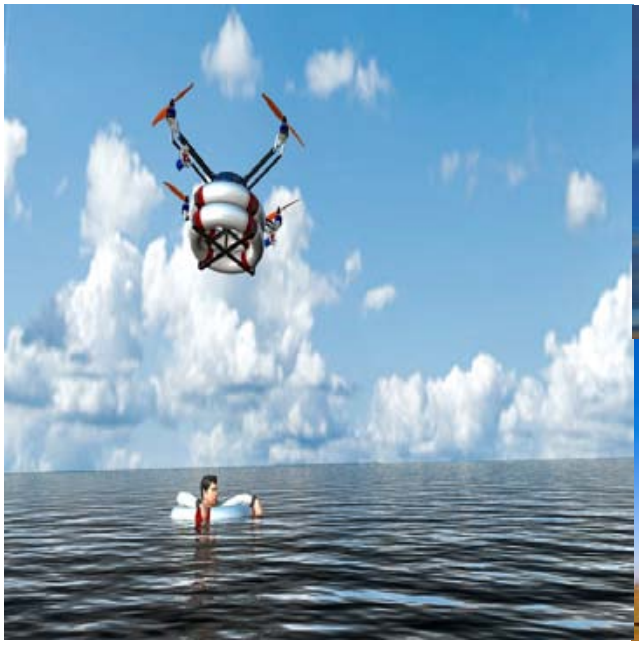
LEC315M

Angle Compensation 3D Electronic Compass with Modbus

Technical Manual

LEC315M

Angle Compensation 3D Electronic Compass with Modbus



Introduction

The LEC315M is a 3D Electronic Compass with high accuracy. It offers high accuracy heading information when tilt angle reaches 40° initially.

LEC315M is a small size, low power consumption compass that is widely used in the antenna steadiness, vehicle navigation, system integration, etc.

Features

- Accuracy: 2°
- Operating t emperature: -40℃ ~ +85℃
- Low work current: <40mA
- High pitch angle measurement range: ± 30°
- Hard magnetic, soft magnetic and angle compensation
- RS232/RS485/TTL Optional, Modbus Optional

Applications

- Satellite tracking
- Drilling equipment
- Optical range finder
- Combat equipment
- Navigation of the underwater robot
- Marine measurement
- Robotic system
- Unmanned aerial vehicles

Specifications

Electrical Specifications

Power supply	5VDC
Operating current	30mA (40mA max)
Operating temperature	-40~+85℃
Sore temperature	-55~+100℃

Performance Specifications

Compass Heading Parameters	Heading Accuracy	2° (RMS)
	Resolution	0.1°
	Repeatibility	0.3°
Compass Pitch Parameters	Pitch Accuracy	0.2°
	Roll Accuracy	0.2°
	Resolution	0.01°
	Measuring Range	±30°
Calibration	Hard Iron Calibration	Yes
	Soft Iron Calibration	Yes
	Limit Tilt User Calibration	Yes
Physical Specifications	Size	L55 x W37 x H24 (mm)
	Weight	130g
	RS232/485/TTL Interface	Optional
Interface Specifications	Startup Delay	<50 ms
	Max Output Frequency	50gHZ
	RS-232 Communication Rate	2400 to 115200 baud rate
	Output Format	Binary high energy protocol
Environment	Shock Resistance	2000g

LEC315M
Angle Compensation 3D Electronic Compass with Modbus

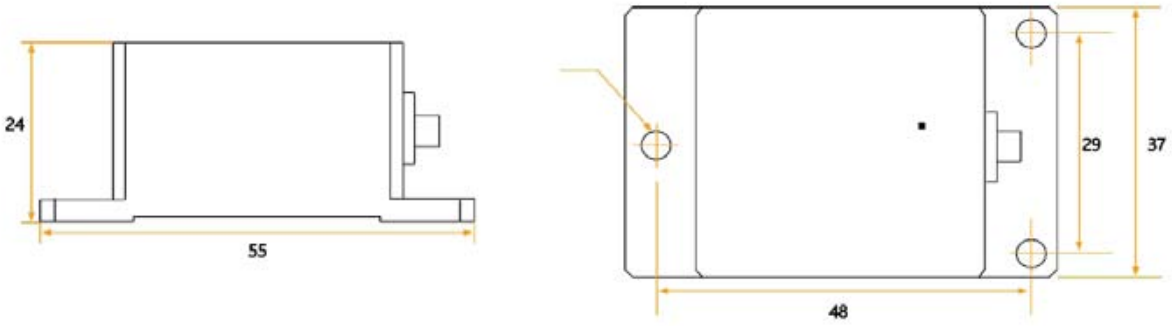
Resolution: the sensor is able to detect and distinguish the minimum the measured change within measuring range.
Accuracy: error between actual angle and the root mean square of angle (≥16 times) multiply measured by the sensor.

Mechanical Characteristics

Connector	metal /Aviation plug (1.5m)
Protection level	IP67
Shell material	Magnesium Aluminum
Installation	Three M4 screws

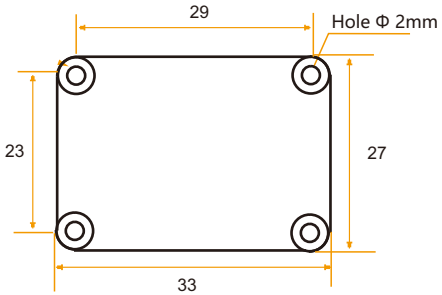
Package size

Size：L55*W37*H24 (mm)



Bare plate product size

Size：L33*W27*H6 (mm)



Installation

Although the LEC315M can compensate for magnetic interference, users should choose a minimum magnetic interference environment to install and use it. Please make sure the LEC315M is away from the iron, nickel, magnets, engines and other magnetic substances as far as possible when place it.

Strictly avoid the magnet, motor and other strong magnetic material close to the compass within 10cm, which may cause the compass measurement accuracy irreversible decline.

Each LEC315M compass provides a 1.5-meter cable (optional). Every installation location magnetic field environment is different, the user must evaluate the installation of the operating environment feasibility.

Our recommended test method is: install the LEC315M compass on the vertical erected aluminum (or other non-magnetic material) rod for the heading accuracy measurement (turning rod perpendicular to the rotating platform, try to avoid large external magnetic field interference).

Calibration

The electronic compass has been calibrated at the factory. In the area where the magnetic field is small, environmental calibration is not necessary when using it, and it can be used directly. But in the process of actual use, it is suggested that the magnetic calibration should be carried out. You can select the calibration method according to the actual situation.

Plane-calibration:

1, place the electronic compass in working environment. Do not carry any magnetic object such as keys and phones

2, connect the product to the system, and put it horizontally

3, send the command of the MODBUS protocol to start calibrating: 01 06 00 14 00 00 C9 CE

4, keep the compass horizontal, rotate one round steadily over about 10 seconds

5, Make the compass in the following state (X at 90° or -90°, Y axis nears 0°, or Y at 90°or -90 °, X axis nears 0°) approximately uniform rotation for a week -- this step can be omitted.

6, send command: 01 06 00 15 00 00 98 0E to save the calibration

7, the calibration is complete.

Multidimensional calibration:

1, place the electronic compass in working environment. Do not carry any magnetic object such as keys and phones

2, keep the compass horizontal (within ±5 degrees)

3, send the command of the MODBUS protocol to start calibrating: 01 06 00 11 00 00 D9 CF

4, set the product face up horizontally (The pitch and roll angles are both within ±5 degrees). Rotate one round steadily over about 10 seconds

5, place the product back up horizontally (The pitch is within 0±5 degrees and the roll is within 180±5 degrees).Rotate one round steadily over about 10 seconds.

6, place the product vertically with a smooth side of the shell down (The pitch is within 0±5 degrees and the roll is within 90±5 degrees).Rotate one round steadily over about 10 seconds

7, place the product vertically with the other smooth side of the shell down (The pitch is within 0±5 degrees and the roll is within -90±5 degrees).Rotate one round steadily over about 10 seconds

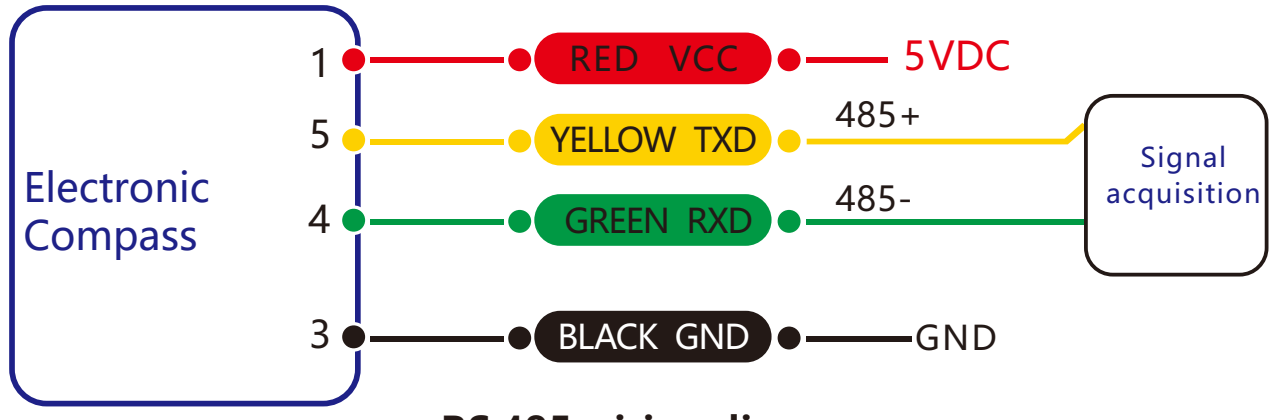
8, after rotating four faces , send command: 01 06 00 12 00 00 29 CF to save the calibration. Because of the MODBUS protocol, there is no return value to indicate the quality of the calibration.

9, the calibration is complete.

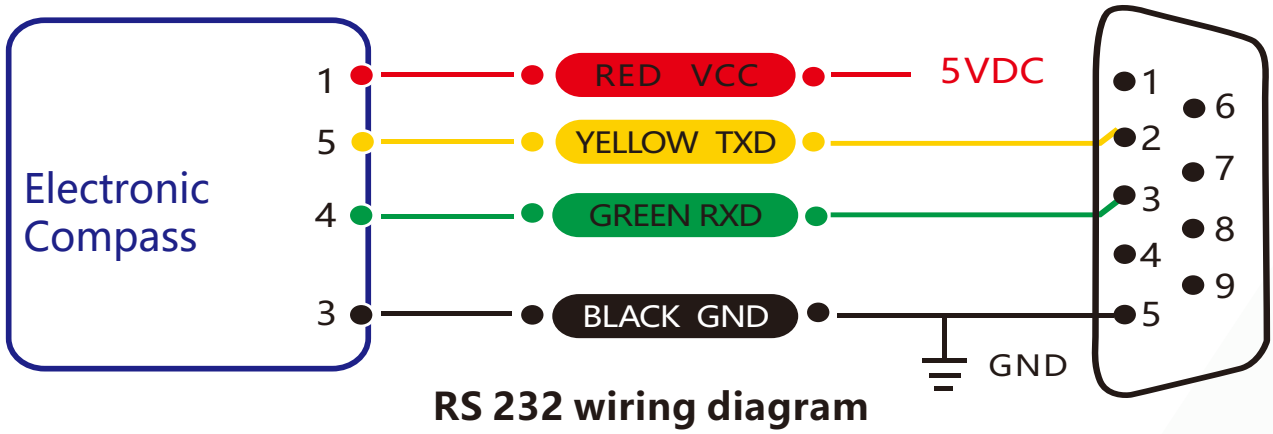
Electrical Connections

Wiring Diagram

	RED	BLUE	BLACK	GREEN	YELLOW
Line function	1	2	3	4	5
	5VDC	NC	GND	RXD (B、D-)	TXD (A、D+)



RS 485 wiring diagram



RS 232 wiring diagram

Communacation Protocol

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

Address Code (1byte)	Function Code (1byte)	The first address of the read register (2 byte)	Number of read registers (2byte)	CRC check (2 byte)
0x77	03(read) 06(write)	XX XX	XX XX	XX XX

Data Format: Hexadecimal.
Address code: default 01 (note: address must not exceed FFF).
Function code: 03 for read register, 06 for prefabricated register.
Address of register: the starting address of the register that needs to be operated.
Number of registers: the number of registers to operate on.
CRC check: Through the calculation of the host computer. (suggested using CRC software)

2 Command format :

2.1 Read the PITCH angle Command : 01 03 00 01 00 01 D5 CA

Address Code (1byte)	Function Code (1byte)	The first address of the read register (2 byte)	Number of read registers (2byte)	CRC check (2 byte)
01	03	00 01	00 01	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Number of bytes of data (1 byte)	Data (2byte)	CRC check (2 byte)
01	03	02	XX XX	ZZ ZZ

XX XX denotes pitch angle with an angle value of hexadecimal number. (PLC or configuration software read out the number is directly the decimal number). The angle is calculated as follows:
Actual angle = (data converted to decimal -20000 / 100).
For example: the return value of the angle value is 3D52, turning it into decimal is 15698,
The real data is (15698-20000) /100=-43.02°, and the other axes are the same.

2.2 Read the ROLL angle Command : 01 03 00 02 00 01 25 CA

Address Code (1byte)	Function Code (1byte)	The first address of the read register (2 byte)	Number of read registers (2byte)	CRC check (2 byte)
01	03	00 02	00 01	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Number of bytes of data (1 byte)	Data (2byte)	CRC check (2 byte)
01	03	02	XX XX	ZZ ZZ

2.3 Read the HEADING angle Command : 01 03 00 03 00 01 74 0A

Address Code (1byte)	Function Code (1byte)	The first address of the read register (2 byte)	Number of read registers (2byte)	CRC check (2 byte)
01	03	00 03	00 01	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Number of bytes of data (1 byte)	Data (2byte)	CRC check (2 byte)
01	03	02	XX XX	ZZ ZZ

2.4 Read the Heading, Pitch and Roll angle Command : 01 03 00 01 00 03 54 0B

Address Code (1byte)	Function Code (1byte)	The first address of the read register (2 byte)	Number of read registers (2byte)	CRC check (2 byte)
01	03	00 01	00 03	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Number of bytes of data (2 byte)	Data (2byte)	CRC check (2 byte)
01	03	06	XX XX YY YY ZZ ZZ	ZZ ZZ

XX XX means PITCH angle YY YY means ROLL angle ZZ ZZ denotes HEADING angle

2.5 Set relative / absolute zero Command : 01 06 00 0A 00 00 A9 C8 / 01 06 00 0A 00 01 68 08

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	Zero Point Type (2byte)	CRC check (2 byte)
01	06	00 0A	00 00(Absolute) 00 01(Relative)	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	Zero Point Type (2byte)	CRC check (2 byte)
01	06	00 0A	00 00(Absolute) 00 01(Relative)	XX XX

Note: The measured angle is referred to the zero point calibrated in factory if absolute zero point is set. The measured angle is referred to the current angle if relative zero point is set. The zero point is the zero point of the dip Angle, and when installing, try to install it in the zero attachment. The Angle changes more, which will cause the change of azimuth.

2.6 Query the relative /Absolute zero point Command： 01 03 00 05 00 01 94 0B

Address Code (1byte)	Function Code (1byte)	The first address of the read register (2 byte)	Number of read registers (2byte)	CRC check (2 byte)
01	03	00 05	00 01	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Number of bytes of data (1 byte)	Data (2byte)	CRC check (2 byte)
01	03	02	00 00(Absolute) 00 01(Relative)	ZZ ZZ

2.7 Set baud rate Command： 01 06 00 0B 00 02 79 C9

	Address Code (1byte)	Function Code (1byte)	Function Code (2byte)	Baud rate type (2byte)	CRC check (2 byte)
Send	01	06	00 0B	XX XX	XX XX
Response	01	06	00 0B	XX XX	XX XX

Note: if XX XX in the baud rate type is
0000, the baud rate is revised to 2400;
0001 indicates that the baud rate is revised to 4800;
0002 indicates that the baud rate is revised to 9600 (the default value);
0003 indicates that the baud rate is revised to 19200;
0004 indicates that the baud rate is revised to 115200;
If the baud rate is changed immediately after the command is sent, the return value is generally confusing.

2.8 Set address Command： 01 06 00 0D 00 02 99 CB

	Address Code (1byte)	Function Code (1byte)	Function Code (2byte)	Modified address (2byte)	CRC check (2 byte)
Send	01	06	00 0D	HH LL	XX XX
Response	LL	06	00 0D	HH LL	XX XX

Note: HH LL represents the address of the product to be changed, HH represents the high position of the address, and LL represents the status of the address, which is 00 00-00 FF. In the example, the address of the product is changed to 0002.

2.9 Query address Command : 77 04 00 2F 33

	Identifier (1byte)	Function Length (1byte)	Product custom protocol address (1byte)	Function Length (1byte)	MODBUS address (1byte)	Checksum (1byte)
Send	77	04	00	2F		33
Response	77	05	00	2F	XX	XX

Note: Because the MODBUS protocol specifies that the product can communicate only when it knows the address of the module, when the MODBUS protocol communication, the address is known in advance and can not be queried. This product uses custom protocols to query the address of the MODBUS protocol. You can see the product introduction of a custom protocol about related custom protocol. And the command is valid for 10 seconds before power.
The XX in the MODBUS address is the product address of the protocol.

2.10 Save setting Command : 01 06 00 0F 00 00 78 09

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	(2byte)	CRC check (2 byte)
01	06	00 0F	00 00	XX XX

Command response :

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	(2byte)	CRC check (2 byte)
01	06	00 0F	00 00	XX XX

Note: command should be sent without a power outage after all previous settings that need to be changed are changed. Otherwise, there is no memory function.

Test Standard

Π Enterprise quality system standards: ISO9001: 2048 standard (certificate number: 56<4<T43788URV,

Π CE certification (certificate number: P!534<!436!X\4484,

Π RoHS (certificate number: J4<3<633<<,

LEC315M

Angle Compensation 3D Electronic Compass with Modbus

Wuxi Bewis Sensing Technology LLC
Address: Building 30, No. 58 Xiuxi Road, Binhu District, Wuxi City, Jiangsu Province, China
Tel/Whatsapp: +86 189 2129 2620
Email: sales@bwsensing.com
Website: www.bwsensing.com