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Product Specifications

VOL.06 产品规格书

DCM308 3-Axis Digital Compass Module

RION 瑞芬 SENSOR TECHNOLOGY

General Description

DCM308 is a high accuracy 3-Axis digital compass with 80℃Dip angle compensation. Which uses advanced algorithms, with hard iron and soft iron corrections, to provide highly accurate heading information over its extra wide tilt range at latitudes up to 80°. The small size and low power requir ements of the DCM308 allow it to fit into today's size sensitive systems. These advantages make RION Corporation's DCM308 the choice for applications that require highest accuracy and performance anywhere in the world.

Features include an extra wide tilt range, high accuracy compass heading, low powerconsumption, large signal noise immunity under all conditions, and a large magnetic field measurement range in a small package.

The DCM308 combines USA patented Magneto-Inductive (MI) sensors and measurement circuit technology with a three-axis MEMS accelerometer for unparalleled cost effectiveness and performance. The magnetic sensors and accelerometers are calibrated to operate from -40 to 85℃; hence the measurement is very stable over temperature and inherently free from offset drift.

DCM308 adopts high-tech levels such as MCU, Water-proof, dust prevention and anti-corrosion PCB, import cable,wide temperature metal-clad ,and so on, to improve the stability and reliability.

Features

●Accuracy: 0.5 °
●Maximum Dip Angle: ±80°
●RS232/RS485 Optional
●Small size: L60*59*29mm
●Binary RS232 interface
●Widely working temperature: -40℃～+85℃
●Small form factorLow power consumption
●Hard and soft iron correction with quality of calibration score

Applications

●High performance ROV navigation
●Vehicle tracking
●Sonar targeting systems
●Survey equipment
●Satellite positioning Search
●GPS system integration
●Remote terrestrial antenna direction indicators
●3-axis magnetic field sensing
●Autopilot
● Robotic systems

Technical Datas

DCM308 Performance Specifications

Parameters	Typical	Units
Heading accuracy	0.5°	Deg RMS
Resolution	0.1°	
Repeatability [1]	0.05°	
Max Dip Angle	85°	Deg

Magnetometer Specifications

Parameters	Typical	Units
Calibrated Field Measurement Range	± 0.8	Gauss
Magnetic Resolution	± 0.5	mGauss
Magnetic Repeatability	± 1.0	

Tilt Specifications

Parameters	Typical	Units
Pitch Accuracy	0.1°for Pitch < 20º	Deg RMS
	0.2°for Pitch < 40º	
	0.4°for Pitch < 80º	
Roll Accuracy	0.1°for Pitch < 20º	Deg RMS
	0.2°for Pitch < 40º	
	0.4°for Pitch < 80º	
Tilt Range	± 80°	Deg
Tilt Resolution	< 0.01°	
Tilt Repeatability [1]	0.05°	Deg RMS

Calibration

Parameters	Typical	Units
Hard Iron Calibration	Yes	
Soft Iron Calibration	Yes	
Limited Tilt User Calibration	Yes	

Mechanical Specifications

Parameters	Typical	Units
Dimensions (L x W x H)	60*59*29	mm
Weight	100	g
Mounting Options	Screw mounts/standoffs; horizontal	
Connector for RS-232	4-pin	

I/O Specifications

Parameters	Typical	Units
Latency from Power-On	< 50	mSec
Latency from Sleep Mode	< 1	
Maximum Sample Rate	20	samples/sec
RS-232 Communication Rate	2400 to 19200	baud
Output Formats	Binary High Performance Protocol	

Power Specifications

Parameters	Typical	Units
Supply Voltage	5V (unregulated)	VDC
Current Draw (Continuous Output) Max.	40	mA
Current Draw (Continuous Output) Typ.	20	mA
Idle Mode [2]	14 - 18	mA
Sleep Mode	1	mA

Environmental Specifications

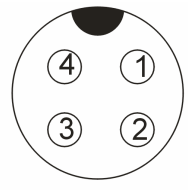
Parameters	Typical	Units
Operating Temperature	– 40 to 85	℃
Storage Temperature	– 40 to 125	℃
Shock	3000	G
Vibration	Z-Axis, Skewed Block, at 1, 2 & 4 Grms @ 10 – 1000 KHz for 30 min. per level	
Humidity	70C with 95% R.H. for 168 hrs	

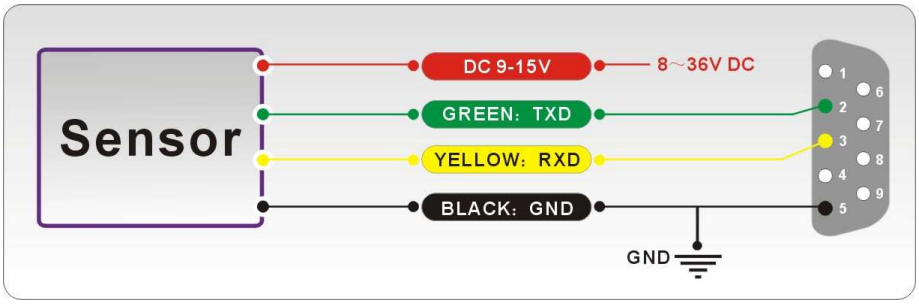
※a. Repeatability is based on statistical data at ±3 sigma limit about the mean.

b.Based on User settings.

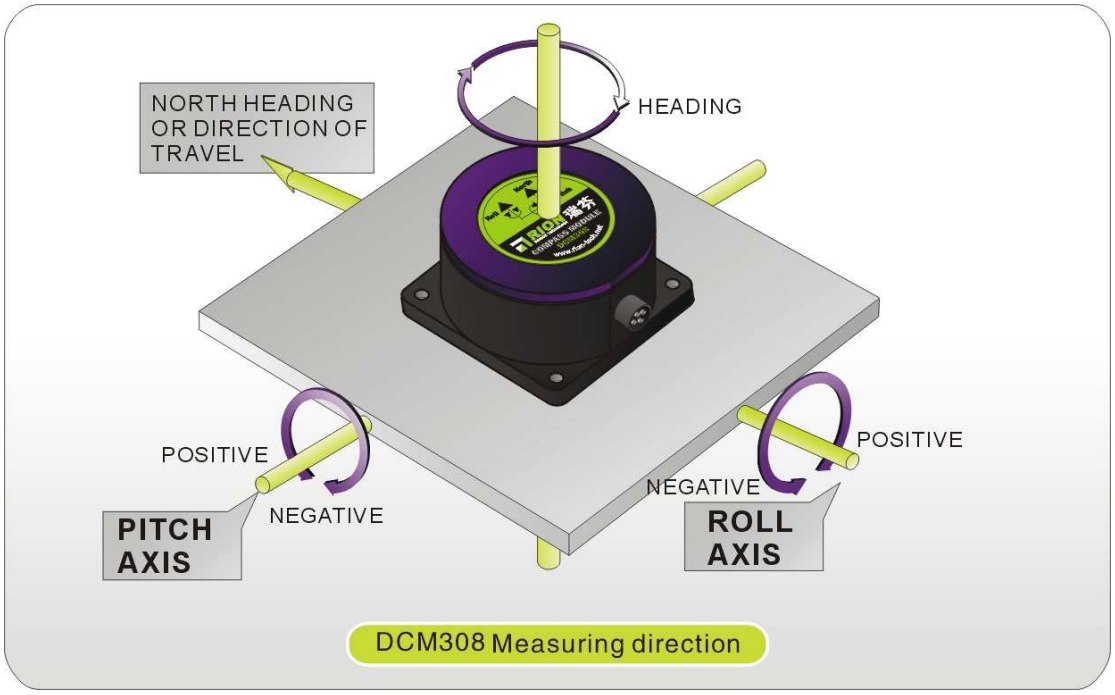
Cable Assembly

Line Funtions	RED	BLACK	YELLOW	GREEN
	1	3	4	5
	DC 5V	POWER-	RXD(A\D+)	TXD（B\D-）





DCM308 Measuring Directions



The DCM308's magnetometers' wide dynamic range and its sophisticated calibration algorithms allow it to operate in many environments. For optimal performance however, you should mount the DCM308 with the following considerations in mind:

The DCM308's magnetometers should not saturate

The DCM308 can be calibrated for large static magnetic fields. However, each axis of the DCM308's magnetometers has a maximum dynamic range of ±80 μT; if the total field exceeds this value for any axis, the DCM308 will not give accurate heading information. When mounting the DCM308,consider the effect of any sources of magnetic fields in the local environment that when added to the earth's field may saturate the DCM308's sensors. For example, large masses of ferrous metals such as transformers and vehicle chassis, large electric currents, permanent magnets such as electric motors, and so on.

Locate the DCM308 away from local sources of changing magnetic fields

It is not possible to calibrate for changing magnetic anomalies. Thus, for greatest accuracy, keep the DCM308 away from sources of local magnetic anomalies that will change with time; for instance,electric equipment that will be turned on and off or nearby ferrous bodies that will be changing positions. Make sure the DCM308 is not mounted close to cargo or payload areas that may be loaded with large sources of local magnetic fields.

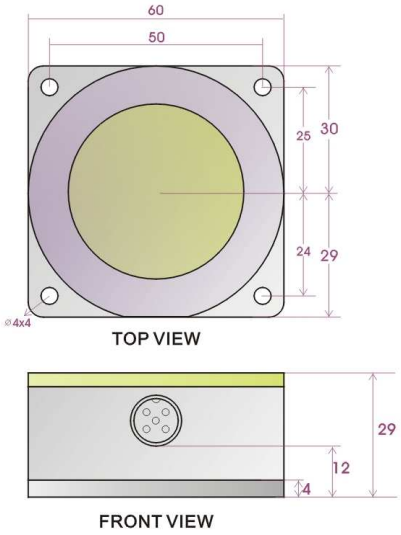
The DCM308 should be mounted in a physically stable location

Choose a location that is isolated from excessive shock, oscillation, and vibration.

Mechanical Parameters

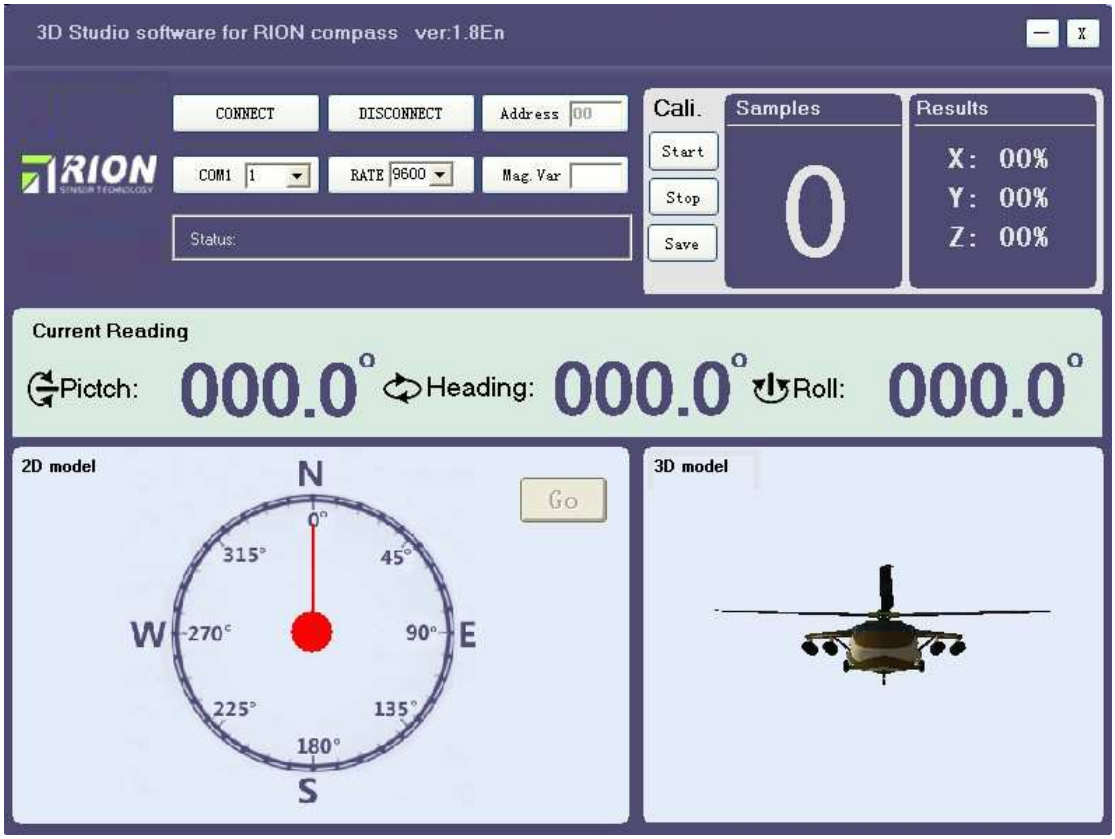
●Connectors： 4-core cable XStandard 2m（Optional）
●Prodtection Level：IP67
●Shell Material： Aluminum Oxide
●Mounted： 4xM4 Anti-jamming screws

Dimension



Units:mm

RION 3D Serial port software



DCM308 Calibration

All compasses can perform well in a controlled environment, where the ambient magnetic field consists solely of the earth's field. In most practical applications, however, an electronic compass will be mounted in a host system such as a vehicle that can contain large sources of local magnetic fields:

ferrous metal chassis, transformer cores, electrical currents, and permanent magnets in electric motors.By performing the user calibration procedure, you allow the DCM308 to identify the major sources of these local magnetic anomalies and subsequently cancel out their effects when measuring the earth's magnetic field for computing compass headings. When you perform the user calibration procedure, the DCM308 takes a series of magnetic field measurements. It analyzes these total field measurements in order to identify the components that are created by the earth's field, which is the desired signal, from those components that are generated by the local environment, which we wish to subtract out.

The end goal of the procedure for the DCM308 is to have an accurate measurement of the static three-dimensional magnetic field vector generated by its host system at its mounting location.This vector is subsequently subtracted out of run-time field measurement to yield the resultant earth's field vector.One major benefit from the DCM308's triaxial magnetometer/triaxial inclinometer system configuration is its ability to compensate for distortion effects in all orientations throughout its usable tilt range. As we have mentioned, a compass must measure the local field vector generated by the host system at its current position within the system in order to accurately calibrate. Because the DCM308's magnetometer is strapped-down, or fixed with respect to its host system, this local field vector does not change as the host system's attitude changes, allowing the DCM308 to accurately compensate in all pitch and roll orientations. Gimbaled fluxgates, for instance, are unable to provide accurate calibration in non-level orientations because its magnetometers, being gimbaled,change position with respect to the host system as attitude changes. This presents a different local distortion field than that measured during calibration.

1) Please properly connect to RS232 port and switch on the power.
2) Using hexadecimal format sent the calibrate command : **"68 04 00 08 0C",(or using RION 3D serial port software,Click Calibration Start)**
3)The compass will respond the command to you .(Each time The compass will respond to you a command when it get a successful point, Refer to Protocol)
4)After the following 12 samples points have been taken, Sent the stop calibration command: **"68 04 00 09 0D"**,At that moment, The compass will stop 2 second for calculating data which just have been taken. It will return a set of the data mean "calculated percentage value".
5)And sent the save command: **"68 04 00 0A 0E"**,The compass will respond by command, You can continue working normally if save successful. Conversely, You have to repeating steps as described above. (And,The factory default settings can used directly)

Note: Once you begin taking calibration points, pausing between desired calibration points will cause unintentional points to be taken with auto sampling enabled.
You will move the compass to the following positions noting that these are not absolute heading directs but rather approximate heading changes referenced to your first heading sample. You do not need to know which way north is. The following 12 samples points will be taken：

Compass with very little pitch

- **1:**0 with small positive roll
- **2:**90 with small negative roll
- **3:**180 with small positive roll
- **4:**270 with small negative roll

With compass pitched approximately 50 degrees

- **5:**0 with small negative roll
- **6:**90 with small positive roll
- **7:**180 with small negative roll
- **8:**270 with small positive roll

With the compass pitched approximately -50 degrees

- **9:**0 with small positive roll
- **10:**90 with small negative roll
- **11:**180 with small positive roll
- **12:**270 with small negative roll.

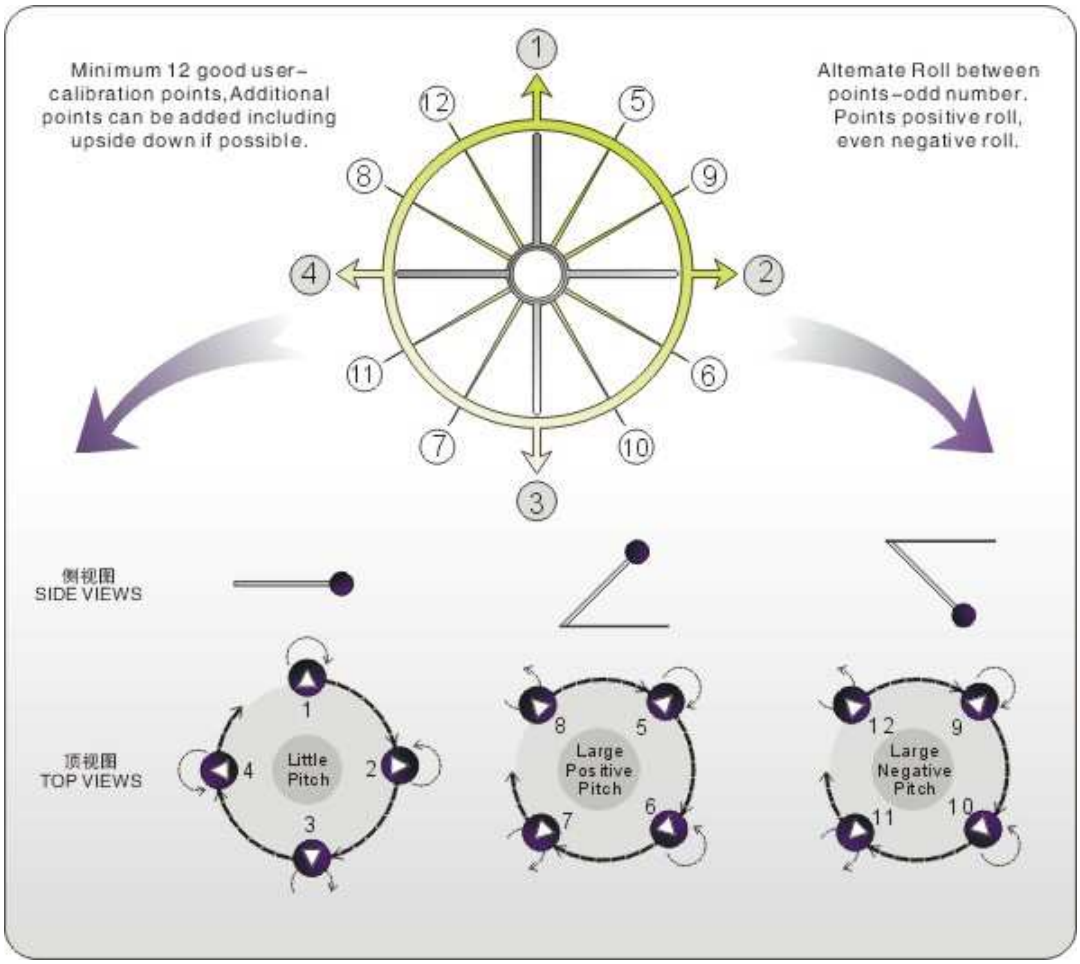
6）Hold the compass level and stable. Press the Start button and wait for a sample to be taken.

7）Rotate the compass to the next heading, approximately 90 degrees, and hold the compass stable until the next sample is taken.

8）Repeat this until all 12 samples are taken, And sent the stop calibration command.

9）Ended by sending the save command of calibration

While the compass was calibrating ,A poor score will result if sources of distortion to be calibrated out moved during the user calibration relative to the compass. A magnetically noisy environment will also result in a poor calibration.



Hard and Soft Iron Effects

Hard iron distortions are caused by permanent magnets and magnetized steel or iron object within close proximity to the sensors. This type of distortion will remain constant and in a fixed location relative to the sensors for all heading orientations. Hard-iron distortions will add a constant magnitude field component along each axis of sensor output and can be easily compensated for using a simple saturation method.

Soft-iron distortions are the result of interactions between the Earth's magnetic field and any magneti -cally "soft" material within close proximity to the sensors. In technical terms, soft materials have a high permeability. The permeability of a given material is a measure of how well it serves as a path for mag -netic lines of force, relative to air, which has an assigned permeability of one.The DCM308 3-axis digital compass features soft-iron and hard-iron correction.

Compass communication protocol

1.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 （1byte）	Check sum (1byte)
68h					

Date format: hexadecimal　　Identifier：Fixed68h

Data length：From data length to check sum（including check sum）length

Address code：Accumulating module adrress，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.

2.Command format

A. Read the value of pitch angle

Send the command： ***68 04 00 01 05***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h	04		01		05

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （3byte）	Check sum (1byte)
68h	07		81	SXXX.YY	

Notes：Data domain is 2 bytes return to angle value, Is compression BCD code,

S:sign-bit(0=Positive 1=Negative) XXX =3 bit integer value　YY=decimal value

Others axis data are the same. For example:102680　Means: −26.8 degrees

B. Read the value of roll angle

Send the command： ***68 04 00 01 05***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h	04		02		06

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （3byte）	Check sum (1byte)
68h			82		

C. Read the value of heading angle

Send the command： ***68 04 00 03 07***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			03		

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （3byte）	Check sum (1byte)
68h			83		

D. Read the value of pitch,roll,heading angle

Send the command： ***68 04 00 04 08***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			04		

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （9byte）	Check sum (1byte)
68h			84		

E. Setting the value of magnetic declination angle

Send the command： ***68 06 00 06 02 08 16***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （2byte）	Check sum (1byte)
68h			06	SXXY	

S:sign-bit(0=Positive 1=Negative) XX =2 bit integer value Y=decimal value

For example:02 08 Means: +20.8 degrees

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			86	00 set successfully FF set successfully	

F. Read the value of magnetic declination angle

Send the command： ***68 04 00 07 0b***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			07		

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （2byte）	Check sum (1byte)
68h			876	SX XY	

F. Start to calibrate

Send the command：***68 04 00 08 0C***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			08		

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			88	00 set successfully FF set successfully	

Notes: Each time The compass will respond to you a command when it get a successful point, Refer to the below format:

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			88	Have been taken point (hexadecimal)	

G. Stop to calibrate

Send the command：***68 04 00 09 0D***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			09		

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （4byte）	Check sum (1byte)
68h			89	EEXXYYZZ	

Notes:EE=error code 00=right FF=wrong

XX=percentage of X axis YY=percentage of Y axis ZZ=percentage of Z axis

H. Save the calibration

Send the command：***68 04 00 0A 0E***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			0A		

※Acknowledge Command：

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

68h			8A	00 set successfully FF set successfully	

Notes: This command have to sending follow on the heels of the calibrate ended, Or return an error.

I. Setting the baud rate

Send the command：***68 05 00 0B 02 12***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			0B		

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			8B	00 set successfully FF set successfully	

Baud rate:00=2400 01=4800 02=9600 03=19200

J. Setting compass address

Send the command：***68 05 00 0B 02 12***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			0F	XX （Compass address）	

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h		FF	8F	00 set successfully FF set successfully	

K. Clear calibrate data

Send the command：***68 05 00 0B 02 12***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			10		

※Acknowledge Command：

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

68h		FF	90	00 set successfully FF set successfully	

L. Setting the output mode of angle

Send the command：***68 05 00 0C 00 11***

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （0byte）	Check sum (1byte)
68h			0C	00:Single output 01:Auto output(one second can be sent one time)	

Notes: The reception mode is factory preset to 01

※Acknowledge Command：

Identifier (1byte)	Date Length (1byte)	Address code (1byte)	Command word (1byte)	Date domain （1byte）	Check sum (1byte)
68h			8C	00 set successfully FF set successfully	

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