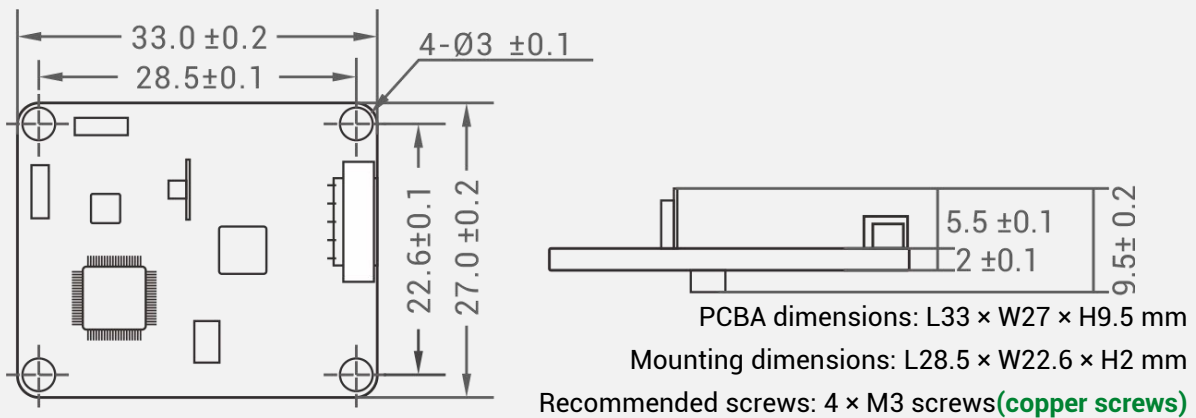
GCM380/GCM385-N		Parameter indicators
Compass Heading Parameters	Optimal heading accuracy	0.5°
	Resolution	0.1°
	Pitch accuracy	0.1°<60°(Measurement Range)
		0.2°<85°(Measurement Range)
	Pitch tilt range	±85°
	Roll accuracy	0.1°<60°(Measurement Range)
		0.2°<180°(Measurement Range)
	Roll tilt range	±180°
	Resolution	0.1°
Calibration	Hard-iron calibration	Yes
	Soft-iron calibration	Yes
	Magnetic interference calibration method	360° horizontal rotation; vertical rotation (optional)
Physical Characteristics	Housing dimensions	L57×W49×H25.5mm
	Housing weight	≤250g(excluding cable)
	RS232/RS485/TTL interface connector	Direct wire leads
Interface Characteristics	Startup delay	<50 ms
	Maximum output rate	20Hz/s
	Communication rate	2400 to 115200 baud
	Output format	High-performance binary protocol
Power Supply	Supply voltage	(Default) DC +5V
	Current (maximum)	30mA
	Active mode	26mA
	Sleep mode	TBD
Environment	Operating temperature	-40℃~+85℃
	Storage temperature	-40℃~+85℃
	Vibration resistance	100g
Ingres Protection	IP67	
Electromagnetic Compatibility	In accordance with EN 61000 and GB/T 17626	
Insulation Resistance	≥100 megohms	
Shock Resistance	100 g @ 11 ms, tri-axial (half-sine wave)	
Vibration Resistance	10grms / 10~1000Hz	

✓ Ordering and Selection

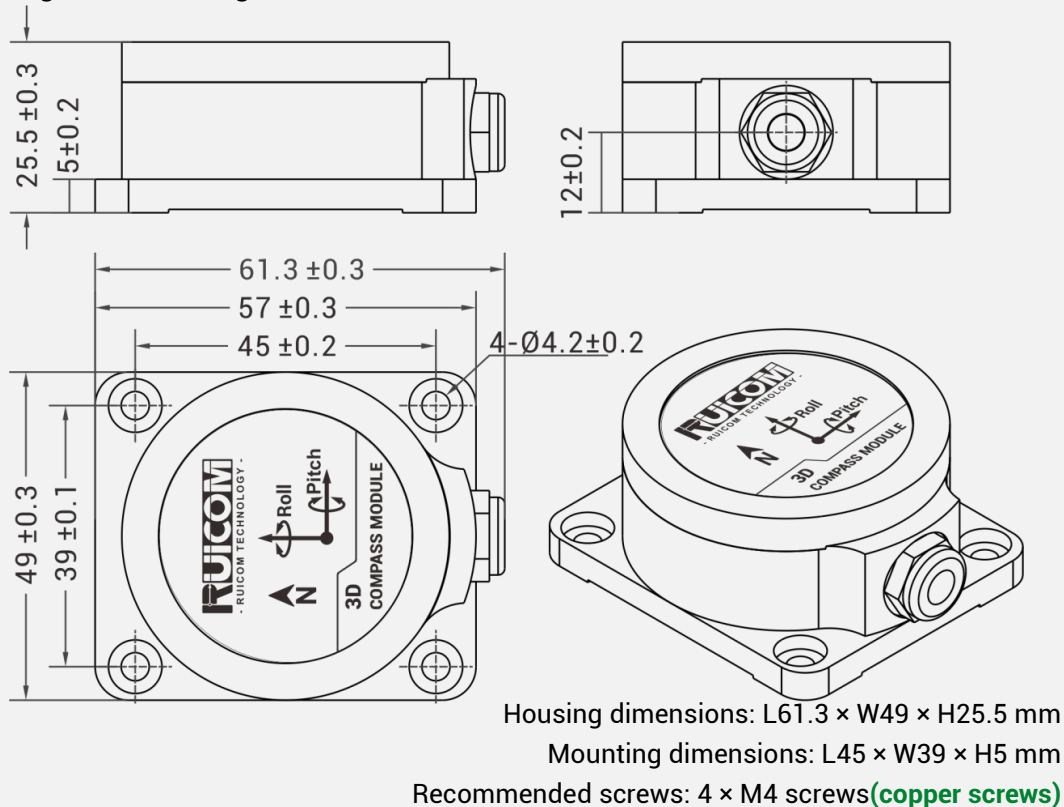
Model	Housing Packaging	Signal Output	Output Protocol	Installation Orientation
GCM38	0: PCBA Board	232: RS232	SP: Serial communication protocol	H: Horizontal installation
	5: Housing Packaging	485: RS485	NMEA: NMEA Protocol	V: Vertical installation
		TTL: TTL Level		
E.g: GCM380-232SP-H: PCBA board / RS232 output / Serial communication protocol / Horizontal mounting.				

✓ Product Dimensions

PCBA Dimension Diagram

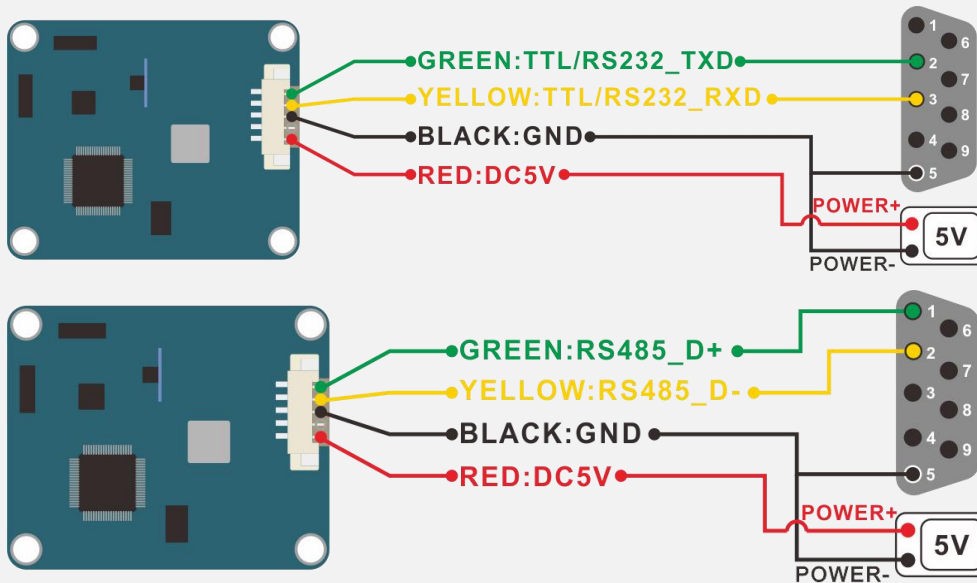


Housing Dimension Diagram

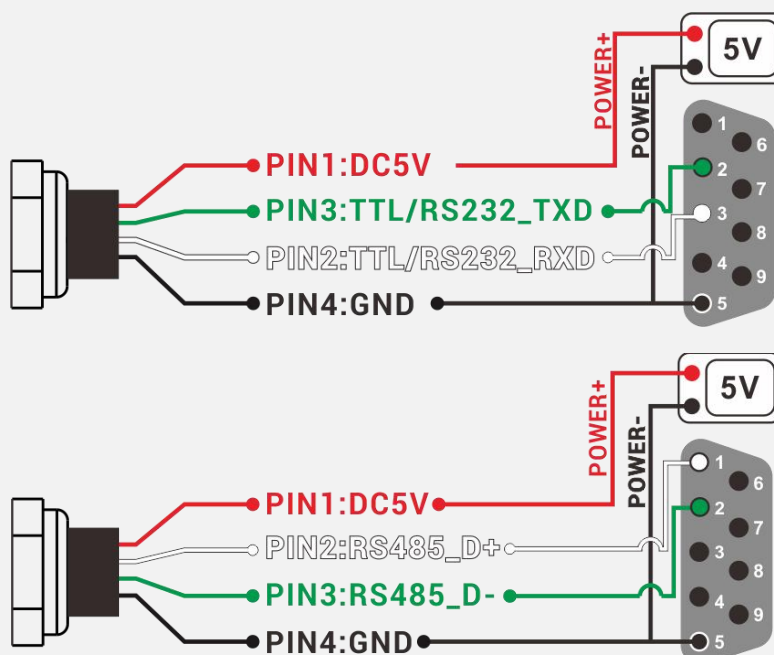


Interface Definition

PIN / Thread Color	Definition	Description
Black	GND	Power supply negative terminal
Red	DC 5V	Power supply positive terminal
Yellow	TTL/RS232_RXD/RS485_D-	Receive data
Green	TTL/RS232_TXD/RS485_D+	Transmit data



PIN / Thread Color	Definition	Description
Red	DC 5V	Positive power supply
White	TTL/RS232_RXD/RS485_D+	Receive data
Green	TTL/RS232_TXD/RS485_D-	Transmit data
Black	GND	Negative power supply



✓ Measurement Direction and Installation Requirements

Azimuth measurement using a 3D electronic compass is based on the principle of geomagnetic sensing; therefore, the installation environment must meet strict requirements for controlling magnetic interference. To ensure measurement accuracy, the following installation guidelines should be observed:

1. Magnetic Environment Requirements: The installation site must be kept away from ferromagnetic materials (e.g., iron objects, permanent magnets) and electromagnetic equipment (e.g., electric motors, transformers). A minimum clearance of 40 cm from potential interference sources must be maintained (the exact distance depends on the magnetic field characteristics of the interference source).

2. Installation Material Specifications: Brass screws are recommended for mounting; mounting brackets should be made of aluminum alloy or other non-magnetic materials.

3. Electromagnetic Interference Precautions: The product can compensate for deviations in a stable magnetic field environment but cannot dynamically compensate for fluctuating magnetic interference.

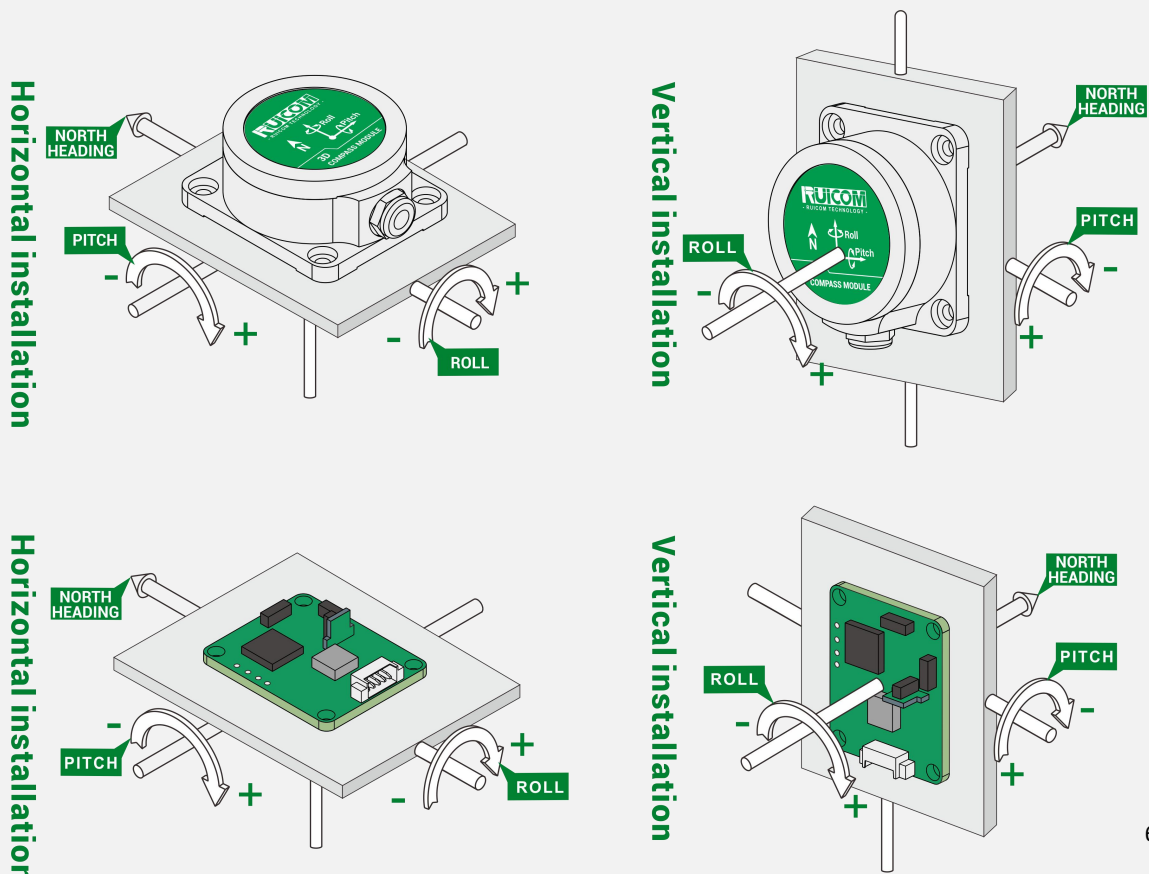
Particular attention must be paid to time-varying magnetic field interference caused by DC power lines; energy storage devices, such as batteries, should be considered potential sources of dynamic interference.

4. Accuracy Verification Method (Laboratory Standard Test Conditions): Use a vertically mounted test rod made of non-magnetic material (aluminum alloy recommended).

The test platform must ensure the axis of rotation is perpendicular to the ground; minimize the rotation radius of the test setup; and control ambient magnetic interference within permissible limits (in a typical interference-free environment, the measured heading accuracy can reach 0.8°).

5. Engineering Application Guidelines (On-site magnetic environment assessment is required for actual installation): For vehicle-mounted applications, it is recommended to align the compass axis perpendicular to the vehicle's direction of motion; installation plans should be tailored to specific application scenarios; and installation feasibility must be evaluated across all potential operating conditions.

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



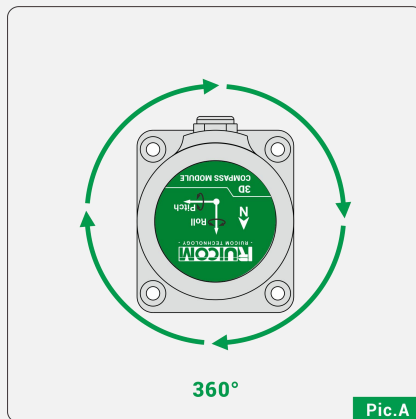
Calibration method

Calibration prerequisites:

- 1) The compass accuracy fails to meet requirements;
- 2) If the installation environment involves fixed magnetic field interference (e.g., mounting on ferrous material), the interference source must be rotated synchronously with the compass during calibration, and their relative positions must remain fixed during operation; otherwise, recalibration is required. If the interference source varies in size or distance (e.g., movable iron components), calibration is not possible, and a minimum installation clearance of 30 cm must be maintained.

Horizontal Installation Calibration Mode:

- 1) Connect the HCM compass to the communication port correctly and turn on the power.
- 2) Planar rotation—rotate more than 360°:



As shown in Figure A

Horizontal calibration start command

68 04 00 41 45

Data field(0byte)

Rotate horizontally at a constant speed for at least one full revolution, ensuring the duration is 20 seconds or longer. The saved value is valid only if the duration is 20 seconds or more; it is invalid if the duration is less than 20 seconds.

Horizontal calibration save command

68 04 00 51 55

Data field(0byte)

No Data Field Command

- 3) Rotate 360° vertically upwards



As shown in Figure B

Command to initiate vertical upward calibration

68 04 00 42 46

Data field(0byte)

Rotate vertically at a constant speed for at least one full revolution, ensuring the duration exceeds 20 seconds. The saved value is valid only if the duration is 20 seconds or longer; it is invalid if the duration is less than 20 seconds.

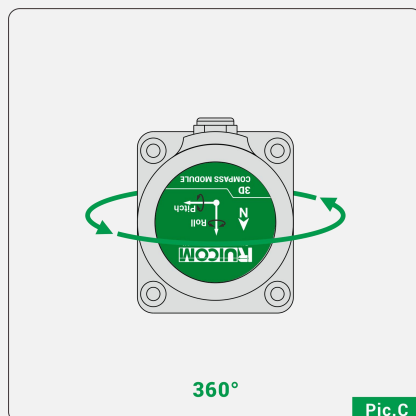
Command to save vertical upward calibration

68 04 00 52 56

Data field(0byte)

Command with no data field

- 4) Rotate 360° vertically downwards



As shown in Figure C

Start calibration command (pointing vertically down)

68 04 00 43 47

Data field(0byte)

Rotate at a constant speed in the vertical plane for at least one full revolution, ensuring the duration exceeds 20 seconds. The saved value is valid only if the duration is 20 seconds or longer; it is invalid if the duration is less than 20 seconds.

Save calibration command (pointing vertically down)

68 04 00 53 57

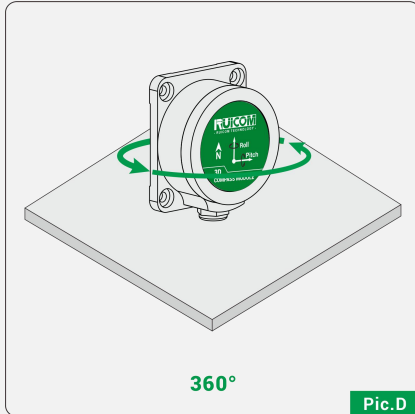
Data field(0 byte)

No data field command

Vertical installation calibration mode:

1) Connect the communication port correctly using the HCM compass and turn on the power.

2) Planar rotation—more than 360°:



As shown in Figure D

Horizontal Calibration Start Command

68 04 00 41 45

Data field(0 byte)

Rotate horizontally at a constant speed for at least one full revolution, ensuring the duration is 20 seconds or longer. The saved value is valid only if the duration is 20 seconds or more; it is invalid if the duration is less than 20 seconds.

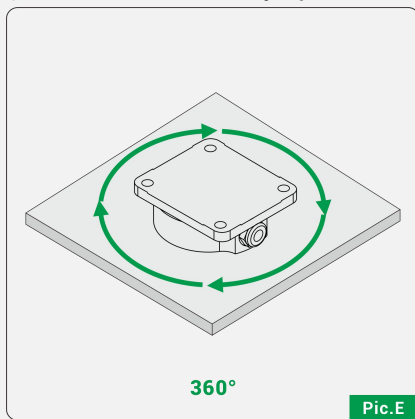
Horizontal Calibration Save Command

68 04 00 51 55

Data field(0byte)

No data field command

3) Rotate 360° vertically upwards



As shown in Figure E

Command to initiate vertical upward calibration

68 04 00 42 46

Data field(0 byte)

Rotate vertically at a constant speed for at least one full revolution, ensuring the duration exceeds 20 seconds. The saved value is valid only if the duration is 20 seconds or longer; it is invalid if the duration is less than 20 seconds.

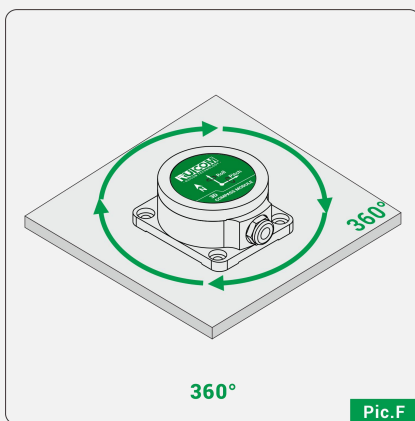
Command to save vertical upward calibration

68 04 00 52 56

Data field(0byte)

No data field command

4) Rotate 360° vertically downwards



As shown in Figure F

Command to initiate vertical downward calibration

68 04 00 43 47

Data field(0byte)

Rotate at a constant speed in the vertical plane for at least one full revolution, ensuring the duration exceeds 20 seconds. The saved value is valid only if the duration is 20 seconds or longer; otherwise, it is invalid.

Command to save vertical downward calibration

68 04 00 53 57

Data field(0byte)

Command with no data field



Serial communication protocol

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

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

Identifier: Fixed at 68H;

Data Length: Length from the Data Length field to the Checksum (inclusive);

Address Code: Address of the data acquisition module; default is 00;

Data Field: Content and length vary according to the Command Code;

Checksum: Sum of Data Length, Address Code, Command Code, and Data Field (ignoring the carry).

2. Command Word Parsing

Descri ption	Meaning / E.g	Description
0X04	Read Roll/Pitch/Heading simultaneously Angle command 68 04 00 04 08	Data field(0 byte) Command with no data field
0X84	Sensor response E.g: 68 0E 00 84 00 10 50 10 10 05 01 04 01 00 1D	Data field(10 byte) AA AB BB CC CD DD EE EF FF GG AA AB BB :3 red bytes representing the Pitch axis CC CD DD :3 blue bytes representing the Roll axis EE EF FF :3 green bytes representing the Heading angle AA AA BB represents the Pitch angle return value in packed BCD format 00 10 50 red : Pitch angle return value in packed BCD format. The high bit of the first byte 0 is the sign bit(0 for positive, 1 for negative) 01 0 represents the three-digit integer part, 50 represents the two-digit fractional part. The parsing method for other axes is the same; the Pitch angle parses to +10.50°. 10 10 05 blue : Roll return value; parsing method same as Pitch; parsed angle is Roll: -010.05°. 01 04 01 green : Heading return value; parsing method same as Pitch; parsed angle is Heading: +104.01°. GG: Indicates magnetic field status; 1 if the threshold is exceeded, 0 if not.
0X06	Set magnetic declination command 68 06 00 06 02 08 16	Data field(2byte) SA AB S: Sign (0 for positive, 1 for negative) AA: Two-digit integer B: One-digit fraction E.g: 02 08 represents +20.8°
0X86	Sensor response E.g: 68 05 00 86 00 8B	Data field(1byte) The value in the data field represents the sensor's response result 00: Setting successful FF: Setting failed

0X07	Read magnetic declination command 68 04 00 07 0b	Data field (0 bytes) No data field command
0X87	Sensor response E.g: 68 06 00 87 02 08 97	Data field (2 bytes) The value in the data field represents the sensor's response result
0X41	Start horizontal calibration command 68 04 00 41 45	Data field (0 bytes) Rotate horizontally at a constant speed for more than one full circle; the saved value is valid only if the duration exceeds 20 seconds; if less than 20 seconds, the saved value is invalid.
0X41	Sensor response E.g: 68 04 00 41 45	Data field (0 bytes) No data field command
0X51	Save horizontal calibration command 68 04 00 51 55	Data field (0 bytes) No data field command
0X51	Sensor response E.g: 68 04 00 51 55	Data field (0 bytes) No data field command
0X42	Start vertical-up calibration command 68 04 00 42 46	Data field (0 bytes) Rotate vertically (facing North) at a constant speed for more than one full circle; ensure the duration exceeds 20 seconds. The saved value is valid only if the duration exceeds 20 seconds; it is invalid if the duration is less than 20 seconds.
0X42	Sensor response E.g: 68 04 00 42 46	Data field (0 bytes) No data field command
0X52	Save vertical-up calibration command 68 04 00 52 56	Data field (0 bytes) No data field command
0X52	Sensor response command E.g: 68 04 00 52 56	Data field (0 bytes) No data field command
0X43	Start vertical-down calibration command 68 04 00 43 47	Data field (0 bytes) Rotate the device vertically at a constant speed for at least one full circle; the saved value is valid only if the duration exceeds 20 seconds.
0X43	Sensor response E.g: 68 04 00 43 47	Data field (0 bytes) No data field command
0X53	Save vertical-down calibration command 68 04 00 53 57	Data field (0 bytes) No data field command
0X53	Sensor response command E.g: 68 04 00 53 57	Data field (0 bytes) No data field command
0X5a	Clear calibration command 68 04 00 5a 5e	Data field (0 bytes) Must be sent 3 times to be valid (Clears current calibration data; factory calibration data is not overwritten)
0X5a	Sensor response command E.g: 68 04 00 5a 5e	Data field (0 bytes) No data field command
0X0e	Restore factory settings command 68 05 00 0e aa bd	Data field (1 byte) Restore factory defaults (current calibration data is overwritten)
0X0e	Sensor response command E.g: 68 05 00 8e 00 93	Data field (1 byte) No data field command
0X0B	Set communication baud rate command 68 05 00 0B 02 12	Data field(1byte) Baud rate: 9600

		00: 2400 02: 9600(default) 04: 38400 01: 4800 03: 19200 05: 115200
0X8B	Sensor response command E.g: 68 05 00 8B 00 90	Data field (1 byte) Value in the data field indicates the sensor's response result 00: Setting successful FF: Setting failed
0X0F	Set module address command 68 05 00 0F 01 15	Data field (1 byte) XX: Module address; address range is 00 to EF. Note: Our products have a universal address: FF. If the configured address is forgotten during operation, the product can still be operated using address FF and will respond normally.
0X8F	Sensor response command E.g: 68 05 00 8F 00 94	Data field(1byte) The value in the data field indicates the sensor's response result. 00: Setting successful FF: Setting failed
0X0C	Set angle output mode 68 05 00 0C 00 11	Data field(1byte) 00: Request-response mode (factory default) 01: Automatic output mode (20 Hz) 02: Automatic output mode (5 Hz) 03: Automatic output mode (10 Hz) 04: Automatic output mode (25 Hz) 05: Automatic output mode (50 Hz)
0X8C	Sensor response command E.g: 68 05 00 8C 00 91	Data field (1 byte) The value in the data field indicates the sensor's response result. 00: Setting successful FF: Setting failed
0X50	Set geomagnetic detection threshold command 68 05 00 50 01 56	Data field (1 byte) BYTE4 value range: 1–10; if the value exceeds the threshold, interference is detected. Saved upon power-off; factory default is 4: 0.44/1.4 ~ 0.44*1.4 Corresponding threshold table: 1: 0.44*0.99~ 0.44/0.9 2: 0.44/1.2~ 0.44*1.2 3: 0.44/1.3~ 0.44*1.3 4: 0.44/1.4~ 0.44*1.4 5: 0.44/1.7~ 0.44*1.7 6: 0.44/1.9~ 0.44*1.9 7: 0.44/2.3~ 0.44*2.3 8: 0.44/2.5~ 0.44*2.5 9: 0.44/2.9~ 0.44*2.9 10: 0.44/3.5~ 0.44*3.5 Other values default to 4: 0.44/1.4~ 0.44*1.4
0XD0	Sensor response command E.g: 68 05 00 D0 00 D5	Data field(1byte) The value in the data field indicates the sensor's response result. 00 00: Success; FF: Failure
0X2A	Set installation mode command E.g: 68 05 00 2a 01 30(Set to vertical)	Data field(1byte) 00: Horizontal; 01: Vertical
0XAA	Set installation mode response command E.g: 68 05 00 AA 00 AF	Data field (1 byte) 00: Success; FF: Failure
0X60	Read accelerometer command E.g: 68 04 00 60 64	Data field (0 bytes)
0XE0	Accelerometer response command Reply 68 0D 00 E0 00 00 01 10	Data field (9 bytes) Three bytes represent one axis AA AB BB CC DD EE EF FF

	00 00 00 01 02 01	AA AB BB represents X-axis acceleration CC CD DD represents Y-axis acceleration EE EF FF represents Z-axis acceleration In the E.g: X-axis acceleration = 0.01g, Y-axis acceleration = -0g, Z-axis acceleration = 1.02g High 4 bits of the first byte: Sign bit Low 4 bits of the first byte: Hundreds digit High 4 bits of the second byte: Tens digit Low 4 bits of the second byte: Ones digit High 4 bits of the third byte: Tenths digit Low 4 bits of the third byte: Hundredths digit
0X61	Read magnetometer command E.g: 68 04 00 61 65	Data field (0 bytes)
0XE1	Respond to magnetometer command Reply 68 0D 00 E1 00 04 15 10 31 48 00 12 93 35	Three bytes represent one axis AA AB BB CC CD DD EE EF FF AA AB BB represents X-axis magnetometer reading CC CD DD represents Y-axis magnetometer reading EE EF FF represents Z-axis magnetometer reading In the E.g: X-axis = 415, Y-axis = -3148, Z-axis = 1293 (75 LSB/ μ T) X: $415/75=5.53\mu$ T Y: $-3148/75=-41.97\mu$ T Y: $1293/75=17.24\mu$ T High 4 bits of the first byte: Sign bit Low 4 bits of the first byte: Ten-thousands digit High 4 bits of the second byte: Thousands digit Low 4 bits of the second byte: Hundreds digit High 4 bits of the third byte: Tens digit Low 4 bits of the third byte: Ones digit

NMEA0183 Communication protocol

Communication: NMEA 0183 (ASCII)

Baud rate: Selectable (4800, 9600, or 19200; default is 19200: 1 start bit + 8 data bits + no parity + 1 stop bit)

Data Protocol

Communication utilizes NMEA proprietary sentences (ASCII).

Upon power-up, the module defaults to a baud rate of 19200 and outputs data.

During operation, the compass outputs the following sentences:

\$PTNTHPR,X,X,A,X,X,A,X,XA*hh<CR><LF>

Heading ,pitch,roll

Set the data update rate (default: 0 frames of data output per minute).

Command	Description
#BAD=0*4A<CR><LF>	Set data output to 0 frames per minute
#BAD=1*4B<CR><LF>	Set data output to 1 frame per minute
#BAD=2*48<CR><LF>	Set data output to 2 frames per minute
#BAD=3*49<CR><LF>	Set data output to 3 frames per minute
#BAD=4*4E<CR><LF>	Set data output to 6 frames per minute
#BAD=5*4F<CR><LF>	Set data output to 12 frames per minute
#BAD=6*4C<CR><LF>	Set data output to 20 frames per minute

#BAD=7*4D<CR><LF>	Set data output to 30 frames per minute
#BAD=8*42<CR><LF>	Set data output to 60 frames per minute
#BAD=9*43<CR><LF>	Set data output to 120 frames per minute
#BAD=10*7B<CR><LF>	Set data output to 180 frames per minute
#BAD=11*7A<CR><LF>	Set data output to 300 frames per minute

Baud rate setting command

Command	Description
#BA4H=8T*2E<CR><LF>	Set baud rate to 4800
#BA4H=16T*11<CR><LF>	Set baud rate to 9600
#BA4H=32T*17<CR><LF>	Set baud rate to 19200

Installation Mode

Command	Description	Response	Description
\$PSILSET,S,1*26<CR><LF>	Configure the module for horizontal mounting	#PSILSET,C,1*36<CR><LF>	Module Return Confirmation
\$PSILSET,S,2*25<CR><LF>	Configure the module for vertical mounting	#PSILSET,C,2*35<CR><LF>	Module Return Confirmation

Activation Information

#F33.6=1*52 After configuring the baud rate or installation mode, send this command to re-initialize and activate the settings.

The installation orientation setting is saved upon power-off, whereas other parameters are not.

Azimuth calibration command

Start command	Response	Remark
#F33.4=0*51<CR><LF>	#F33.4=0*51<CR><LF>	Horizontal start command
#F33.4=1*50<CR><LF>	#F33.4=1*50<CR><LF>	Vertical start (upward)
#F33.4=2*53<CR><LF>	#F33.4=2*53<CR><LF>	Vertical start (downward)
Save command	Response	Remark
#F2FE.2=1*67<CR><LF>	#F2FE.2=1*67<CR><LF>	Horizontal Save Command
#F2FE.2=2*64<CR><LF>	#F2FE.2=2*64<CR><LF>	Vertical Save (Upward)
#F2FE.2=3*65<CR><LF>	#F2FE.2=3*65<CR><LF>	Vertical Save (Downward)