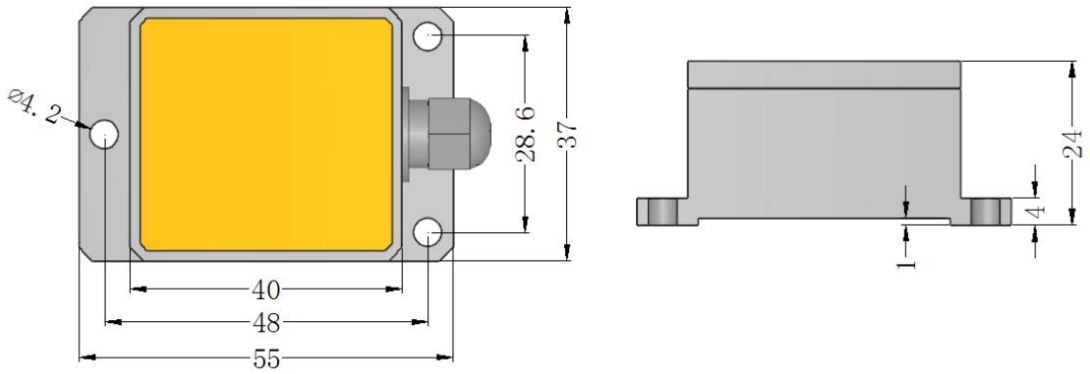
SUCH

SCM225 High-precision 2D Electronic Compass

User Manual

SUCH

Product size diagram



Product size: L55*W37*H24MM

Default horizontal upward installation: The sensor installation surface should be kept parallel to the target surface during installation; please refer to the rotation diagram for installation method. If other installation methods are required, refer to the "Product Installation Method" diagram and make a note when ordering.

Specification

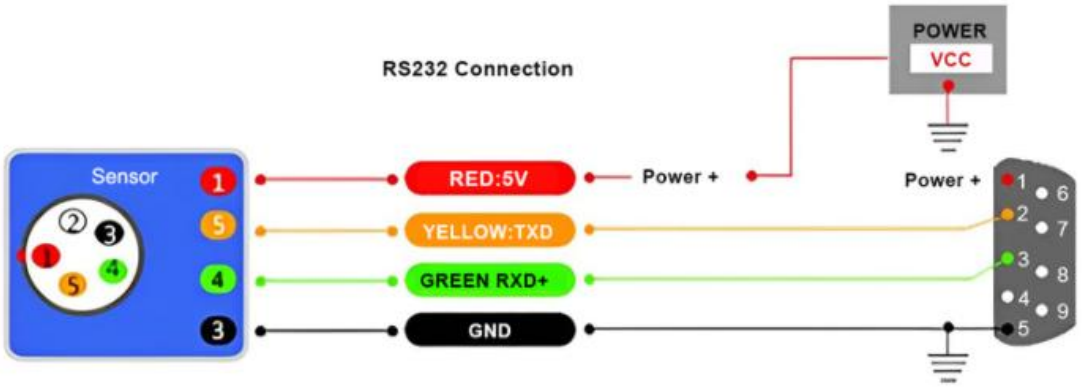
Mechanical characteristics	
Connector	Lead (1.5m) or waterproof aviation socket (customized)
Protection level	IP67
Casing material	Aluminum alloy frosted oxidation
Installation	Three M4 screws

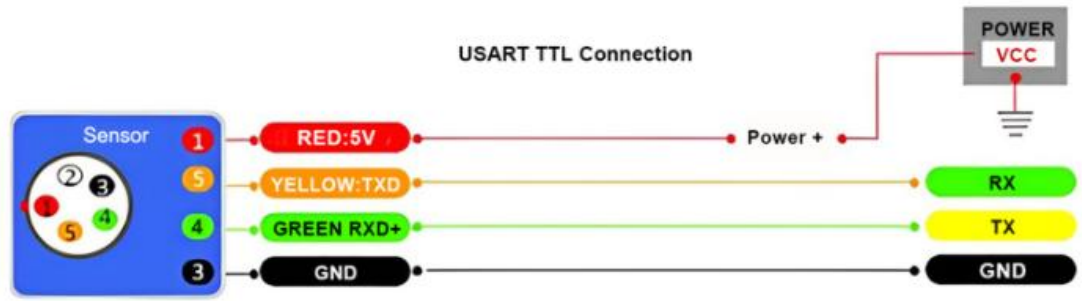
Performance Indicators		
Compass heading parameters	Heading accuracy	1°
	Resolution	0.1°
	Repeatability	0.3°
Heading angle	Navigation tilt angle range	+/-5°
	Heading angle measurement range	0~360°
Calibration	Hard iron calibration	✔
	Soft iron calibration	✔
	Magnetic field interference calibration	one rotation of the plane (two-dimensional calibration)
Physical characteristics	Size	L55*W37*H24 (mm)
	Weight	75g
	RS-232/RS485 interface connector	5-pin

Interface characteristics	Startup delay	<50ms
	Maximum sampling rate	50 times/second
	RS-232 communication rate	2400~19200 baud rate
	RS-485 communication	Optional
	TTL communication	Optional
	Output format	Hexadecimal
Power supply	Supported voltage	DC+5V (9~36V can be customized)
	Current (maximum)	40mA
	Operating mode	30mA
Environment	Storage range	-40℃~+125℃
	Operating temperature	-40℃~+70℃
	Vibration resistance	2500g

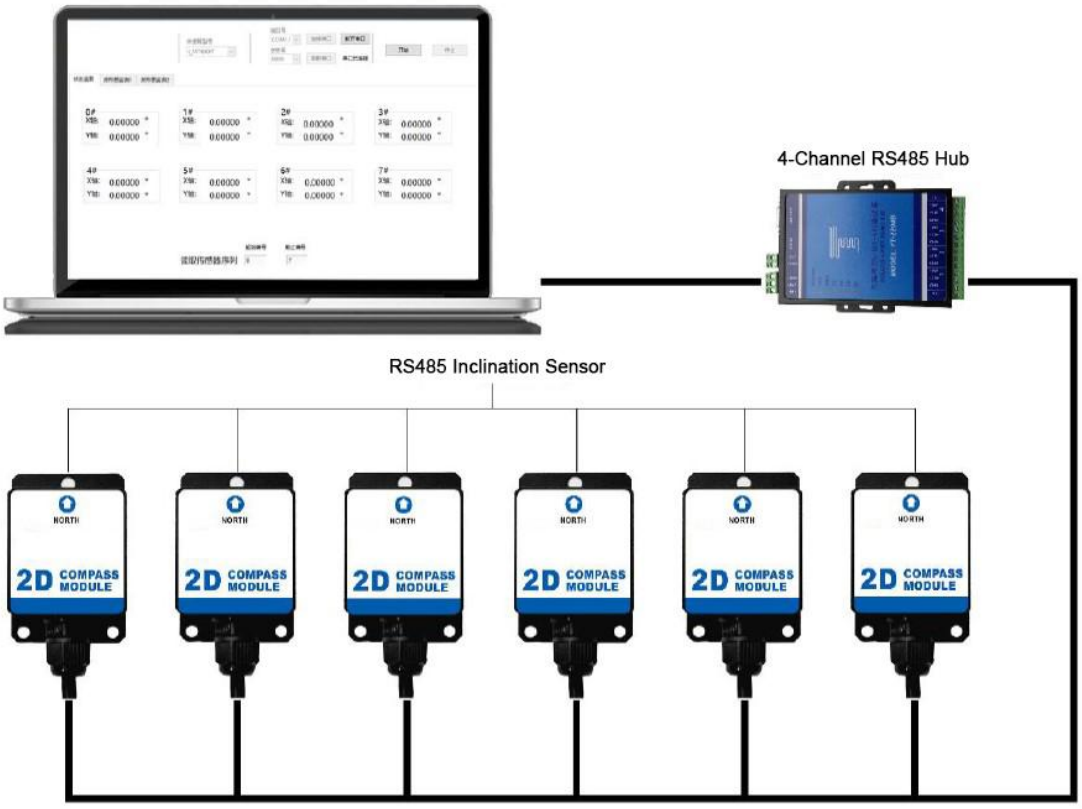
Electrical Connection

Line color / function / Interface	RED	WHITE	BLACK	GREEN	YELLOW
	1	2	3	4	5
RS232	VCC	NC	GND	RXD	TXD
RS485	VCC	NC	GND	(B、D-)	(A、D+)
TTL	VCC	NC	GND	RXD	TXD

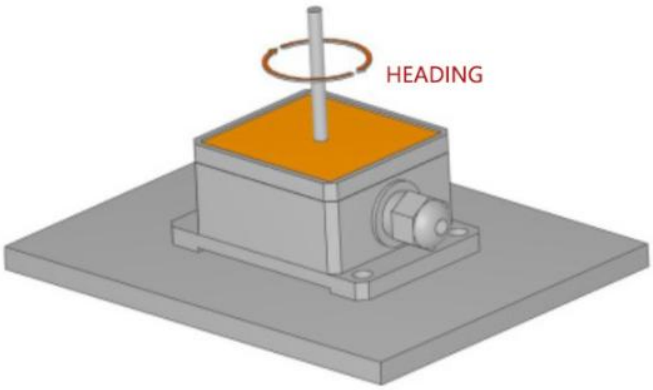




Line color function / Interface	RED	BLACK	GREEN	YELLOW	WHITE	BROWN
RS422	1	2	3	4	5	6
	VCC	GND	RXD- (B-)	RXD+ (A+)	TXD+ (A+)	TXD- (B-)



Test Installation



Although SCM225 can compensate for magnetic interference, users should choose an environment with minimal magnetic interference to install and use it. Place SCM225 away from iron, nickel, magnets, motors and other magnetic materials as far as possible. If there are these magnetic media around, please maintain a distance of at least 0.5m. To ensure that the product achieves the best measurement effect, non-magnetic screwdrivers and non-ferrous screws must be used during installation. **Be sure to strictly avoid strong magnetic materials such as magnets and motors within 10cm of the compass, which may cause irreversible decrease in the measurement accuracy of the compass.**

Each SCM225 electronic compass is provided with a 1.6-meter cable, and the cable length is optional. Although the SCM225 can compensate for magnetic deviation in a stable magnetic environment, it cannot compensate for changing magnetic interference. For example, a wire with DC generates a magnetic field. If the DC changes, the magnitude of the magnetic field will also change. Batteries are another source of variable interference. The magnetic field environment of each installation location is different, and the user must evaluate the feasibility of the installation in the operating environment.
The heading accuracy of the SCM225 can reach 1°, which has been rigorously verified and is beyond doubt. Scientific testing methods are also crucial. The test method we recommend is: install the SCM225 electronic compass on a vertically erected aluminum (or other non-magnetic material) rod to measure the heading accuracy (the rotating rod is perpendicular to the rotating platform, and try to avoid large external magnetic field interference).

Calibration Method

Calibration premise

1) The test compass does not achieve accuracy.
2) The compass installation environment has magnetic field interference. 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 the iron will have magnetic field interference, then it is necessary to rotate the iron and the compass together for calibration, and the iron will not be separated from the compass during use (fixed installation), and once separated, it needs to be recalibrated.

Our electronic compass has been calibrated in a non-magnetic environment in the factory, and no additional environmental calibration is required when used in a non-magnetic environment. When there are ferrous or alloy materials around the compass (such as iron, Nickel, etc.), batteries, microphones, high-current coils or motors, etc., the geomagnetic field around the compass will be distorted (including hard magnetic interference and soft magnetic interference: hard magnetic refers to a constant magnetic field, such as the magnetic field generated by a permanent magnet; soft magnetic refers to a magnetic field that can be magnetized and changed, such as silicon steel sheets, etc.). In this case, we recommend environmental calibration. When performing environmental calibration, the relative position of the surrounding interfering substances and the compass should remain unchanged during the rotation of the compass (that is, rotate with the compass). During environmental calibration, the compass can learn the surrounding disturbed magnetic field environment and compensate for the influence of hard and soft magnetics to improve the accuracy of the compass.

[Note] During environmental calibration, the operator is required to have no mobile phone, keys, metal or powered equipment that can affect the electromagnetic field.
1. Place the compass on a horizontal surface away from interference, then correctly connect it to the RS232 communication interface and turn on the power.

2. Send the calibration start command in hexadecimal format: 68 04 00 08 0C
3. The compass will return a response command.
4. Rotate the compass from 0° to 360° for one circle (or more) and the compass will collect the surrounding magnetic field data. (The rotation speed should not be too fast, and should be controlled at more than 40 seconds per circle.)
5. After returning to 0°, send the stop calibration command in hexadecimal format: 68 04 00 09 0D, and the calibration is successful.

Note: *If the compass is fixedly installed in other supporting equipment, please install the compass and rotate it together with the supporting equipment to collect the interference source of the supporting product and ensure that the compass can measure accurately.*

Communication Protocol

If you want to access the compass directly, you can access it through the compass's communication protocol, so that the compass can be easily integrated into your system.

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

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)		(1byte)
0x68					

Data format: hexadecimal
Identifier: fixed to 0x68
Data length: length from data length to checksum (including checksum)
Address code: address of acquisition module, default is 0x00
Data field: varies according to different content and length of command word
Checksum: sum of data length, address code, command word and data field, without considering carry (**Note:** when command word or data field changes, checksum will change. Please change the checksum accordingly when you change the data field.)

2. Command format

2.1 Read HEADING axis angle (azimuth angle)

Send command: 68 04 00 03 07

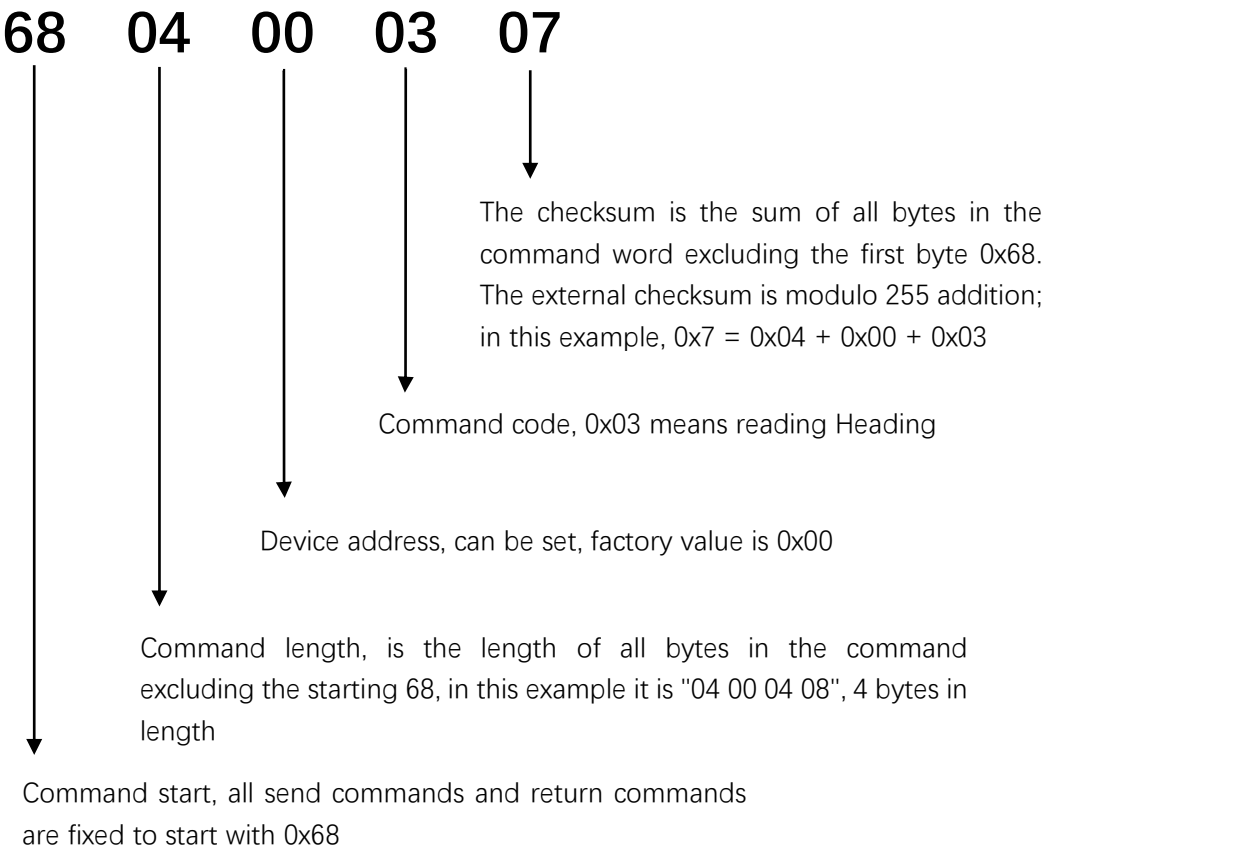
Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x03		

Response command:

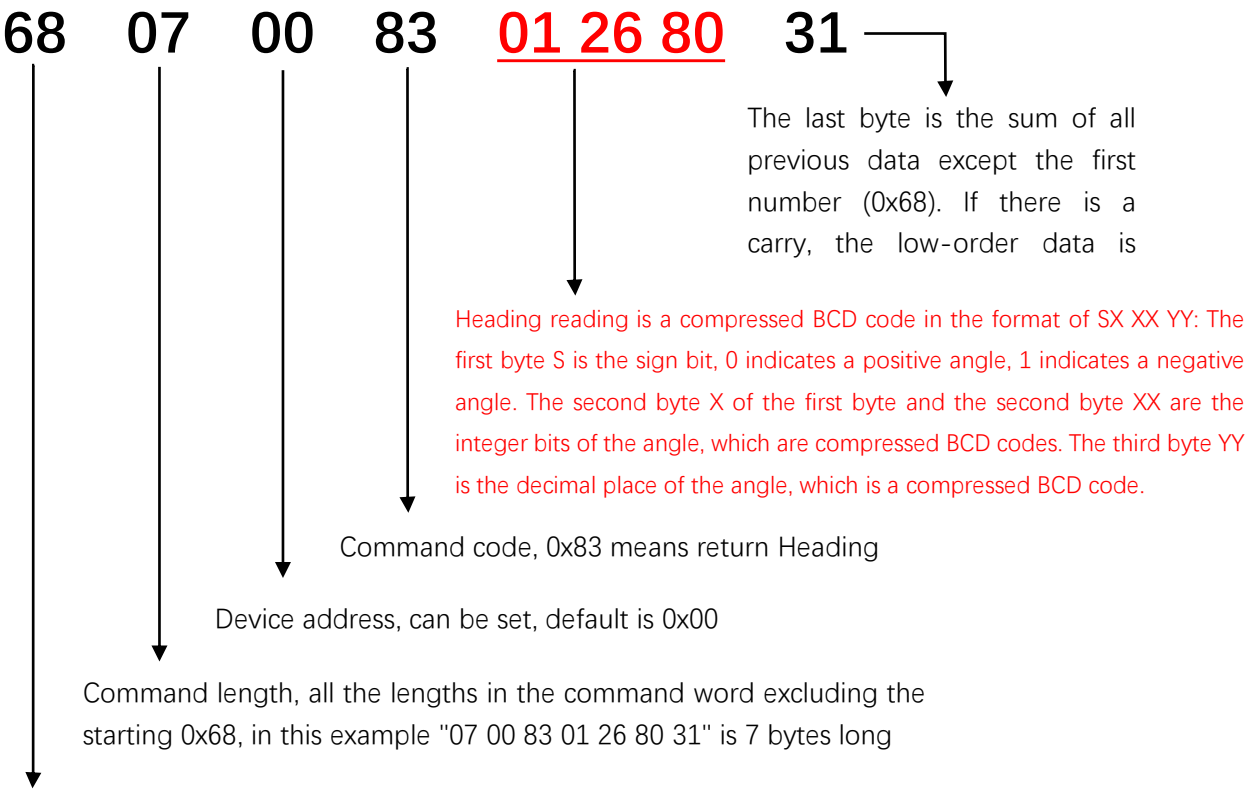
Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(3byte)	(1byte)
0x68			0x83	SXXX.YY	

*Data field is 3 bytes to return angle value, which is compressed BCD code, S is the sign bit (0 positive, 1 negative) XXX is a three-digit integer value, YY is a decimal value. For example, 012680 means 126.8°.

For example, **the sending and returning commands for reading Heading are as follows:**



The corresponding heading angle readings in this example are: **126.8°.**



2.2 Set magnetic declination

Send command: 68 06 00 06 02 08 16

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(2byte)	(1byte)
0x68			0x06	SXX.Y*	

*S indicates the sign, 0 is positive and 1 is negative, XX is a two-digit integer, and Y is a one-digit decimal. For example, 02 08 is +20.8°. The calibration sum of this command is 16 (hexadecimal). 16=06+00+06+02+08. If the magnetic declination is set to -3.2°, the command is 68 06 00 06 10 32 4E, where 4E=06+00+06+10+32. The same applies to setting other magnetic declinations.

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x86	0x00: Setting successful 0xFF: Setting failed	

2.3 Reading magnetic declination

Send command: 68 04 00 07 0B

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x07		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(2byte)	(1byte)
0x68			0x87	SXX.Y*	

*SX X.Y format is the same as the format of the magnetic declination to be set in command 2.2.

2.4 Start calibration

Send command: 68 04 00 08 0C

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x08		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x88	0x00: Setting successful 0xFF: Setting	

				failed	

*This command is used to correct the deviation of the magnetic field around the environment where the compass is used. Each compass generally needs to be calibrated once in a new environment to avoid the magnetic field at the measurement site affecting the measurement accuracy. After the calibration is completed, the save calibration command must be sent (see 2.5).

2.5 Save calibration

Send command: 68 04 00 09 0D

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x09		

Response command: 68 09 00 89 00 00 80 3F 0C E9

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(5byte)	(1byte)
0x68			0x89	N*	

*This return command returns the calibration fitting error and the number of valid calibration points obtained during the calibration process. The 5-byte data field includes the calibration error represented by a 4-byte floating point and the number of calibration points represented by a 1-byte integer. For example, the data field in the example is: 00 00 80 3F 0C, where 00 00 08 3F is the floating point number 1, and 0C is 12.

2.6 Stop calibration

Send command: 68 04 00 12 16

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x12		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x72	0x00: Setting successful 0xFF: Setting failed	

2.7 Clear calibration data

Send command: 68 04 00 10 14

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x10		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x90	0x00: Setting successful 0xFF: Setting failed	

2.8 Set communication rate

Send command: 68 05 00 0B 03 13

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x0B		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x8B	0x00: Setting successful 0xFF: Setting failed	

Note: 0x00 means 2400, 0x01 means 4800, 0x02 means 9600, 0x03 means 19200, 0x04 means 115200, 0x05 means 14400, 0x06 means 38400, 0x07 means 57600, and the default value is 0X02:9600. If the baud rate is set to 19200, the command is 68 05 00 0B 03 13, where 13=05+00+0B+03. The same applies to setting other baud rates.

Note: After setting the baud rate, the device will return a response command at the original baud rate. After that, the baud rate setting will take effect. The host computer needs to make corresponding baud rate changes to communicate with the device again.

2.9 Setting the angle mode

Send command: 68 05 00 0C 00 11

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x0C	0x00: Question and answer 0x01: 5Hz Data Rate 0x02: 15Hz Data Rate 0x03: 25Hz Data Rate 0x04: 35Hz Data Rate 0x05: 50Hz Data	

				Rate	

*The default output mode is 00; if the device is in non-response mode, there will be 10s of idle time without sending data after each power-on restart, and the continuous output data mode will start after 10s.

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x8C	0x00: Setting successful 0xFF: Setting failed	

Note: 5Hz Data Rate means automatic data output 5 times per second, and so on. When the product you are using is an RS485 interface, because the 485 interface is half-duplex, when the product automatically outputs data to the outside, it may not be able to effectively receive the input command. At this time, you may need to send the command repeatedly for the product to receive it. Therefore, if you need to **send commands to interact with the product during the use of the 485 interface product, it is recommended to set the product to work in the question-and-answer mode**. In addition, when the product is set to the automatic output mode, there will be no output within 10 seconds after the product is powered on. At this time, the product can effectively receive external setting commands.

2.10 Set the module address

Send command: 68 05 00 0F 01 15

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x0F	XX module address	

Note: The default address of the sensor is 00.

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x8F	0x00: Setting successful 0xFF: Setting failed	

1. If multiple sensors are connected to a bus at the same time, such as RS485, each sensor needs to be set to a different address to achieve separate control and response speed.
2. If the new address is successfully changed, the address code in all subsequent commands and response data packets must be replaced with the changed new address code to take effect, otherwise the sensor will not respond to the command.
3. The XX module address ranges from 00 to EF.

2.11 Query module address

Send command: 68 04 00 1F

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(0byte)
68	04	00	1F		

Note: The query module address does not consider the check bit

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x1F		

2.12 update flash (save settings)

Send command: 68 04 00 0A 0E

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x0A		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x8A	0x00: Setting successful 0xFF: Setting failed	

*For various parameter settings, if the save setting command is not sent after the setting is completed, these settings will disappear after power failure.

2.13 Restore factory settings

Send command: 68 04 00 0E 12

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(0byte)	(1byte)
0x68			0x0E		

Response command:

Identifier	Data length	Address code	Command word	Data field	Checksum
(1byte)	(1byte)	(1byte)	(1byte)	(1byte)	(1byte)
0x68			0x8E	0x00: Setting successful 0xFF: Setting failed	