



# SPECIFICATIONS

Item No.: HCM705B

Desc.: High Accuracy Gyro Compass

# Production implementation standard reference

- Enterprise quality system standards: ISO9001: 2008 standard (certification number: 128101)
- Tilt sensor production standards: GB / T 191 SJ 20873-2003 inclinometer general specification of Level
- Gyro accelerometer test standard: QJ 2318-92 Gyro accelerometer test methods
- Software development reference standard: GJB 2786A-2009 military software development General requirements
- Product environmental testing standards: GJB150
- Electromagnetic anti-interference test standards: GB / T 17626

•Version: Ver.01

•Date: Jul.22nd,2015



### **General Description**

HCM705B is a high accuracy triaxial electronic compass, using the the US patent technology of hard magnetic and soft magnetic calibration algorithm, to make sure the compass in a magnetic field interference environments has best effect through 3D calibration method , HCM705B integrated three-axis flux-gate sensor, through the CPU real-time calculating heading , and use triaxial accelerometer to compensate the heading Angle of large scope inclination.Electronic compass integrates high precision MCU control, output way various, in which the standard interface including RS232 / RS485 / TTL interface...etc, also can accept other communication interface customization.

HCM705B with small volume, low power consumption, can be applied in antenna stable, vehicles, systems integration, and many other fields, high shock resistance and high reliability make compass work normally under the extremely harsh environment, more suitable for the miniaturization of today's military precision measuring integrated control system.

#### **Features**

- •Heading accuracy: 0.3°~0.5°
- •Tilt angle resolution: 0.1°
- With hard magnetic ,soft magnetic and angle compensation
  Standard RS232/RS485/TTL output interface
- **Application**
- •Satellite antenna search satellite
- •GPS integrated navigation
- •Gun emission system
- Laser range finder
- •ROV underwater robot navigation
- Special occasion robot

- •Roll angle measuring range :±180°
- •Tilt angle accuracy: 0.2°
- •Size: L94×W31×H24mm
- •Wide temperature :  $-40^{\circ}C \sim +85^{\circ}C$
- •Marine navigation surveying and mapping
- Antenna servo control
- Infrared imager
- Map for plotter
- Oceanography measurement instruments
- Unmanned aircraft





## **Ordering information**



E.g: HCM705B-232: 360tilt 3D sealed with enclosure /RS232 output

# **Electrical Characteristics**

HCM705B Technical Data				
Compass		0.3° tilt <10°		
heading	The best heading accuracy	1.0° tilt <180°		
parameter	Resolution	0.1°		
		0.1°<15°(Measuring range)		
		0.1°<30°(Measuring range)		
	Pltch accuracy	0.1°<60°(Measuring range)		
		0.2°<90°(Measuring range)		
<b>A</b>	Pitch tilt range	±85°		
Compass tilt		0.1°<15°(Measuring range)		
parameter		0.1°<30°(Measuring range)		
	Roll accuracy	0.1°<60°(Measuring range)		
		0.2°<180°(Measuring range)		
	Roll tilt range	±180°		
	Resolution	0.1°		
	Hard iron calibration	Yes		
Calibration	Soft iron calibration	Yes		
	Magnetic field interference calibration	24 points(3D calibration)		
<b>5</b>	Dimension	L94×W31×H24mm		
Physical	Weight	20g		
leatures	RS-232/RS485/TTL interface connector	5PIN connector		
	Start delay	<50MS		
Interface	Maximum output rate	20Hz/s		
features	Communication rate	2400 to19200baud		
	Output format	Binary high performance protocol		
	Davien averali	(Default) DC+5V		
Power	Power supply	(Customized) DC9~36V		
	Current(Maximum)	20mA		



	ldeal mode	18mA	
	Sleep Mode	TBD	
	Operating range	-40℃~+85℃	
Enviroment	Storage temperature	-40℃~+100℃	
	Resistance shock performance	2500g	
Electromagnetic	According to EN61000 and GBT17626		
MTBF	≥40000 hours/times		
Insulation	≥100M		
Shock	100g@11ms、3Times/Axis(half sinusoid)		
Anti-vibration	10grms√ 10~1000Hz		
Weight	80g(without cable)		

#### **Electrical Connection**

Line	BLACK	WHITE	GREEN	RED	GRAY
color	GND	RS232(RXD)	RS232(TXD)	Vcc 5V	FACTORY
function	Power	Or RS485(D+)	Or RS485(D-)	Power supply positive	Use only
	Negative				



#### HCM705B Measuring Directions&Fix

The azimuth of HCM705B 3D electronic compass is using geomagnetic principle, so it is very important to select a minimum magnetic interference environment for installation . Please install the HCM505B away from the iron, magnets, engines and other magnetic objects as much possible as you can. Need control over 30CM distance(different magnetic interfere the compass in different distance) at least even there are these magnetic medium around . In order to ensure best measurement environment please must use the <u>M3 anti-interference screws</u> for installation .

HCM705B electronic compass with 1 meter cable, RION company optional cable can be 10 meters. The sensor cable as short as possible to get minimum noise. Although HCM705 to compensate the moderate deviation in the stable magnetic environment, but it CAN NOT compensate the changeable magnetic interference. Please special pay much more attention to the wire carry with a direct current to create the magnetic field , because if the direct current change, size of the magnetic field will also change. Battery is also another change of interference sources. Every installation is different and the user must evaluate the installation feasibility of all possible operating conditions.



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The best heading accuracy of HCM705B can reach  $0.3^{\circ} \sim 0.5^{\circ}$ , this undergo a rigorous validation indisputable, the most scientific test method is equally crucial. The test method we recommend is: Please install the HCM705B 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, HCM705B should do its installation in the perpendicular to the movement direction.













0755-29657137 0755-29123494

# HCM705B Calibration methods:

#### **Calibration lemmas:**

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 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 over 30cm).

1) Correctly connect the HCM compass to the RS232 communication port, turn on the power. Correctly

2) Select automatic calibration mode or manual calibration mode; Automatic calibration MODE: send commands "6804 004448" (or click on the software A - MODE)

Manual calibration MODE: send commands ", 6804, 004347 "(or click on the software M - MODE) using hexadecimal format send calibration START command:" 68 00 04 08 0C "(or click RION's 3D debugging software" CALI - START ")

3) HCM compass will return the response command, at the same time the compass take each point will return a response, please refer to the communication protocol.

4) With the following rotation rules after minimum taking the 12 calibration points, then send the stop calibration command: 68 04 00 09 0D (or click the RION 3D debugging software "CALI-STOP" button), the compass will pause about 2 seconds, the internal CPU automatically calculate just sampling data, after the calculation will return a set of data, is the percentage value of the data just gain. 5)Then send the save calibration command: 68 04 00 0A 0E "(or click RION 3D debugging software" CALI-SAVE "Save button), the compass will return the answer reply command, you can work

properly if successfully saved, if return unsuccessful information, the user can repeat the above calibration steps also can return to the compass factory default calibration data work.

6) Following 2) Send a calibration start command to begin calibration, keep the stability of the module posture, waiting for the first point is sampled.

7) after the first point sampling, rotate module around 90 degrees horizontally to keep the module stability, wait for the next point is sampled. (Refer to the below diagram calibration steps)

8) Repeat the above steps until the sample to 18 points, and then send the calibration stop button.

9) Send calibration save command to end the calibration .

#### When calibrate, if the distance of the magnetic interference source with the compass occur change, the percentage of the calibration will be lower, the precision will be weaker.

Note: When you start the calibration and take points, move the compass to the following location, please note that these points are not absolute heading orientation, but with reference to the first point sampling heading orientation relative orientation change value. That is, you do not need to know which position the real North Pole is in Further for example, the 90degree rotation and 15 degrees pitch only one reference value, to allow a certain sampling angle value error, unnecessarily strictly require very precise. Take at least below12 points calibration, it is recommended that 24 points, the user can sample more points in



order to improve the accuracy, up to 50 points at most, the same sampling principle with the following methods, just a sampling of the pitch angle and roll angle point will increase.

**Note**: When you start the calibration and take points, move the compass to the following location, please note that these points are not absolute heading orientation, but with reference to the first point sampling heading orientation relative orientation change value. That is, you do not need to know which position the real North Pole is in.Further for example, the 90degree rotation and 15 degrees pitch only one reference value, to allow a certain sampling angle value error, unnecessarily strictly require very precise. Take at least below12 points calibration, it is recommended that 24 points ,the user can sample more points in order to improve the accuracy, up to 50 points at most, the same sampling principle with the following methods, just a sampling of the pitch angle and roll angle point will increase.

#### The calibration steps are as follows:



The standard starting point can be anyone azimuth of 360°, as long as each change angle to keep the basic level about 90° to change (do not require too precise). Example as left Pic.A: starting point for H = 0°, R = 0°, P = +15° (firstly calibrate the pitch value P) please keep this posture for 2 to 3 seconds don't move, the system will take the first point . After took the first point, again rotate 90° horizontally, please keep this posture for 2 to 3 seconds don't

move, the system will take the second point. After took the second point, again rotate

90 °horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the third point.

After took the third point, again rotate 90 ° horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the fourth point.



After took the fourth point, H and R are the same, and then increase + P angle value.

Refer to the left Pic.B: starting point H = 0 °, R = 0 °, P = +55 ° ,please keep this posture for 2-3 seconds don't move, the system will take the fifth point.

After took the fifth point, again rotate 90 °horizontally, please keep this posture for 2 to 3 seconds don't move,

the system will take the sixth point.

After took the sixth point, again rotate 90 °horizontally,

please keep this posture for 2 to 3 seconds don't move, the system will take the seventh point. After took the seventh point, again rotate 90°horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the eighth point.







After took the eighth point, H and R are the same , then calibrate –P angle .

Refer to the left Pic.C: starting point H=0°, R=0°, P=-15°,please keep this posture for 2-3 seconds don't move, the system will take the ninth point. After took the ninth point, again rotate 90 °horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the tenth point. After took the tenth point, again rotate 90 °horizontally, please keep this posture for 2 to 3 seconds don't move,

the system will take the eleventh point.

After took the eleventh point, again rotate 90 °horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the twelfth point.



After took the twelfth point, H and R are the same , then increase –P angle value .

Refer to the left Pic.D: starting point H=0°, R=0°, P=-55°,please keep this posture for 2-3 seconds don't move, the system will take the thirteenth point. After took the thirteenth point, again rotate 90 °horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take fourteenth point.

After took the fourteenth point, again rotate

90 °horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the fifteenth point.

After took the fifteenth point, again rotate 90 °horizontally, please keep this posture for 2 to 3 seconds don't move, the system will take the sixteenth point.



After took the sixteenth point then finished P calibration, then calibrate R,R(Roll value)can calibrate alternately .

Refer to the left Pic.E: starting point H=0°, R=+15°, P=0°,please keep this posture for 2-3 seconds don't move, the system will take the seventeenth point. After took the seventeenth point, again rotate 90°horizontally, alternate the negative Roll value R=-15°, please keep this posture for 2 to 3 seconds don't move, the system will take the eighteenth point. After took the eighteenth point, again rotate

90°horizontally, alternate the positive Roll value R=+15 $^{\circ}$  ,please keep this posture for 2 to 3



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0755-29123494

seconds don't move, the system will take the nineteenth point.

After took the nineteenth point, again rotate 90 °horizontally,alternate the negative Roll value R=-15°, please keep this posture for 2 to 3 seconds don't move, the system will take the twentieth point.



After took the twenty second point, again rotate 90°horizontally, alternate the positive Roll value  $R=+55^{\circ}$ , please keep this posture for 2 to 3 seconds don't move, the system will take the twenty third point. After took the twenty third point, again rotate 90 °horizontally,alternate the negative Roll value  $R=-55^{\circ}$ , please keep this posture for 2 to 3 seconds don't move, the system will take the twenty fourth point. Sending stop command---compass response----Re-sending save command---compass response save successfully.

#### **RION's 3D Software**

You can download the RION angle debugging software from RION's official website for the preliminary angle debugging, also you Can download public version of the comassistant software on line for using



Open/Close: Open and close COM port;

Com: Select the the device corresponding to the COM port

Address: Fill in the sensor current address code, the factory default is 00



0755-29657137 0755-29123494

- Set Address: Set the sensor address code input box on the right to enter the desired address code, click Set Addr button
- Save Data: Save the data, click here data can be synchronized Save angle data, the file is stored by default in the C: ---- COMDATA file

Set Zero: Set relative zero, the sensor current angle is 00.00 degrees

Cancel Zero: Unset the relative zero, to restore the sensor to the factory absolute zero;

Baud Rate: Select the sense baud rate, the factory default is 9600;

- Set Baud Rate: Set the sensor baud rate, on the right of the selection box to select corresponding baud rate then click SetB.R. button;
- Auto Output: Switch the sensor to automatically output mode, in the automatic output mode can be filled with different output frequency in Hz;
- Catechism: The sensor switch to answer pattern, such as choosing the answer type, must input "send command "( command, please refer to the specification ) on the left of "Send Command" input box, but also can fill in the transmit frequency in the Send Data, the unit Hz;
- Mag. Dec.: Magnetic declination setting, in the right box directly enter the local magnetic declination, click "Mag.Dec." Button to confirm .
- Calibration: compass calibration forum
- Start: Start calibration
- Stop: Stop the calibration (Click this button, keep the compass shaking state to avoid incorrect calibration of the acquisition)
- Save: stop calibration and save data. (Specific calibration method please refer to this specification calibration description)
- Note: after install the RION's debugging software, if can not open, please operate by the following steps ( please appear to the administrator status to operate ):
- 1) Copy these three files mscomm.srg, mscomm32.ocx, mscomm32.dep from the folder to C:/Windows/system32 path below。
- 2) Click "Start" "run" -- regsvr32 mscomm32.ocx, You are prompted to install successful dialog.

#### Product Communication Protocol

HCM705B is based on TRAX, increase the communication protocol of RION.

MCU read TRAX azimuth, roll, pitch, magnetic field X, magnetic field Y, magnetic field Z, azimuth Status. Through a serial port output azimuth, roll, pitch and azimuth state data of four parameters. Magnetic field is used to determine the coefficient of magnetic interference.

-、Data Frame Format :	(8 bits of data bits,	1 stop bit, no check,	the default rate 9600
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ldentifier (1byte)	Data Length (1byte)	Address code (1byte)	Command word (1byte)	Data Domains	Checksum (1byte)
68h					

Identifier: Fixed 68H

Data length: From data length to checksum (including checksum) length

Address code: Accumulating module address, Default :00

Date domain will be changed according to the content and length of command word

Check sum: Data length, Address code, Command word and data domain sum, No carry.



## $\pm$ 、Command word analysis

Desc.	Meaning/Example	Description
0X04	Meanwhile read	Data domain (0byte)
	Pitch、Roll、Heading、	No Data domain command
	Angle command	
	68 04 00 04 08	
0X84	Sensor answer reply	Data domain (9byte)
	E.g	AA AB BB CC CD DD EE EF FF
	68 0D 00 84 00 10 50 10 10 05 01	AA AB BB:3 Characters is Pitch Axis
	04 01 23	CC CD DD: 3 Characters is Roll Axis
		EE EF FF: 3 Characters is Heading angle
		Angle format with same analytic method as Pitch、Roll、
		Heading
		On the left example , the angle is
		: Pitch: +010.50°,Roll:-010.05°, Heading+104.01°
0X06	Setting declination command	Data domain(2byte) SA AB
	68 06 00 06 02 08 16	S is symbol 0 positive 1 negative
		AA: two digits integer, B: two digits decimals
		E.g: 02 08 is +20.8 deg
0X86	Sensor answer reply	Data domain (1byte)
	E.g: 68 08 00 86 00 8E	Data domain in the number means the sensor response
		result
		00 Setting successfully
		FF Setting failure
0X07	Read declination command	Data domain (0byte)
	68 04 00 07 0b	No Data domain command
0X87	Sensor answer reply	Data domine (2byte)
	E.g: 68 06 00 87 02 08 97	Data domain in the number means the sensor response
0X08	Start calibration command	Data domain (0byte)
01/00	68 04 00 08 0C	No Data domain command
0X88	Sensor answer reply	Data domain (1byte)
	E.g: 68 05 00 88 00 8D	Data domain in the number means the sensor response
		00 Stort sussess EE Stort failure
Noto: at	fter each module take a point returne	data at a time, until the stop calibration, format as below
0888		Data domain (1byte)
	E.g. 66 05 00 66 07 94	
		sensor collects the calibration points (nexadecimal)
0X09	top calibration command	Data domain (0byte)
01/02	68 04 00 09 0D	No Data domain command
0X89	Sensor answer reply command	Data domain (4byte)
	E.g: 68 05 00 89 XX CS	AX IS UU CAN RECEIVE, FF CAN NOT RECEIVE
0X0A	Save calibration command	Data domain (0byte)
	68 04 00 0A 0E	No Data domain command
0X8A	Sensor answer reply command	Data domain (1byte)



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	E.g: 68 05 00 8A 00 8F	Data domain in the number means the sensor response
		result
		00 Success FF Failure
UXUB	Setting communication	Data domain (1byte)
		01 means 9600
		02 means 9000
		03 means 19200
		04 means 38400
		05 means 115200
0Y8B	Sensor answer renly command	Data domain (1byta)
UNUD	E a: 68 05 00 8B 00 90	Data domain in the number means the sensor response
	L.g. 00 00 00 00 00 00	
		00 Success EE Failure
0X0F	Setting module address	Data domain (1byte)
	command	XX module address, address from 00 to EF range
	68 05 00 0F 01 15	Note: Our products have a unified address: <b>FF, If forgot</b>
		the set address when operating ,can use the FF
		address to operate the product, still normal response.
0X8F	Sensor answer reply command	Data domain(1byte)
	E.g: 68 05 00 8F 94	Data domain in the number means the sensor response
		result
		00 Success FF Failure
	Setting angle output mode	Data domain (1hvte)
0X0C	ootting anglo output mouo	
0X0C	68 05 00 0C 00 11	00: answer reply mode 01: Auto output mode
0X0C	68 05 00 0C 00 11	00: answer reply mode 01: Auto output mode Default : answer reply mode
0X0C 0X8C	68 05 00 0C 00 11 Sensor answer reply command	00: answer reply mode       01: Auto output mode         Default : answer reply mode         Data domain (1byte) ,
0X0C	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91	00: answer reply mode       01: Auto output mode         Default : answer reply mode         Data domain (1byte) ,         Data domain in the number means the sensor response
0X0C	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91	00: answer reply mode       01: Auto output mode         Default : answer reply mode         Data domain (1byte) ,         Data domain in the number means the sensor response result
0x0C	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91	O0: answer reply mode       01: Auto output mode         Default : answer reply mode         Data domain (1byte) ,         Data domain in the number means the sensor response         result         00       Success         FF       Failure
0X0C 0X8C 0X2A	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       00 ata domain in the number means the sensor response result         00       Success       FF         Data domain (1byte)       00 Success       FF         Data domain (1byte)       00 Success       FF
0x0C 0x8C 0x2A	68 05 00 0C 00 11           Sensor answer reply command           E.g: 68 05 00 8C 00 91           Setting angle output mode           68 05 00 2A 00 2F	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       01         Data domain (1byte),       0         Data domain in the number means the sensor response         result       00         Success       FF         Data domain (1byte)       00: Horizontal mounting measurement
0X0C 0X8C 0X2A	68 05 00 0C 00 11           Sensor answer reply command           E.g: 68 05 00 8C 00 91           Setting angle output mode           68 05 00 2A 00 2F	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       0         Data domain in the number means the sensor response       result         00 Success FF Failure       0         Data domain (1byte)       00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)
0X0C 0X8C 0X2A	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       02         Data domain in the number means the sensor response       result         00       Success       FF         Data domain (1byte)       00: Horizontal mounting measurement         00: Horizontal mounting measurement (connector down)         Factory default: Horizontal mounting measurement
0X0C 0X8C 0X2A	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mountir	00: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       0.1         Data domain in the number means the sensor response       result         00       Success       FF         Data domain (1byte)       00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement         ng the compass horizontally, the roll and pitch angle output 0
0X0C 0X8C 0X2A	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting	00: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       0.1         Data domain in the number means the sensor response       result         00       Success FF Failure         Data domain (1byte)       00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement         ng the compass horizontally, the roll and pitch angle output 0         Data in (1byte)
0X0C 0X8C 0X2A 0XAA	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command	00: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       Data domain in the number means the sensor response         result       00 Success FF Failure         Data domain (1byte)       00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement         ng the compass horizontally, the roll and pitch angle output 0         Data domain (1byte) ,         Deta domain (1byte) ,
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0X0C 0X8C 0X2A 0XAA	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command E.g: 68 05 00 AA 00 AF	00: answer reply mode       01: Auto output mode         Default : answer reply mode       Data domain (1byte) ,         Data domain in the number means the sensor response         result       00 Success FF Failure         Data domain (1byte)         00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement         ng the compass horizontally, the roll and pitch angle output 0         Data domain (1byte) ,         Data domain (1byte) ,         Data domain (1byte) O         Dots domain (1byte) ,         Data domain (1byte) ,
0X0C 0X8C 0X2A 0X2A 0X41	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command E.g: 68 05 00 AA 00 AF Query mounting mode command 68 04 00 41 45	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       Data domain (1byte),         Data domain in the number means the sensor response result       00         O0 Success FF Failure       Data domain (1byte)         O0: Horizontal mounting measurement       01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement       other angle output 0         Og the compass horizontally, the roll and pitch angle output 0       Data domain (1byte),         Data domain in the number means the sensor response result       00         Success FF Failure       Data domain (1byte),         Data domain (1byte),       Data domain in the number means the sensor response result         O0 Success FF Failure       Data domain in the number means the sensor response result
0X0C 0X8C 0X2A 0X2A 0XAA 0X41 0XC1	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command E.g: 68 05 00 AA 00 AF Query mounting mode command 68 04 00 41 45 Sensor answer reply command	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       Data domain (1byte) ,         Data domain in the number means the sensor response         result       00 Success FF Failure         Data domain (1byte)         00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement         ng the compass horizontally, the roll and pitch angle output 0         Data domain (1byte) ,         Data domain in the number means the sensor response         result         00 Success FF Failure         Data domain (1byte) ,         Data domain (1byte) ,         Data domain (1byte) ,         Data domain (1byte) ,         Data domain in the number means the sensor response         result         00 Success FF Failure         Data domain (0byte)         Data domain (0byte)
0X0C 0X8C 0X2A 0X2A 0X41 0XC1	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command E.g: 68 05 00 AA 00 AF Query mounting mode command 68 04 00 41 45 Sensor answer reply command E.g: 68 05 00 C1 00 C6	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       Data domain (1byte) ,         Data domain in the number means the sensor response result       00         O0 Success FF Failure       Data domain (1byte)         Dot: Horizontal mounting measurement       01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement       01         Og the compass horizontally, the roll and pitch angle output 0       0         Data domain (1byte) ,       Data domain in the number means the sensor response result         00 Success FF Failure       Data domain (1byte) ,         Data domain (1byte) ,       Data domain (1byte) ,         Data domain (1byte) ,       Data domain in the number means the sensor response result         00 Success FF Failure       Data domain (0byte)         Data domain (1byte)       Data domain (1byte)
0X0C 0X8C 0X2A 0X2A 0X41 0XC1	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command E.g: 68 05 00 AA 00 AF Query mounting mode command 68 04 00 41 45 Sensor answer reply command E.g: 68 05 00 C1 00 C6	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       Data domain (1byte) ,         Data domain in the number means the sensor response result       00         O0 Success FF Failure       Data domain (1byte)         Dot: Horizontal mounting measurement       01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement       00         Data domain (1byte),       Data domain (1byte)         Data domain in the number means the sensor response result       00         Data domain (1byte),       Data domain in the number means the sensor response result         D0 Success FF Failure       Data domain (1byte),         Data domain (1byte)       Data domain (1byte)
0x0C 0X8C 0X2A 0X2A 0X41 0XC1	68 05 00 0C 00 11 Sensor answer reply command E.g: 68 05 00 8C 00 91 Setting angle output mode 68 05 00 2A 00 2F Horizontal mounting mode: mounting Vertical mounting mode: mounting Sensor answer reply command E.g: 68 05 00 AA 00 AF Query mounting mode command 68 04 00 41 45 Sensor answer reply command E.g: 68 05 00 C1 00 C6	O0: answer reply mode       01: Auto output mode         Default : answer reply mode       01: Auto output mode         Data domain (1byte) ,       Data domain in the number means the sensor response         result       00 Success FF Failure         Data domain (1byte)       00: Horizontal mounting measurement         01: Vertical mounting measurement (connector down)         Factory default: Horizontal mounting measurement         ng the compass horizontally, the roll and pitch angle output 0         Data domain (1byte) ,         Data domain in the number means the sensor response         result         00 Success FF Failure         Data domain (1byte) ,         Data domain (1byte) ,         Data domain (1byte) ,         Data domain (0byte)         Data domain (1byte)         Data domain in the number means the sensor response         result       00 Horizontal mounting mode 01 Vertical mounting



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0X42	Query mounting mode command 68 04 00 42 46	Data domain(0byte)
0XC2	Sensor answer reply command	Data domain(1byte)
	E.g: 68 05 00 C2 00 C7	Data domain in the number means the sensor response
	3	result
		00: answer reply mode 01: Auto output mode
0X43	Set manual calibration mode	Data domain (Obvte)
0,40	command	
	68 04 00 43 47	
0XC3	Sensor answer reply command	Data domain (1byte)
UNCO	E a: 68 05 00 C3 00 C8	Data domain in the number means the sensor response
	g. 00 00 00 00 00	result
		00 Success FE Failure
0¥44	Set auto calibration mode	
0,44	command	
	68 04 00 44 48	
0XC4	Sensor answer reply command	Data domain (1byte)
	E a: 68 05 00 C4 00 C9	Data domain in the number means the sensor response
		result
		00 Success EE Failure
0X45	manual calibration mode	Data domian (Obyte)
	command	Each node must send one time
	68 04 00 45 49	
0X88	Sensor answer reply command	Data domain(1byte).
	68 05 00 88 xx cs	Data domain in the number means the sensor response
		result xx=0~18
		00: 0 point, 01: 1 point, 02: 2 points 0F: 15 points
0X46	Set auto calibration mode	Data domain(1byte)
	68 05 00 46 00 4B	00: compass mode 01: AHRS mode
		02: MIX Mixture mode
0XC6	Sensor answer reply command	Data domain(1byte),
	E.g:68 05 00 C6 00 CB	Data domain in the number means the sensor response
		result
		00 Success FF Failure
0X4F	Set auto calibration mode	Data domain(1byte)
	command	
	68 04 00 4F 53	
0XCF	Sensor answer reply command	Data domain(1byte),
	E.g: 68 05 00 CF 00 54	Data domain in the number means the sensor response
		result
		00: compass mode 01: AHRS mode
		02: MIX Mixture mode
		Default is compass mode
		When test has the magnetic interference automatically
		switch to the AHRS mode, non-magnetic interference is
		detected, then switch to the compass mode
0X47	When calibration if output HPR	Data domain (1byte)
	data command	00: Calibration no HPR data output



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	68 05 00 47 00 4C	01: Calibration has HPR data output
0XC7	Sensor answer reply command E.g: 68 05 00 C7 00 CC	Data domain (1byte), Data domain in the number means the sensor response result 00 Success FF Failure
0X48	Choose specific parameters command (this command usually don't need customers operation ) E.g: 68 07 00 48 02 05 18 6E Choose HEADING and PITCH	Data domain (1-10byte)Byte4 : Choose the number of parameters, BYTE5~BYTE14: Parameter ID, number optional.05: heading18H:PITCH19H:ROLL15H:AccelX16H:AccelY17H: AccelZ1BH:MAGX1CH:MAGY4AH:GyroX4BH:GyroY4BH:GyroZ
0XC8	Sensor answer reply command E.g: 68 05 00 C8 00 CC	Data domain (1byte), Data domain in the number means the sensor response result 00 Success FF Failure
0X14	Read specific parameter data command ( this command can be used after OX48 command be used ) 68 04 00 14 18	Data domain (0byte)
0X94	Sensor answer reply command E.g: 68 YY 00 94 XX ID1 DA1 DA2 DA3 DA4 ID2 DB1 DB2 DB3 DB4 CE	Data domain (5-46byte), Data domain in the number means the sensor response result BYTE4: XX ; Read the number of parameter, BYTE5:corresponding the paramterID number。 ParameterID number as below: 05: heading 18H:PITCH 19H:ROLL 15H:AccelX 16H:AccelY 17H: AccelZ 1BH:MAGX 1CH:MAGY 1DH:MAGZ 4AH:GyroX 4BH:GyroY 4BH:GyroZ DA1,DA2,DA3,DA4 is FLOAT 32 the big end of data storage mode • ParameterID (1BYTE) + Floating-point number data(4BYTES) indicate one group number.
0X49	The reference magnetic reset command 68 04 00 49 4D	Data domain (0byte)
0XC9	Sensor answer reply command E.g:68 05 00 C9 00 CE	Data domain (1byte), Data domain in the number means the sensor response result 00 Success FF Failure
0X4B	Module reset command 68 04 00 4B 4F	Data domain(0byte) The module to reset
0XCB	Sensor answer reply command 例:68 05 00 CB 00 CE	Data domain (1byte), Data domain in the number means the sensor response result



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0X05	Set relative ZERO command 68 05 00 05 00 0A	Data domain (1byte) 00: Cancel relative ZERO enter absolute ZERO 01: Set relative ZERO
0X85	Sensor answer reply command E.:68 05 00 85 00 8A	Data domain(1byte), Data domain in the number means the sensor response result 00 Success FF Failure
0X50	Set the geomagnetic threshold judgment command 68 06 00 50 24 16 CS	Data domain (2byte) MAX(BYTE4) : AB/100 ,E.g 24 , is 24/100=0.24 MIN(BYTE5) same as above 16/100=0.16
0XD0	Sensor answer reply command E.g: 68 05 00 D0 00 D5	Data domain(1byte), Data domain in the number means the sensor response result 00 Success FF Failure





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# (RION Compass data forma)

- Data format:

Baud rate: (9600, 8 data bits, 1 data top, No check)

 $\equiv$ , Angle output format:

For example:

# Pitch: +020.10 ° Roll: -005.25°



(All Products are subject to change or update without notice.)

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# RI

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 •DIGITAL INCLINOMETER
 •ACCELEROMETER

 •ATTITUDE AND HEADING REFERENCE SYSTEM
 •ELECTRONIC GYROSCOPE

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