ATO-DCM250B/260B

▸ INTRODUCTION

DCM250B/260B is a low-cost three-dimensional electronic compass, using hard and soft magnetic calibration algorithm, so that the compass can eliminate the influence of magnetic field through the calibration algorithm in the environment with magnetic field interference. The DCM250B&260B integrates a three-axis fluxgate sensor, calculates the heading in real time through the central processor, and uses a three-axis accelerometer to perform heading compensation for a wide range of tilt angles, ensuring that the compass can also provide high accuracy at tilt angles up to ±85° Heading data. The electronic compass integrates high-precision MCU control and diversified output methods. The standard interfaces include RS232/RS485/TTL and other interfaces, and other communication interfaces can be customized.

The DCM250B/260B is small size, low in power consumption, and can be used in many fields such as stable antennas, vehicles, system integration, etc. The high shock resistance and high reliability also make the compass work normally in extremely harsh environments, and is more suitable for today's Precision measurement integrated control system.

▸ MAIN FEATURES

★ Heading accuracy: 0.8°
★ Inclination measurement range: ±85°
★ Inclination resolution: 0.1°
★ Inclination accuracy: 0.2°
★ Temperature range: -40℃～+85℃
★ DC 5V power supply
★ With hard magnetic, soft magnetic and tilt compensation
★ Standard RS232/RS485/TTL output interface

▸ APPLICATION

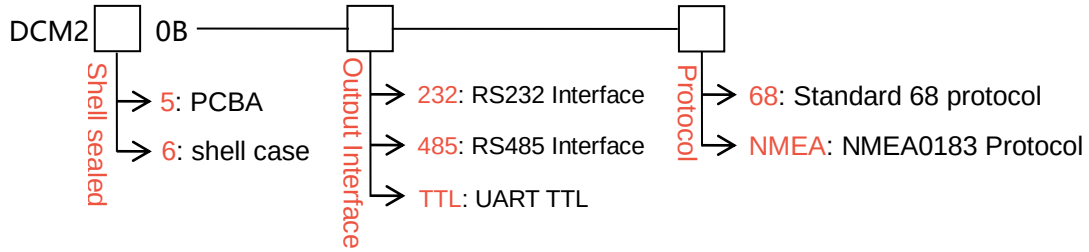
★ Navigation surveying ★ Satellite antenna searching ★ GPS combined navigation
★ Antenna servo control ★ Infrared imager ★ Special occasion robots
★ ROV underwater robot navigation ★ Laser rangefinder
★ Mapping ★ Oceanographic survey instrument

▸ SPECIFICATIONS

DCM250B		Parameters
Compass heading parameters	Heading accuracy	0.8°
	Resolution	0.1°
Compass inclination	Pitch accuracy	0.1°<15°(measure range)
		0.2°<30°(measure range)

parameter		0.3°<60°(measure range)
	Pitch range	±85°
	Rolling accuracy	0.1°<15°(measure range)
		0.2°<30°(measure range)
		0.3°<60°(measure range)
	Roll range	±85°
	Resolution	0.1°
	Tilt compensation angle range	<40°
calibration	Hard iron calibration	Yes
	Soft iron calibration	Yes
	Magnetic field interference calibration method	Rotate horizontally one round (2D calibration)
	PCBA size	L33×W27×H9mm
	RS232/RS485/TTL	PCBA: 4PIN 30cm terminal cable
Interface	Start delay	<50mS
	Output rate	20Hz/s
	Baud rate	2400 to 19200baud
	Output format	Binary high-performance protocol
Power supply	Supply voltage	(default) DC+5V
		(optional) DC 9～36V
	Current (MAX)	45mA
	Ideal mode	35mA
	Sleep mode	TBD
Environment	Operating range	-40℃～+85℃
	Storage temperature	-40℃～+85℃
	Anti-vibration performance	2500g
EMC	According to EN61000 and GBT17626	
MTBF	≥98000 hours/time	
Insulation resistance	≥100MΩ	
Impact resistance	100g@11ms, three direction (half sinusoid)	
Anti-vibration	10grms\10～1000Hz	
Weight	PCBA:≤25g (excluding cable)	

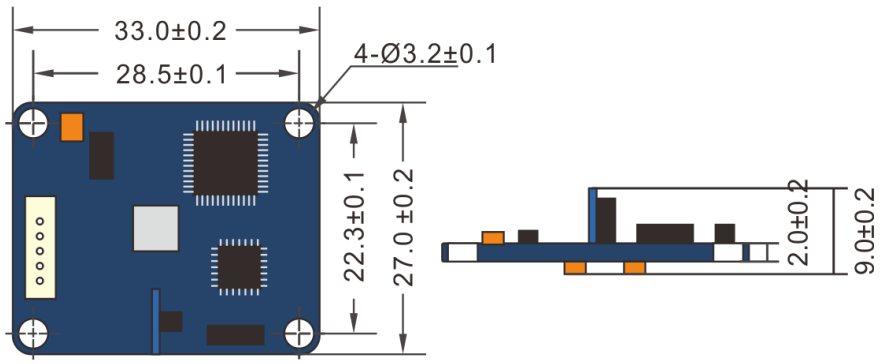
▸ ORDER INFORMATION



E.g.: DCM260B-232-68: Enclosure/RS232 output/Standard 68 protocol.

▸ PRODUCT SIZE

PCBA SIZE

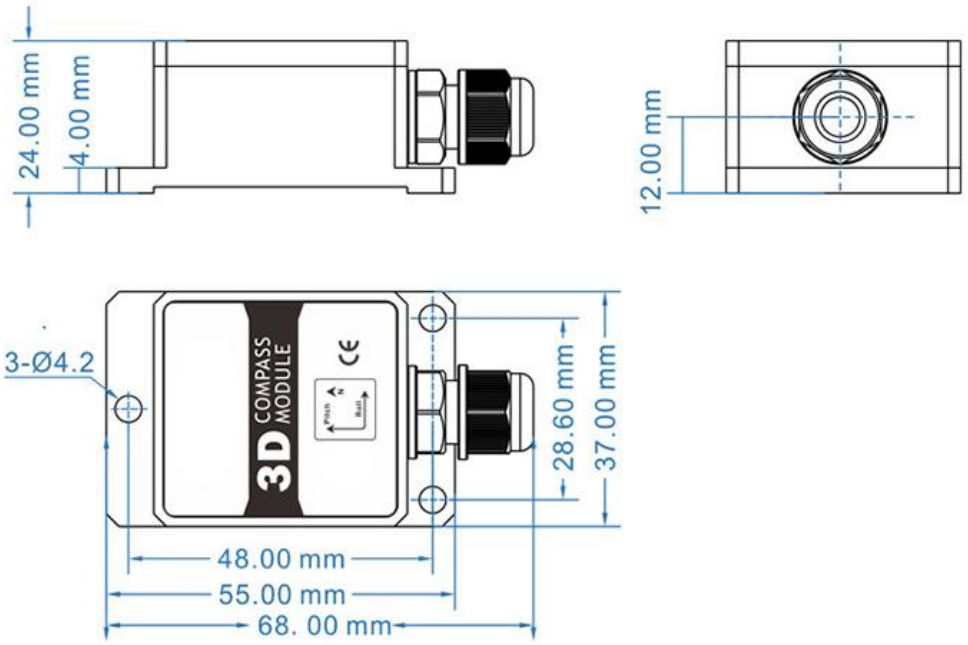


PCBA size: L33×W27×H9mm

Installation size: L28.3×W22.3×H2mm

Ounting screws: 4 M3 screws**(Copper screw)**

SHELL



SIZE

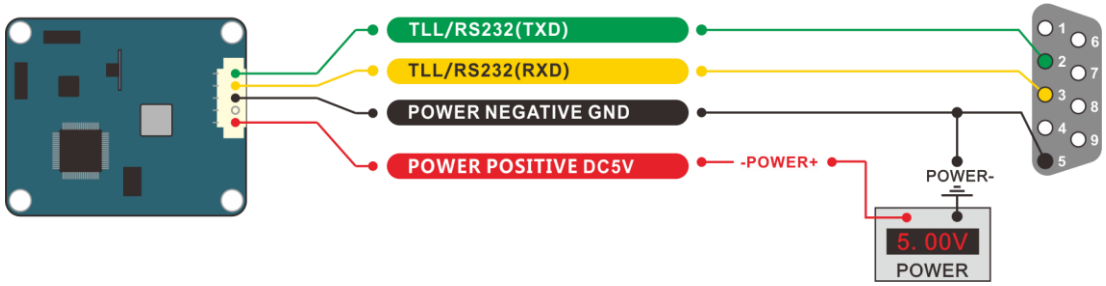
Shell size: L55×W37×H24mm

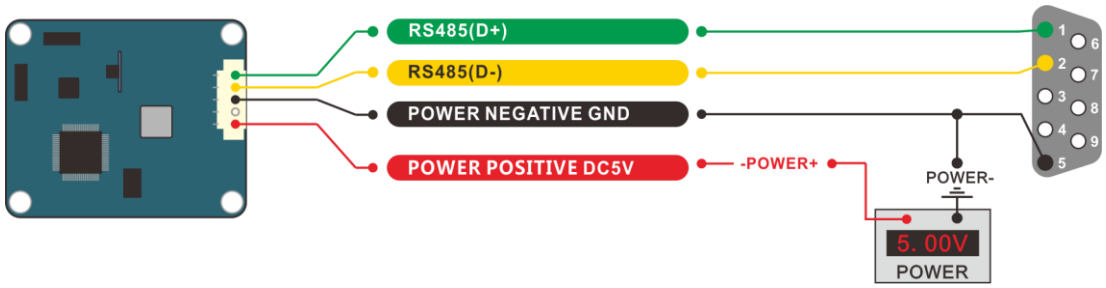
Installation size: L48×W28.6×H4mm

ounting screws: 3 M4 screws**(Copper screw)**

▸ CONNECTION

Color Function	RED	BLACK	YELLOW	GREEN
	DC 5V	GND	RS232(RXD) TTL(RXD) RS485(D-)	RS232(TXD) TTL(TXD) RS485(D+)





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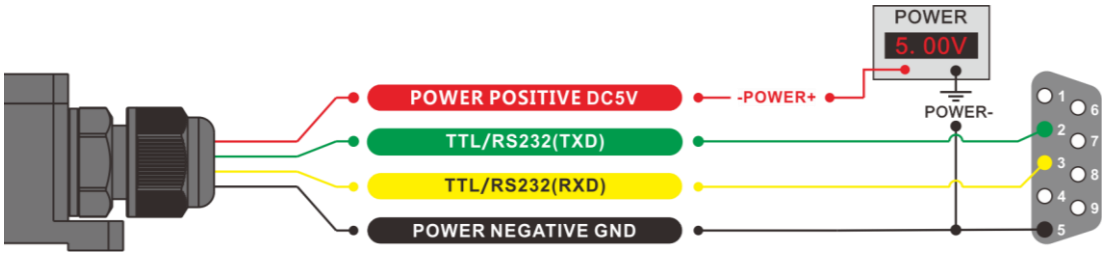
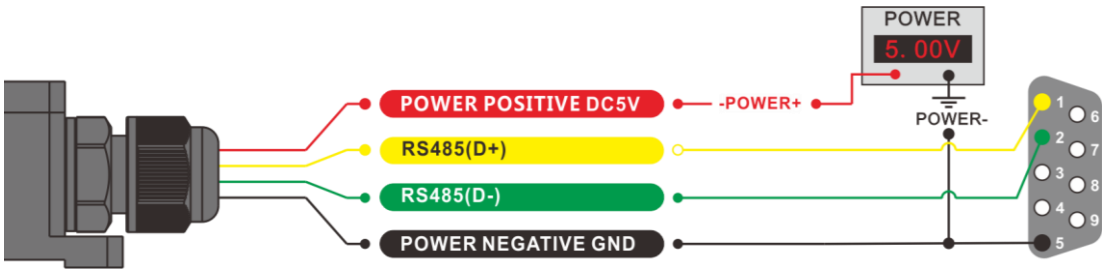




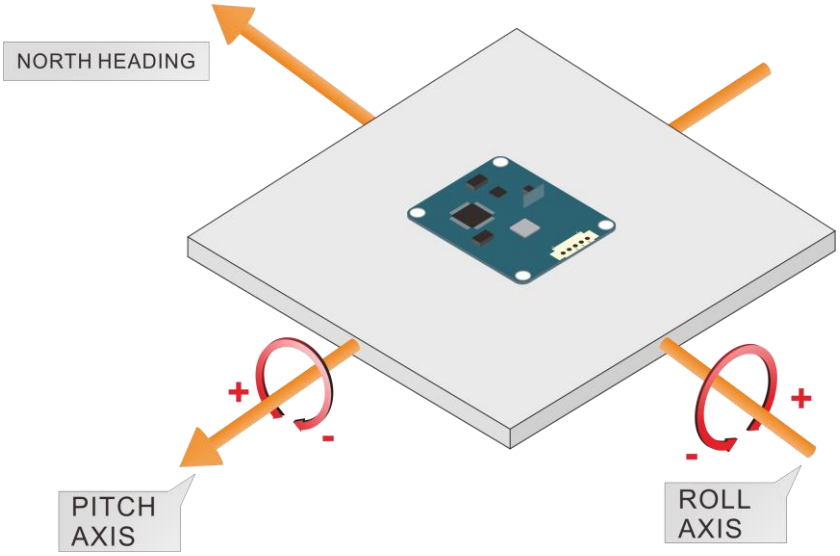
▸ MEASUREMENT AND INSTALLATION

Because the azimuth of the DCM250B&260B three-dimensional electronic compass uses the principle of geomagnetism, it is necessary to choose the environment installation location with the smallest magnetic interference. Please install the product away from iron, magnets, motors and other magnetic objects. Even if there are these magnetic sources around, it needs to be kept away at least 40CM (different magnetic fields have different interference distance). In order to ensure product measurement accuracy, M3 anti-interference copper screws must be used during installation.

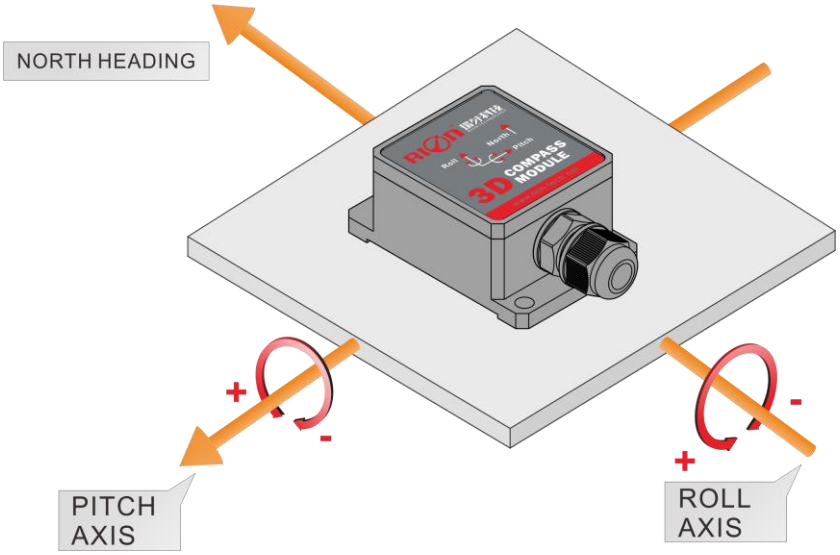
This product can compensate for moderate deviations in a stable magnetic environment, but cannot compensate for changing magnetic interference. Please pay attention to the magnetic field generated by the DC wire, because the magnitude of the magnetic field will change with the DC current. The battery is also a source of interference. Each installation is different and the user must evaluate the installation feasibility under all possible operating environments.

In a non-interference environment, the measured heading accuracy of this product is ≤1°, but scientific test methods are also crucial. Our recommended test method is: install this electronic compass on a vertical aluminum (non-magnetic other material) rod to make heading accuracy measurements (of course the rotating rod is perpendicular to the rotating platform, try to avoid large external magnetic fields interference). Doing so can reduce the radius of compass rotation, scientifically improve the measurement accuracy. This is only to provide laboratory installations, which must be handled flexibly for specific situations. For example: when installed on a car, this product is installed perpendicular to the direction of movement.

DCM250B installation and measurement direction



DCM260B installation and measurement direction



▸ CALIBRATION METHOD

Prerequisites :
1) The accuracy of the test compass does not meet the requirements;
2) There is magnetic field interference in the compass installation environment.
This interference is fixed, and the distance between the interference magnetic field and the compass will not change after installation (for example: the compass is installed on an iron material, because iron will have magnetic field interference, which It is necessary to rotate and calibrate the iron together with the compass, and the iron will not be separated from the compass during use again. Once separated, it needs to be re-calibrated. If the size of the iron is not fixed, or the distance from the compass changes It is not fixed, this kind of interference cannot be calibrated, it can only be installed away from the distance, the safety distance is controlled above 40CM).

1) Use the DCM compass to properly connect to the RS232 communication port and turn on the power.

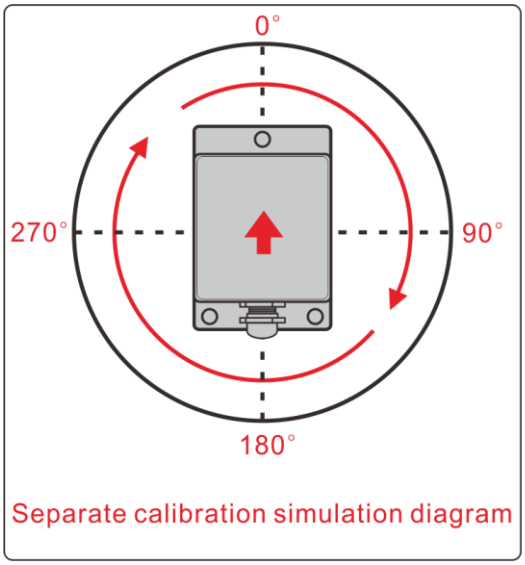
2) Send the calibration start command in hexadecimal format: "68 04 00 08 0C" (or click the "CALI-START" start button of RION 3D debugging software)

3) The DCM compass will return a response command.

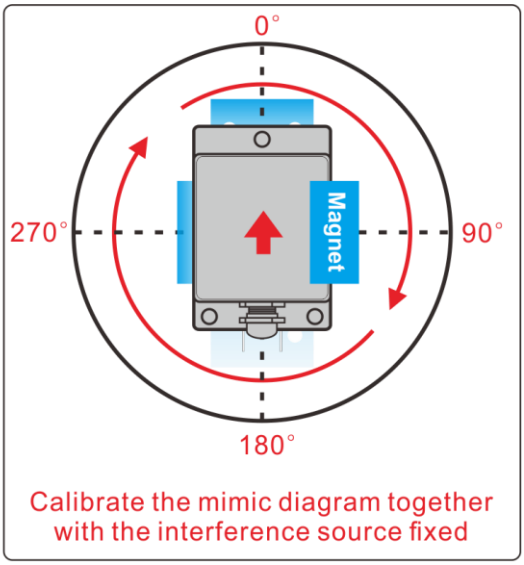
4) Rotate the compass one circle from 0° to 360° in situ to collect the magnetic field data around the compass. (The rotation speed should not be too fast, and it should be more than 40 seconds per circle.)

5) After returning to 0°, send the stop calibration command in hexadecimal format: "68 04 00 0A 0E", the calibration is successful. (or click the "CALI-SAVE" button of RION 3D debugging software)

Note: If the compass is installed in other supporting equipment, which has magnetic interference, please install the compass and rotate it with the supporting equipment to collect the interference data to ensure that the compass can accurately measure.



Separate calibration simulation diagram



Calibrate the mimic diagram together with the interference source fixed

The starting point can be at any point of 360°, and it can rotate more than 1 circle on the spot Within 2 laps, the speed of rotation should be as uniform as possible, not too fast!

▸ COMMUNICATION 68 PROTOCOL

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

Identifier (1byte)	Data length (1byte)	Add. code (1byte)	Commandword (1byte)	Data field	checksum (1byte)
68h					

Identifier: fixed at 68H.

Data length: the length from data length to checksum (including checksum).

Address code: the address of the acquisition module, the default is 00.

The data field changes according to the different content and length of the command word.

Checksum: The sum of data length, address code, command word and data field does not consider carry.

2. Command word analysis

Command	Meaning/ Example	Explanation
0X04	**Read Roll, Pitch, Heading at the same time** **Angle command** **68 04 00 04 08**	Data field (0byte) No data field command
0X84	**Sensor replies** **E.g: 68 0D 00 84 00 10 50 10 10 05 01 04 01 1C**	**DCM250**: data domain（9byte） **AA AB BB CC CD DD EE EF FF** **AA AB BB**:3 red bytes indicate Pitch; **CC CD DD**:3 blue bytes indicate Roll; **EE EF FF**:3 green bytes indicate Heading; **AA AA BB** are returned angle value of Pitch，is compress BCD code. **00 10 50** The three red bytes are the angle value returned by Pitch, which is the compressed BCD code. The high-order 0 of the first byte is the sign bit (0 is positive, 1 is negative). 01 0 is a three-digit integer value, and 50 is a two-digit decimal value. The analysis method of other axis data is the same, the pitch angle is +10.50°; **10 10 05** The three blue bytes are the return value of Roll, and the parsing method is the same as that of Pitch, the analytical angle is Roll: -010.05°; **01 04 01** Green three-byte Heading return value, the parsing method is the same as Pitch, and the parsing angle is Heading: +104.01°.
0X84	**Sensor replies** **E.g: 68 0D 00 84 00 10 50 10 10 05 01 04 01 1C**	**DCM260**:data domain（9byte） **AA AB BB CC CD DD EE EF FF** **AA AB BB**:3 red characters represent the Roll; **CC CD DD**:3 blue characters represent the pitch; **EE EF FF**:3 green characters for Heading angle; **AA AA BB**:Returns the angle value for Roll, the compressed BCD code; **00 10 50** The three red bytes are the angle value returned by Roll, which is the compressed BCD code. The high-order 0 of the first byte is the sign bit (0 is positive, 1 is negative). 01 0 is a three-digit

		integer value, and 50 is a two-digit decimal value. The analysis method of other axis data is the same, and the Roll angle is analyzed as +10.50°; **10 10 05** The three blue bytes are the return value of Pitch, the parsing method is the same as that of Roll, the analytical angle is Pitch:-010.05°; **01 04 01** Green three-byte Heading return value, the parsing method is the same as Pitch, and the parsing angle is Heading: +104.01°.
0X06	**Set magnetic declination command** ***68 06 00 06 02 08 16***	Data field（2byte） SA AB S is the sign 0 positive 1 negative AA: two integers, B: a decimals E.g: 02 08 is +20.8°
0X86	**Sensor response reply E.g: 68 05 00 86 00 8B**	Data field (1byte) The number in the data field indicates the result of the sensor response 00:setting successfully FF:setting failed
0X07	**Read magnetic declination command** ***68 04 00 07 0b***	Data field (0byte) No data field command
0X87	**Sensor response reply E.g: 68 06 00 87 02 08 97**	Data field (2byte) The number in the data field indicates the result of the sensor response
0X08	**Start calibration command** ***68 04 00 08 0C***	Data field (0byte) No data field command
0X88	**Sensor response reply E.g: 68 05 00 88 00 8D**	Data field (1byte) The number in the data field indicates the result of the sensor response 00:Start success FF:start failure
0X0A	**Save calibration command 68 04 00 0A 0E**	Data field (0byte) No data field command
0X8A	**Sensor response reply command E.g: 68 05 00 8A 00 8F**	Data field (1byte) The number in the data field indicates the result of the sensor response 00:setting successfully FF:setting failed
0X0B	**Set communication baud rate command** ***68 05 00 0B 02 12***	Data field (1byte) Baud rate:00 means 2400 01 means 4800 **02 means 9600(default)** 03 means 19200 04 means 38400 05 means 115200
0X8B	**Sensor response reply command E.g: 68 05 00 8B 00 90**	Data field (1byte) The number in the data field indicates the result of the sensor response 00:setting successfully FF:setting failed
0X0F	**Set module address command** ***68 05 00 0F 01 15***	Data field (1byte) XX module address, the address ranges from 00 to EF. Note: Our products have a unified address: **FF. If you forget the address you set during the**

		operation, you can use the FF address to operate the product and it will respond normally.
0X8F	**Sensor response reply command** **E.g: 68 05 00 8F 00 94**	Data field (1byte) The number in the data field indicates the result of the sensor response 00:setting successfully FF:setting failed
0X0C	**Set angle output mode** **68 05 00 0C 00 11**	Data field (1byte) 00: Q&A 01: Automatic output type Factory default: Q&A
0X8C	**Sensor response reply command** **E.g: 68 05 00 8C 00 91**	Data field (1byte) The number in the data field indicates the result of the sensor response 00:setting successfully FF:setting failed

▸ NMEA0183 COMMUNICATION PROTOCOL

Communication NMEA0183（ASCII）

Baud rate 4800 \9600\19200, could set(default as 19200, one start bit + 8 data bit+non-parity +1 stop bit)

Data protocol

Communicate use NMEA special sentence (ASCII).

After power on module, baud rate is 19200 as default and 0 data output.

During operation, compass output sentence as below:

$PTNTHPR,X.X,A,X.X,A,X.XA*hh<cr><lf>

Heading ,pitch,roll

Set data refresh rate

Command	Description
#BAD=0*4A<CR><LF>	set 0-readouts per minute
#BAD=1*4B<CR><LF>	set 1-readout per minute
#BAD=2*48<CR><LF>	set 2-readouts per minute
#BAD=3*49<CR><LF>	set 3-readouts per minute
#BAD=4*4E<CR><LF>	set 6-readouts per minute
#BAD=5*4F<CR><LF>	set 12-readouts per minute
#BAD=6*4C<CR><LF>	set 20-readouts per minute
#BAD=7*4D<CR><LF>	set 30-readouts per minute
#BAD=8*42<CR><LF>	set 60-readouts per minute
#BAD=9*43<CR><LF>	set 120-readouts per minute
#BAD=10*7B<CR><LF>	set 180-readouts per minute
#BAD=11*7A<CR><LF>	set 300-readouts per minute

Baud rate set command

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

Activation message

#F33.6=1*52 When the baud rate is set, send this command to reset and activate.

Heading angle calibration command

#F33.4=0*51<CR><lf>	#F33.4=0*51<CR><lf>	Horizontal command
#F2FE.2=1*67<CR><lf>	#F2FE.2=1*67<CR><lf>	Horizontal command

Power off save function (This command takes effect only before the setting of baud rate and frequency)

Start command		
#BA6S=1*6A	#BA6S=1*6A	send the command, the setting for baud rate and output rate will be saved after power off
#BA6S=0*6B	#BA6S=0*6B	send the command, the setting for baud rate and output rate will be invalid after power off