RION TECH

CE RoHS

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CE certification:ATSZAHE19122300 2
RoSH certification: 18300RC2041080 1

V1.9

HIGH ACCURACY 3D DIGITAL COMPASS

HCM370B/HCM375B-N

Technical Manual

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○ RoHS certification: 18300RC20410801
○ China National Intellectual Property Appearance Patent (Patent No.: ZL201730609573.9)
○ Revision time:2023-9-21
Note: Product functions, parameters, appearance, etc. will be adjusted as the technology upgrades. Please contact our pre-sales business to confirm when purchasing.

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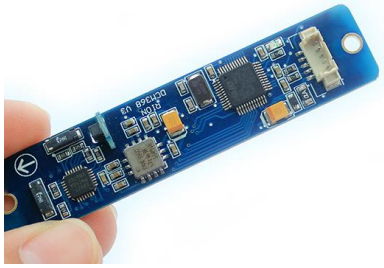
HCM370B/375B-N HIGH ACCURACY 3D DIGITAL COMPASS



HCM SERIES HIGH ACCURACY
3D DIGITAL COMPASS

INTRODUCTION

The HCM370B/HCM375 B-N is a high-precision three-dimensional compass with high resolution, strong noise immunity and stable temperature offset. It uses advanced hard and soft iron calibration algorithms and uses high-precision accelerometers for tilt compensation, so that its roll angle can provide high-precision heading information at any tool face of 360 °. In the environment with fixed interference, this product can still maintain a high measurement accuracy.

Long strip volume with a width of only 1.95 CM. Reaching IP67 waterproof grade, it is more suitable for drilling measurement. It has the characteristics of small size and low power consumption, and can be quickly and conveniently integrated into various products. The product can be ordered with complete packaging products or circuit boards.

This product integrates a three-axis magnetic field sensor and a three-axis acceleration sensor, calculates the course data in real time through an industrial single-chip microcomputer with high reliability and strong anti-interference capability, and uses a three-axis accelerometer to compensate the course for a wide range of tilt angles, which is a product with high performance and stability. With small size and low power consumption, it is widely used in handheld devices, mobile devices, antenna stabilization, vehicles, system integration and many other fields.

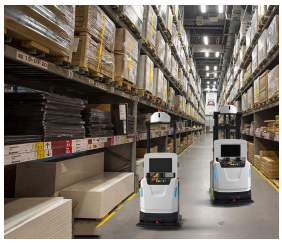
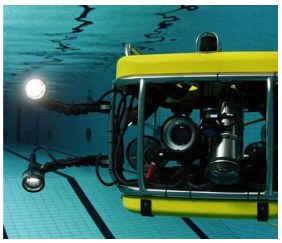
MAIN FEATURE

★ Heading Accuracy: 0.5°
★ Tilt Resolution: 0.1°
★ Working Temp.: -40℃~+85℃
★ With Hard And Soft Magnetic Calibration
★ Roll Measure Range:±180°
★ Tilt Accuracy: <0.2°(Full Range)
★ Dimension: L111.5×W19.5×H19.5mm
★ Rs232/Rs485/Ttl Output

APPLICATION

★ Satellite antenna search satellite
★ GPS integrated navigation
★ Infrared imager
★ Map for plotter
★ Oceanography measurement instruments
★ Marine navigation surveying and mapping
★ Antenna servo control
★ Laser range finder
★ ROV underwater robot navigation

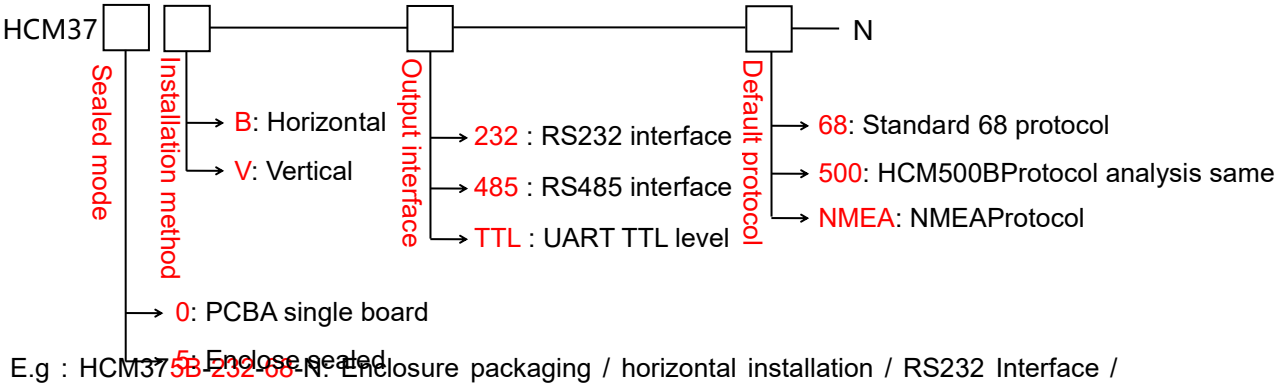


▶ PRODUCT PARAMETERS

HCM370B / HCM375B-N		Parameter
Heading	Heading Accuracy	0.5°
	Resolution	0.1°
Compass inclination parameter	Pitch Accuracy	0.1°<15°(Measure Range)
		0.1°<30°(Measure Range)
		0.1°<60°(Measure Range)
		0.2°<85°(Measure Range)
	Pitch Range	±85°
	Roll Accuracy	0.1°<15°(Measure Range)
		0.1°<30°(Measure Range)
		0.1°<60°(Measure Range)
		0.2°<180°(Measure Range)
	Roll Range	±180°
	Resolution	0.1°
Calibration	Hard Magnetic Calibration	Available
	Soft Magnetic Calibration	Available
	Magnetic Filed Interference Calibration Method	Rotate 360° Horizontally; Vertical Rotation(Optional)
Physical properties	PCBA size	L76×W16.5×H9.3mm
	PCBA weight	≤ 10g (excluding terminal wire)
	PCBA terminal line	30cm terminal wire
	Housing package size	L111.5×W19.5×H19.5mm
	Housing package weight	≤ 85g (excluding cable)
	Housing connector cable	Standard 1 m 5 PIN aerial connector cable
	Output interface	RS232/RS485/TTL (Optional)
Interface	Start Delay	<50ms
	Max Output Rate	20Hz/s
	Communication Rate	2400 to 115200baud (default 9600)
	Output Format	Binary High Performance Protocol
Power Supply	Power Voltage	(Default)DC+5V
	Current(Max)	30ma
	Ideal Current	26ma
	Sleep Mode	TBD
Environment	Working Temp.	-40℃~+85℃
	Storage Temp.	-40℃~+85℃
	Anti-Shock Performance	100g
	Protection Level	IP67
Electromagnetic compatibility	According TO EN61000 and BT17626	
MTBF	≥98000 Hour/Time	
Insulation Resistance	≥100MΩ	
Anit-Impact	100g@11ms、3 Axial Direction (Half Sinusoid)	
Anti-Shock	10grms、10～1000Hz	

PRODUCT ORDERING INFORMATION



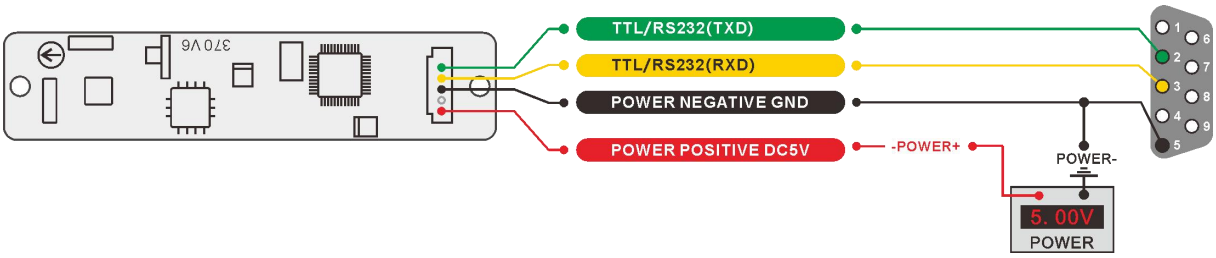
E.g : HCM375B-232-68-N: Enclosure packaging / horizontal installation / RS232 Interface / Standard 68 protocol.

ELECTRICAL CONNECTION

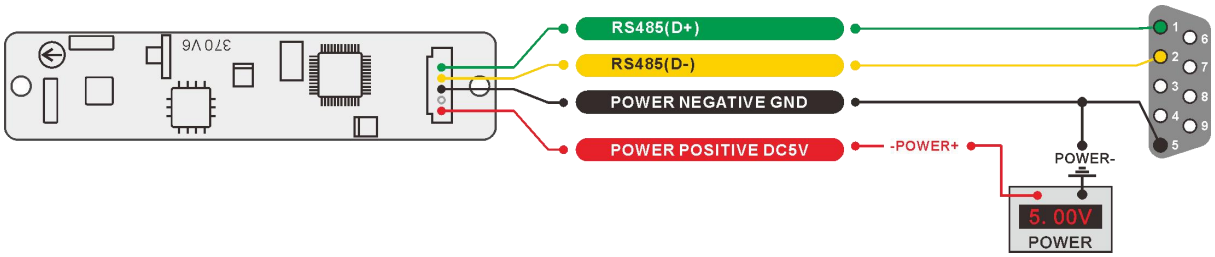
HCM370B Single Board 232/TTL Output Wiring Definition

Cable Color Definition	BLACK	RED	YELLOW	GREEN
	GND Power negative	DC 5V Power positive	TTL/RS232(RXD) OR RS485(D-)	TTL/RS232(TXD) OR RS485(D+)

HCM370B Single Board RS 232/TTL Output Wiring Diagram

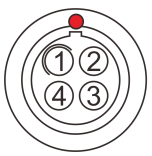


HCM370B Single Board RS485 Output Wiring Diagram

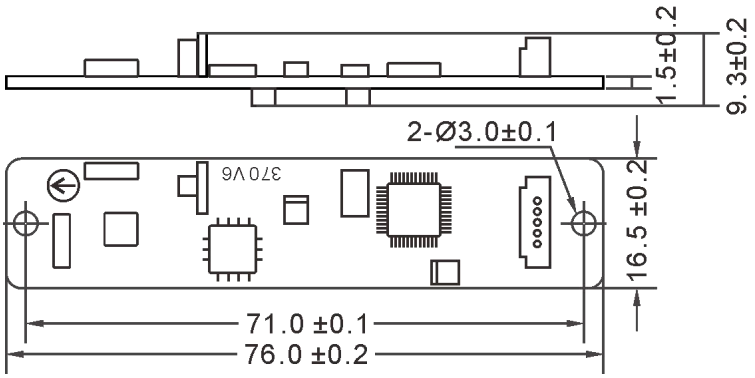


HCM375B Wiring Definition

Cable Color Definition	BLACK	PINK	BLUE	BROWN
	GND Power negative	RS232(RXD) OR RS485(D+)	RS232(TXD) OR RS485(D-)	DC 5V Power positive



PCBA SIZE

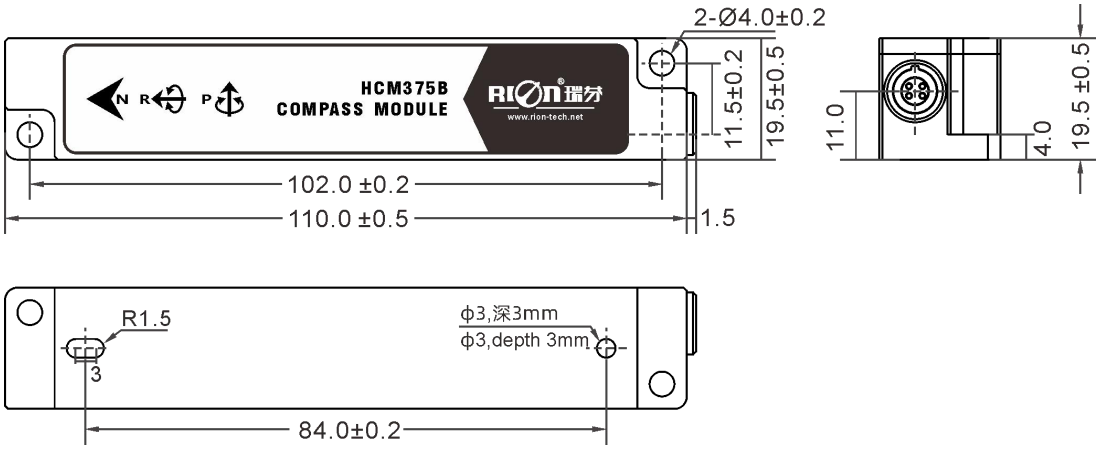


PCBA board size: L76 × W16.5 × H 9.3mm

Installation size: L71 × H1.5mm

Mounting screws: 2 M3 screws(Copper screw)

HOUSING PACKAGE SIZE



Housing package: L111.5 × W19.5 × H19.5mm

Installation size: L102 × W11.5 × H4mm

Mounting screws: 2 M4 screws(Copper screw)

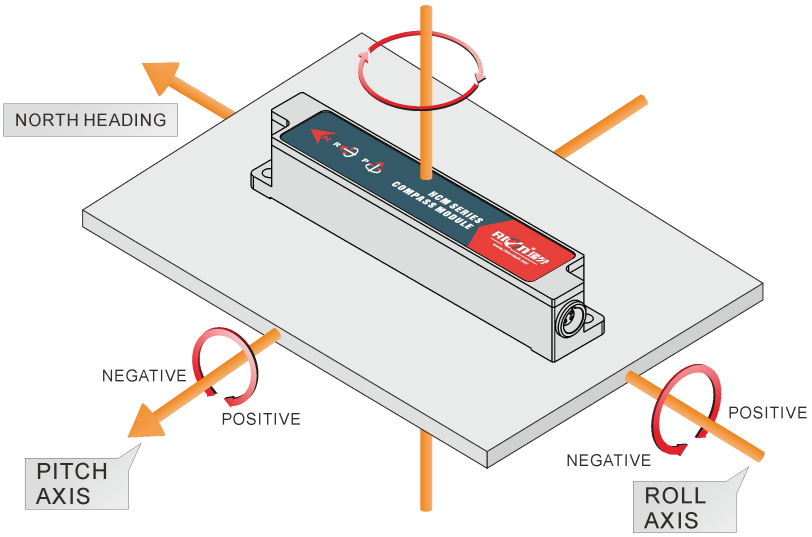
MEASURING DIRECTIONS&FIX

HCM370B-HCM375B 3D electronic compass azimuth is using geomagnetic principle, so it is very important to select a minimum magnetic interference environment for installation positon. Please place and install the it away from the iron, magnets, engines and other magnetic objects as much possible as you can. Need control over 30CM distance(different magnetic interfere with the compass in different distance) at least even there are these magnetic medium around . In order to ensure the measurement accuracy of the product, M3 anti-interference copper screws must be used during installation.

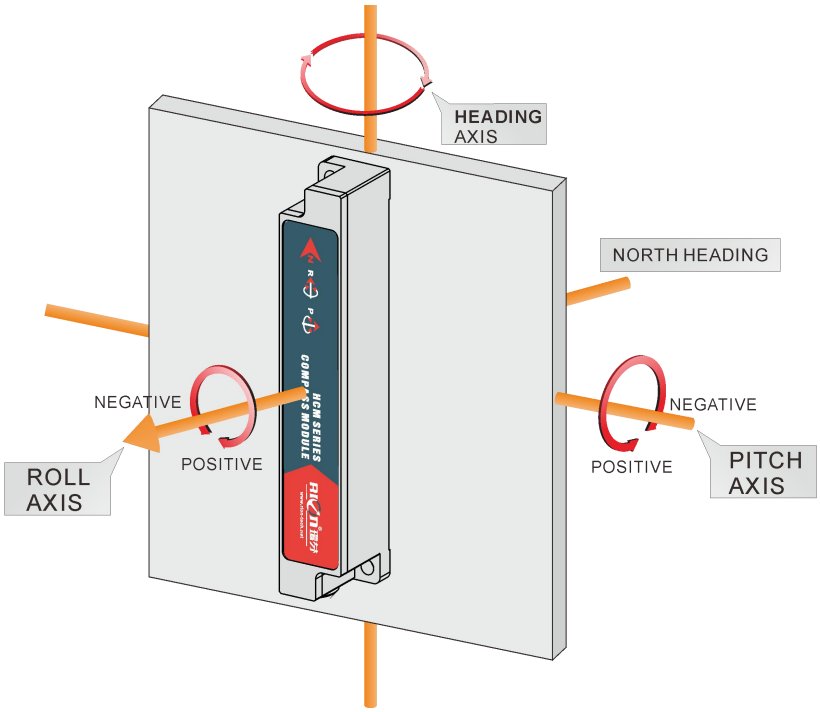
Although it can compensate the moderate deviation in the stable magnetic environment, but it can not compensate the changed magnetic interference. Please pay much attention to the wire with DC will generates a magnetic field , because if the DC change then the magnetic field will also change in size . The battery also is another interference source of changing . Each installation is different, and the user must evaluate the feasibility of installation under all possible operating environment.

The optimal heading accuracy of it can reach 0.3°~0.5°, this undergo a rigorous validation

indisputable, the most scientific test method is equally crucial. The test method we recommend is: Please install the electronic compass to a vertical and erect aluminum pole (non-magnetic material), then proceed with heading accuracy measurement (of course the rotating rod perpendicular to the rotating platform, as much as possible to avoid large external magnetic field interference). Doing so can reduce the compass turning radius, to scientifically improve the measurement accuracy. This is just to provide the installation of the laboratory, must be flexible to deal with the specific situation.E.g: is mounted in the car, HCM505B should do its installation in the perpendicular to the movement direction.



Horizontal Installation Diagram



Vertical Installation Diagram

CALIBRATION METHOD

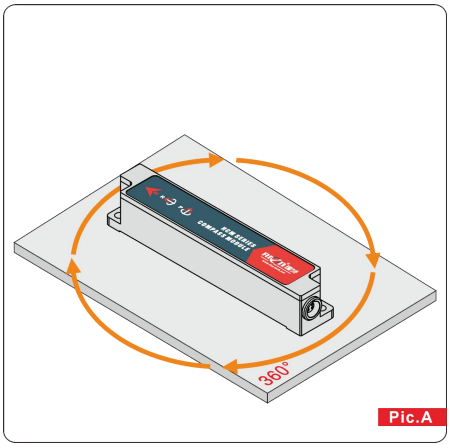
Calibration prerequisite:
1) The accuracy of testing compass can not reach the requirements;
2) compass installation environment have magnetic interference, the interference is fixed, and the interference magnetic field and compass installation will not happen again in distance changes (example: compass to be installed above an iron material, because the iron will have magnetic interference, at this time then need to rotate and calibrate the iron and compass, and the iron and compass will not be separated when using , once they are separated then need to recalibrate. If the iron size is not fixed, or with a compass distance change is not fixed, the interference can not be calibrated,only can install it in a very far away , safe distance control in above 30cm).

Horizontally Install Calibration Mode:

Connect the DCM compass to the RS232 communication port and turn on the power.

1) Plane rotation - 360° or more:Figure A

Horizontal start calibration command

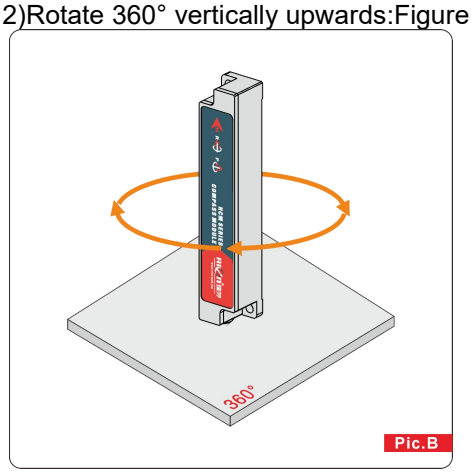


Pic.A

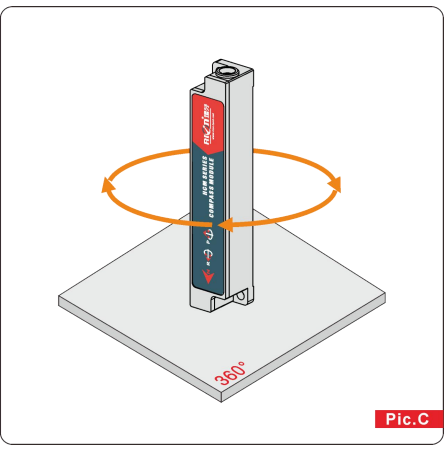
68 04 00 41 45
Data field (0byte)
Horizontal rotate for more than 1 revolution at a constant speed, the guaranteed time is above 20s. The value saved above 20s is valid, and the value saved below 20s is invalid.
Save calibration commands horizontally
68 04 00 51 55
Data field (0byte)
No data field command

2)Rotate 360° vertically upwards:Figure B

Start calibration command vertically upwards
68 04 00 42 46
Data field(0byte)
North facing sky, rotate vertically for more than 1 revolution at a constant speed, the guaranteed time is above 20s. The value saved above 20s is valid, and the value saved below 20s is invalid.
Save calibration commands vertically upwards
68 04 00 52 56
Data field (0byte)
No data field command



Pic.B



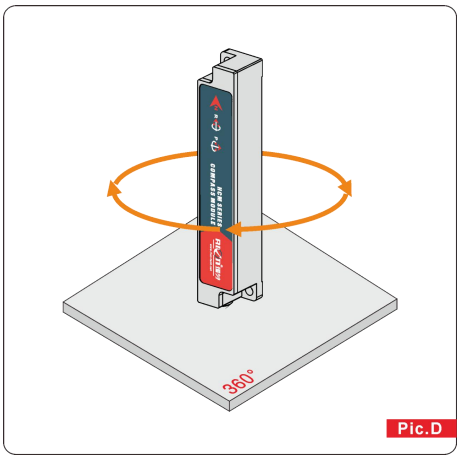
Pic.C

3)Rotate 360° vertically downwards:Figure C
Start calibration command vertically downwards
68 04 00 43 47
Data field(0byte)
North facing the ground,rotate vertically for more than 1 revolution at a constant speed, the guaranteed time is above 20s. The value saved above 20s is valid, and the value saved below 20s is invalid.
Save calibration commands vertically downwards
68 04 00 53 57
Data field(0byte)
No data field command

Vertical Installation Calibration Mode:

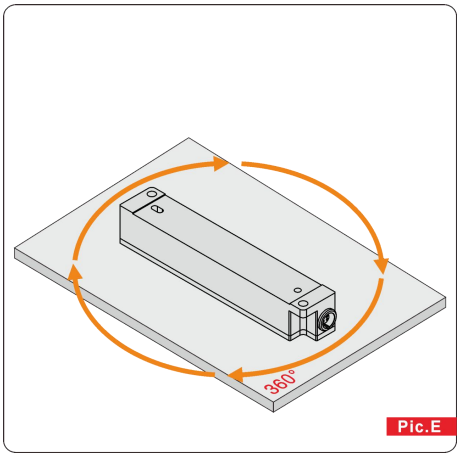
Connect the DCM compass to the RS232 communication port and turn on the power.

1) Plane rotation - 360° or more:Figure D



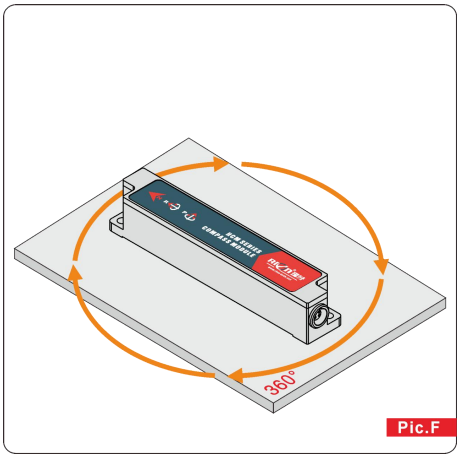
Horizontal start calibration command
68 04 00 41 45
Data field(0byte)
Horizontally rotate more than 1 revolution at a constant speed，the guaranteed time is above 20s. The value saved above 20s is valid, and the value saved below 20s is invalid.
Save calibration commands horizontally
68 04 00 51 55
Data field(0byte)
No data field command

2)Rotate 360° vertically upwards:Figure E



Start calibration command vertically upwards
68 04 00 42 46
Data field(0byte)
North facing sky, rotate vertically for more than 1 revolution at a constant speed，the guaranteed time is above 20s. The value saved above 20s is valid, and the value saved below 20s is invalid.
Save calibration commands vertically upwards
68 04 00 52 56
Data field(0byte)
No data field command

3)Rotate 360° vertically downwards:Figure F



Start calibration command vertically downwards
68 04 00 43 47
Data field(0byte)
North facing the ground,rotate vertically for more than 1 revolution at a constant speed, the guaranteed time is above 20s. The value saved above 20s is valid, and the value saved below 20s is invalid.
Save calibration commands vertically downwards
68 04 00 53 57
Data field (0byte)
No data field command

RION 68 COMMUNICATION PROTOCOL

Ⅰ. DATA FRAME FORMAT(8 Bits Date,1 Bit Stop,No Check,Default Baud Rate 9600)

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain	Check sum (1byte)
68					

Number format: hexadecimal;

Designator: fixed at 68 H;

Data length: from data length to checksum (including the length of checksum);

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

And that data field is correspondingly Chan according to different content and lengths of the command words;

Checksum: The sum of the data length, address code, command word, and data field without regard to carry.

For example: Send query command 68 04 00 04 08

Checksum calculation method 04 + 00 + 04 = 08

Ⅱ. Command word parsing

1.Read Pitch, Roll, Heading instructions simultaneously: Command word 04H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain	Checksum (1byte)
68H	04H	00H	04H	None	08H

Sensor reply Pitch, Roll, Heading: Command word 0X84

(select the reply of standard protocol)

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (10byte)	Checksum (1byte)
68H	0EH	00H	84H	00 10 50 10 10 05 01 04 01 00	1DH

Data domain(10byte):

AA AB BB CC CD DD EE EF FF GG;

AA AB BB:Three red characters represent the return value of the Pitch axis;

CC CD DD:The 3 blue characters represent the return value of the Roll axis;

EE EF FF:The 3 green characters represent the return value of the heading angle;

E.g:00 10 50 The three **red** bytes are the Pitch return value, which is the compressed BCD code. The upper four bits of the first byte, **0**, are the sign bits (0 positive, 1 negative). **01 0** is a three-bit integer value, and **50** is a two-bit decimal value. The other axis data are analyzed in the same way, and the pich angle is analyzed as + 10.50°.;

10 10 05 The three **blue** bytes are the return value of Roll, the parsing method is the same as Pitch, and the parsing angle is Roll: -010.05°;

01 04 01 The three **green** bytes are the return value of Heading, the parsing method is the same as Pitch, and the parsing angle is Heading:+ 104.01°;

GG:When the magnetic field exceeds the threshold value, it is 1, and when it does not exceed the threshold value, it is 0. (Multipoint calibration byte is invalid)

Sensor reply Pitch, Roll, Heading: Command word 84H **(select reply of 500 protocol)**

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (9byte)	Checksum (1byte)
68H	0DH	00H	84H	00 10 50 10 10 05 01 04 01	1CH

Data domain(9byte):

AA AB BB CC CD DD EE EF FF;

AA AB BB:Three red characters represent the return value of the Pitch axis;

CC CD DD:The 3 blue characters represent the return value of the Roll axis;

EE EF FF:The 3 green characters represent the return value of the heading angle;

E.g:00 10 50 The three **red** bytes are the Pitch return value, which is the compressed BCD code. The upper four bits of the first byte, **0**, are the sign bits (0 positive, 1 negative). **01 0** is a three-bit integer value, and **50** is a two-bit decimal value. The other axis data are analyzed in the same way, and the pich angle is analyzed as + 10.50 °.;

10 10 05 The three **blue** bytes are the return value of Roll, the parsing method is the same as Pitch, and the parsing angle is Roll: -010.05°;

01 04 01 The three **green** bytes are the return value of Heading, the parsing method is the same as Pitch, and the parsing angle is Heading:+ 104.01°.

2. Set Declination Command: Command Word 06H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (2byte)	Checksum (1byte)
68H	04H	00H	06H	02H 08H	16H

Data domain(2byte):SA AB

S is the symbol 0 plus 1 minus AA: two-digit integer, B: one-digit decimal

E.g:02 08:+20.8°

Sensor reply reply: Command word 86H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	04H	00H	86H	00H	8BH

Data domain(1byte)

The number in the data field indicates the result of the sensor respond

00:Setup succeeded FF:Setup failed

3. Read declination command: Command word 07H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	07H	None	0BH

Data domain(0byte)

No data domain command

Sensor reply reply: Command word 87H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (2byte)	Checksum (1byte)
68H	06H	00H	87H	02H 08H	97H

Data domain(2byte)

SA AB

S is the symbol 0 plus 1 minus AA: two-digit integer, B: one-digit decimal

E.g:02 08:+20.8°

The number in the data field indicates the result of the sensor respond

4. Horizontal start calibration command: command word 41H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	41H	None	45H

Data domain(0byte)

When rotating more than one circle at a constant horizontal speed, the storage value is valid only when the guarantee time is more than 20s, and the storage value is invalid when the guarantee time is less than 20s.

Sensor reply reply: Command word 41H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	41H	None	45H

Data domain(0byte)

No data domain command

5. Horizontal Save Calibration Command: command word 51H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	51H	00H	55H

Data domain(0byte)

No data domain command

Sensor reply reply: Command word 51H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	51H	00H	55H

Data domain(0byte)

No data domain command

6. Vertical Up Start Calibration Command: command word 42H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	42H	None	46H

Data domain(0byte)

The storage value is valid only when the vertical uniform rotation of the north sky is more than

1 circle and the guarantee time is more than 20s, and the storage value is invalid when the guarantee time is less than 20s.

Sensor reply reply: Command word 42H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	42H	None	46H

Data domain(0byte)

No data domain command

7. Save the calibration command vertically upward: command word 52H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	52H	None	56H

Data domain(0byte)

No data domain command

Sensor reply reply: Command word 52H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	52H	None	56H

Data domain(0byte)

No data domain command

8. Vertical Down Start Calibration Command: command word 43H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	43H	None	47H

Data domain(0byte)

Rotate north to the ground at a constant vertical speed for more than one circle, and ensure that the storage value is valid only when the time is more than 20s, and the storage value is invalid when the time is less than 20s.

Sensor reply reply: Command word 43H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	43H	None	47H

Data domain(0byte)

No data domain command

9. Save calibration command vertically downward: command word 53H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	53H	None	57H

Data domain(0byte)

No data domain command

Sensor reply reply: command word 53H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	53H	None	57H

Data domain(0byte)

No data domain command

10. Clear calibration command: command word 5AH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	5AH	None	5EH

Data domain(0byte)

Must be sent 3 times to be valid (clear current calibration data, factory calibration data will not be overwritten)

Sensor reply reply: command word 5aH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (0byte)	Checksum (1byte)
68H	04H	00H	5aH	None	5eH

Data domain(0byte)

No data domain command

11. Recover factory commands: command word 0BH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	0EH	AAH	BDH

Data domain(1byte)

Recall factory defaults (current calibration data overwritten)

Sensor reply reply: command word 0EH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	8EH	00H	93H

Data domain(1byte)

00:Success FF:Failure

12. Set Communication Baud Rate Command: command word 0BH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	0BH	02H	12H

Data domain(1byte)

Baud rate: default value: 9600

00:2400 01:4800 **02:9600**

03:19200 04:38400 05:115200

Sensor reply reply: command word 8BH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	8BH	00H	90H

Data domain(1byte)

00:Success FF:Failure

13. Set Module Address Command: Command Word 0FH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	0FH	01H	15H

Data domain(1byte)

XX module address, address from 00 to FEH.

Note: The unified address of our products is FF. If you forget the address during the operation, you can use the FF address to operate the product, and it can still respond normally.

Sensor reply reply: command word 8FH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	8FH	00H	94H

Data domain(1byte)

The number in the data field indicates the result of the sensor respond

00:Success FF:Failure

14. Set Angle Output command: command word 0CH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	0CH	00H	11H

Data domain(1byte)

00:Question and answer style 01:Automatic output type 20Hz

02:Automatic output type5Hz 03:Automatic output type 10Hz

04:Automatic output type 25Hz 05:Automatic output type 50Hz

Factory default: Q & A

Sensor reply reply: command word 8CH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	8CH	00H	91H

Data domain(1byte)

The number in the data field indicates the result of the sensor respond

00:Success FF:Failure

15. Command for setting geomagnetic judgment threshold: command word 50H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	50H	01H	56H

Data domain(1byte)

Value range of BYTE4: 1 ~ 10. If it is greater than the threshold value, it is judged as interference and saved in case of power failure. The factory default setting 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

The other values are 4:0.44/1.4~0.44*1.4

Sensor reply reply: command word D0H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	D0H	00H	D5H

Data domain(1byte)

The number in the data field indicates the result of the sensor respond

00:Success FF:Failure

16. Set installation mode command: Command word 2AH (set vertical)

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	2AH	01H	30H

Data domain(1byte)

00:Horizontal installation 01:Vertical installation

Recalibration is required after changing the installation mode.

Sensor reply reply: command word AAH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	AAH	00H	AFH

Data domain(1byte)

00:Success FF:Failure

16-1. Set installation mode command: Command word 2AH (set horizontal)

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	2AH	00H	2FH

Data domain(1byte)

00:Horizontal installation 01:Vertical installation

Recalibration is required after changing the installation mode.

Sensor reply reply: command word AAH

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	05H	00H	AAH	00H	AFH

Data domain(1byte)

00:Success FF:Failure

Read Accelerometer Command: Command Word 60H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	04H	00H	60H	None	64H

Data domain(0byte)

Sensor reply reply: command word E0H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (9byte)	Checksum (1byte)
68H	0DH	00H	E0H	00 00 01 10 00 00 00 01 02	01H

Data domain(9byte)

Parse three bytes to represent an axis

AA AB BB CC CD DD EE EF FF

AA AB BB Represents a X-axis Acceleration

CC CD DD Represents a Y-axis Acceleration

EE EF FF Represents a Z-axis Acceleration

In the left example, X-axis acceleration = 0.01g, Y-axis acceleration = -0g, and Z-axis acceleration = 1.02g

The first byte high 4 bits is sign bit.

The first byte low 4 bits is hundreds.

The second byte high 4 bites are tens.

The second byte low 4 bites are ones.

The third byte high 4 bits are tenths.

The third byte low 4 bits are percentile.

17. Read magnetometer command: command word 61H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (1byte)	Checksum (1byte)
68H	04H	00H	61H	None	65H

Data domain(0byte)

Sensor reply reply: command word E1H

Identifier (1byte)	Data length (1byte)	Address Code (1byte)	Command word (1byte)	Data domain (9byte)	Checksum (1byte)
68H	0DH	00H	E1H	00 04 15 10 31 48 00 12 93	35H

Data domain(9byte)

AA AB BB CC CD DD EE EF FF

AA AB BB Represents a X-axis magnetometer

CC CD DD Represents a Y-axis magnetometer

EE EF FF Represents a Z-axis magnetometer

In the left example, the X-axis magnetometer = 415, the Y-axis magnetometer = -3148, and the Z-axis magnetmeter = 1293 (75LSB/uT)

NMEA0183 COMMUNICATION PROTOCOL

Baud rate 4800 \ 9600 \ 19200 can be set

(default is 19200, 1start bit, 8 data bits, no parity, 1stop bit)

Data Protocol Communication uses NMEA proprietary statements (ASCII).

After the module is powered on, the default baud rate is 19200 and the data output is 0.

In operation, Compass outputs the following statement

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

Heading ,pitch,roll

Set Data Refresh Rate

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

Baud Rate Set Command

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

Installation Mode

Command	Description	Response	Description
$PSILSET,S,1*26	Set horizontal install	#PSILSET,C,1*36	Module back confirm
$PSILSET,S,2*25	Set vertical install	#PSILSET,C,2*35	Module back confirm

Activation Message

#F33.6=1*52 Message to be sent after any of the above commands has

been sent to reinitialize and activate any change.

Heading Angle Calibration Command

Start command	Response	Remark
#F33.4=0*51<CR><lf>	#F33.4=0*51<CR><lf>	Horizontal command
#F33.4=1*50<CR><lf>	#F33.4=1*50<CR><lf>	Vertical up
#F33.4=2*53<CR><lf>	#F33.4=2*53<CR><lf>	Vertical down
Store command	**Response**	**Remark**
#F2FE.2=1*67<CR><lf>	#F2FE.2=1*67<CR><lf>	Horizontal command
#F2FE.2=2*64<CR><lf>	#F2FE.2=2*64<CR><lf>	Vertical up
#F2FE.2=3*65<CR><lf>	#F2FE.2=3*65<CR><lf>	Vertical down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