BW-IMU127C Serials

Low-cost Modbus Inertial Measurement Unit

Technical Manual

BW-IMU127

ow-cost Modbus Inertial Measurement Unit

Introduction

Dv d or z0frvw lqhuwld0 phdvxuhphqw vhqvru/ wkh EZ0LPX45: phdvxuhv wkh dwwlwxgh sdudphwhuv ri wkh prwlrq fduulhu +uro0 dqj0h/ slwfk dqj0h/ dqjx0du yh0rflw|/ dffho0hudwlrq,1Dwwlwxgh dqg dqjx0du yh0rflw| ghyldwlrqv duh hvwlpdwhg e| d 90vwdwh Nd0pdq il0whu zlwk dssursuldwh jdlq/ wkdw lv vxlwde0h iru lqhuwld0 dwwlwxgh phdvxuhphqwlq prwlrq ru yleudwlrq1

EZ0LPX45: xvhv klj k0| uho0de0h PHPV dffho0hur phwhuv dqg j|urvfrshv ı dqg hqvxuh phdvxuhphqw dffxudf| wkurxjk do jrulwkpv/ phdqzkl0h/ wkh vhd0 ghvljq dqg vwulfw surfhvv hqvxuh wkdw wkh g|qdplf sdudphwhuv ri wkh fduulhu vxfk dv wkh dqjx0du yh0rflw| dffho0hudwlrq dqg dwwlwxgh fdq eh dffxudwh0| phdvxuhg xqghu kduvk frqglwlrqv1 Wkurxjk ydulrxv frpshqvdwlrqv vxfk dv qro0lqhdu frpshqvdwlrq/ txdgudwxuh frpshqvdwlrq/ whpshudwxuh frpshqvdwlrq dqg guliw frpshqvdwlrq/ wkh huuru vrxufh ri EZ0LPX45: fdq eh juhdw0| hol plqdwhg/ dqg wkh surgxfw dffxudf| 0hyh0 fdq eh lpsuyhg1 Wkh EZ0LPX45: lv htxlsshg zlwk gljlwd0 lqwhuidfh wkdw fdq eh hdvl0| lqwhjudwhg lqwr wkh xvhu*v v|vwhp1

Features

- G|qdplf frpshqvdwlrq dqg txdgudwxuh frpshqvdwlrq
- Zero instability: 30 °/h
- Vshfld0 riivhw wudfnlqj do jrulwkp hol plqdwhv guliw
- J|ur guliw frpshqvdwlrq
- Vwdqgdug UV5652UV7;82WW02Prgexv rxwsxw lqwhuidfh
- Rshudwlqj whpshudwxuh=χ 073 ł .;8 ł ı whpshudwxuh frpshqvdwlrq
- Klj k0shuirupdqfh Nd0pdq il0whu do jrulwkp
- Vpd00 vl}h χ L60 × W59× H29mm

Applications

- Ed0dqfh fdu
- Gxpshu
- Sodwirup vwdel0lw|
- Lqglylgxd0 frpedwhtxlsphqw
- URY xqghuzdwhu urerw qdyljdwlrq
- Pdulqh vxuyh|
- Urerw
- Xqpdqqhg Dhuld0 Yhkl f0hv

Specifications

Electrical Specifications

Sr zhu vxss0|	9-38Y GF
Rshudwlqj fxuuhqw	63pD ε Pd{73pD ζ
Rshudwlqj wh p shudwxuh	073¢;8 ł
Vwruh wh p shudwxuh	088¢433 ł

Performance Specifications

Pitch angle	Resolution		0.01°
	measuring range		-90°~+90°
Roll angle	Resolution		0.01°
	Range		-180° ~+180°
Gyro	Resolution		0.05°/sec
	Range		±400°/sec
	Zero instability		30 °/h
	ARW		3.1 °/√h
	Noise density		0.007 °/s/√Hz
	Zero absolute error		±0.3 °/sec
Accelerometer	Range: X,Y,Z		±3.6 g
	Resolution		2 mg
	Bias stability		±20 mg
Maximum output frequency	500Hz		
Start delay	50ms		
Anti-vibration performance	2000g		

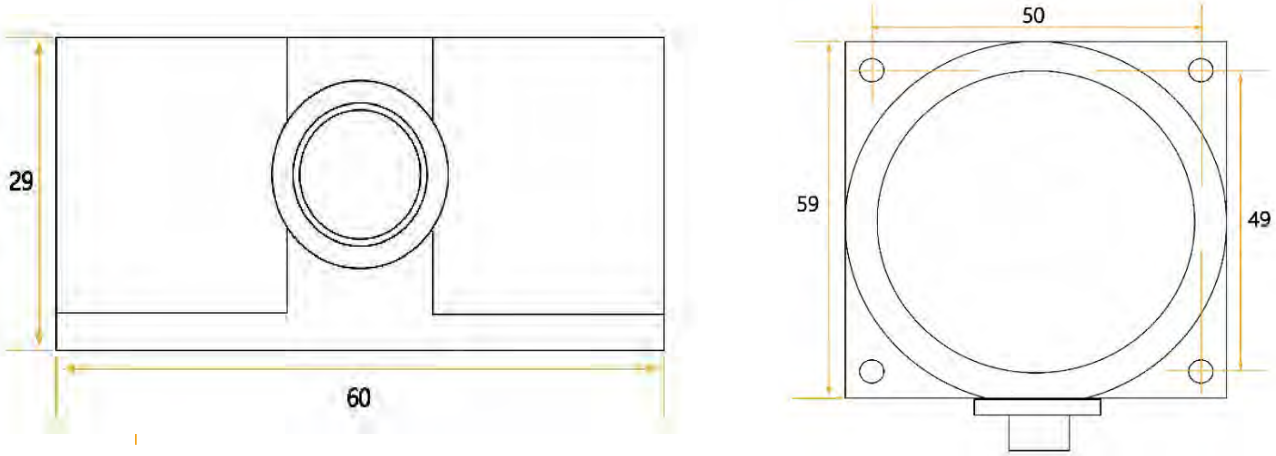
Resolution: The measured minimum change value that the sensor can detect and resolve within the measurement range.
Accuracy: The error between the actual angle and the Root mean square(RMS) of the measured angle of the sensor (≥16 times).

Mechanical Characteristic

Connector	Metal connector (standard cable is 1.5m))
Protection level	IP67
Shell material	Magnesium alloy sanding oxidation
Installation	Three M4 screws

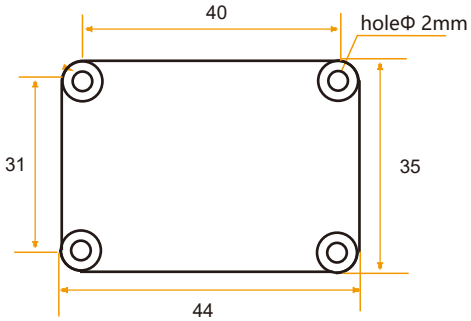
Package size

Size：L60*W59*H29（mm）



Bare plate product size

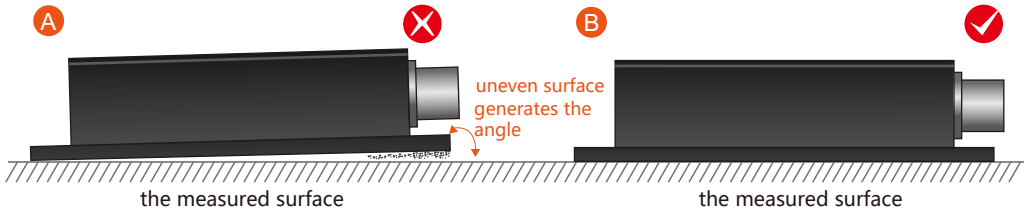
Size：L44*W35*H11（mm）
Note: ±1mm error for length and width dimensions, please refer to actual size.

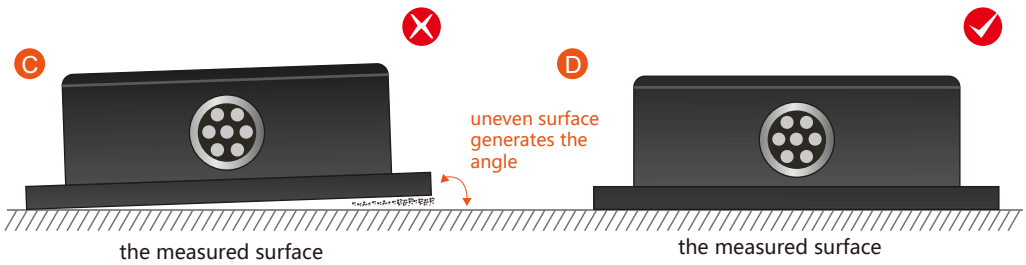


Installation direction

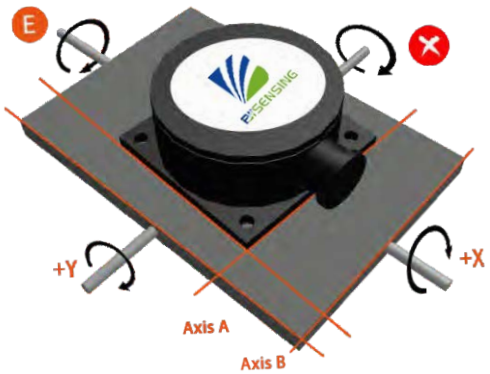
The correct installation method can avoid measurement error. The following points should be made when installing the sensor:

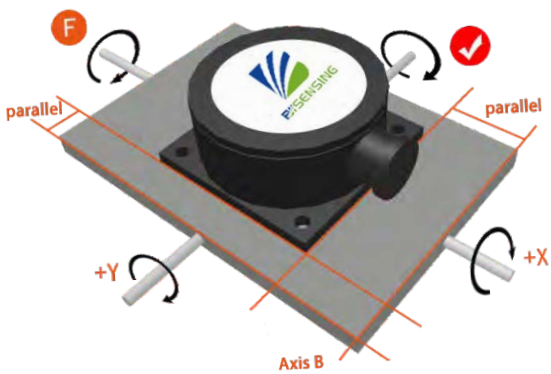
First of all, to ensure that the sensor mounting surface and the measured surface completely close, the measured surface should be as horizontal as possible, can not have the angle shown in Figure A and Figure C, the correct installation is shown in Figure B and Figure D.





Secondly, the bottom cable of the sensor and the axis of the measured object shouldn't generate the angle shown in E. When installing, the bottom cable of the sensor should be kept parallel or orthogonal to the rotation axis of the measured object. This product can be installed horizontally or vertically (vertical installation requires customization). The correct installation method is shown in Figure F.



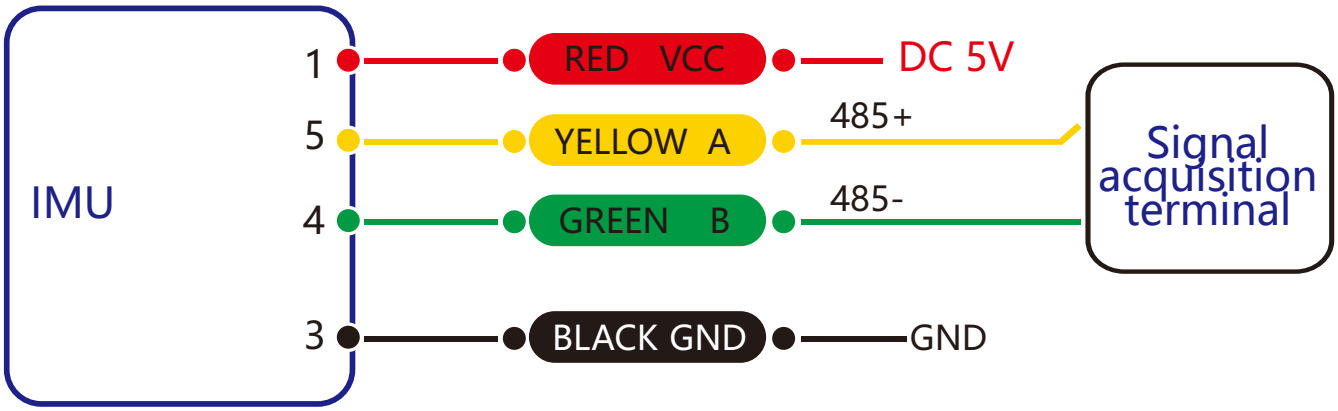


Finally, the installation surface of the sensor must be fixed with the measured surface tightly smoothly, to avoid measurement error that may be caused by the acceleration and vibrati

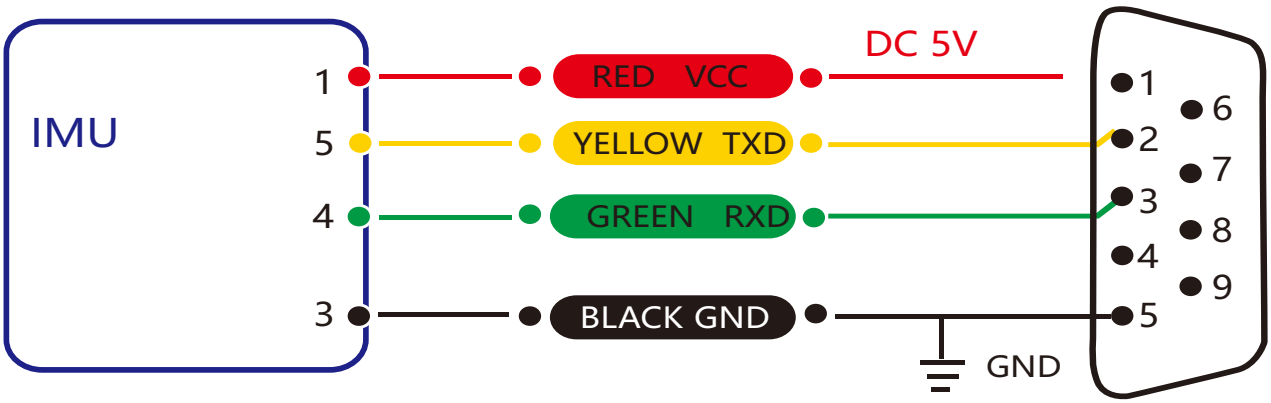
Electrical connections

Electrical interfaces

Cable color & function	RED	BLUE	BLACK	GREEN	YELLOW
	1	2	3	4	5
	VCC DC 5V	NC	GND	RXD (B、D-)	TXD (A、D+)



RS 485 wiring diagram



RS 232 wiring diagram

Note: The RS232 interface needs to share the product ground wire with the communication ground wire.

Debugging software

Users can directly download serial assistant on official website (Supports-Download). You can also use more convenient and intuitive PC software.

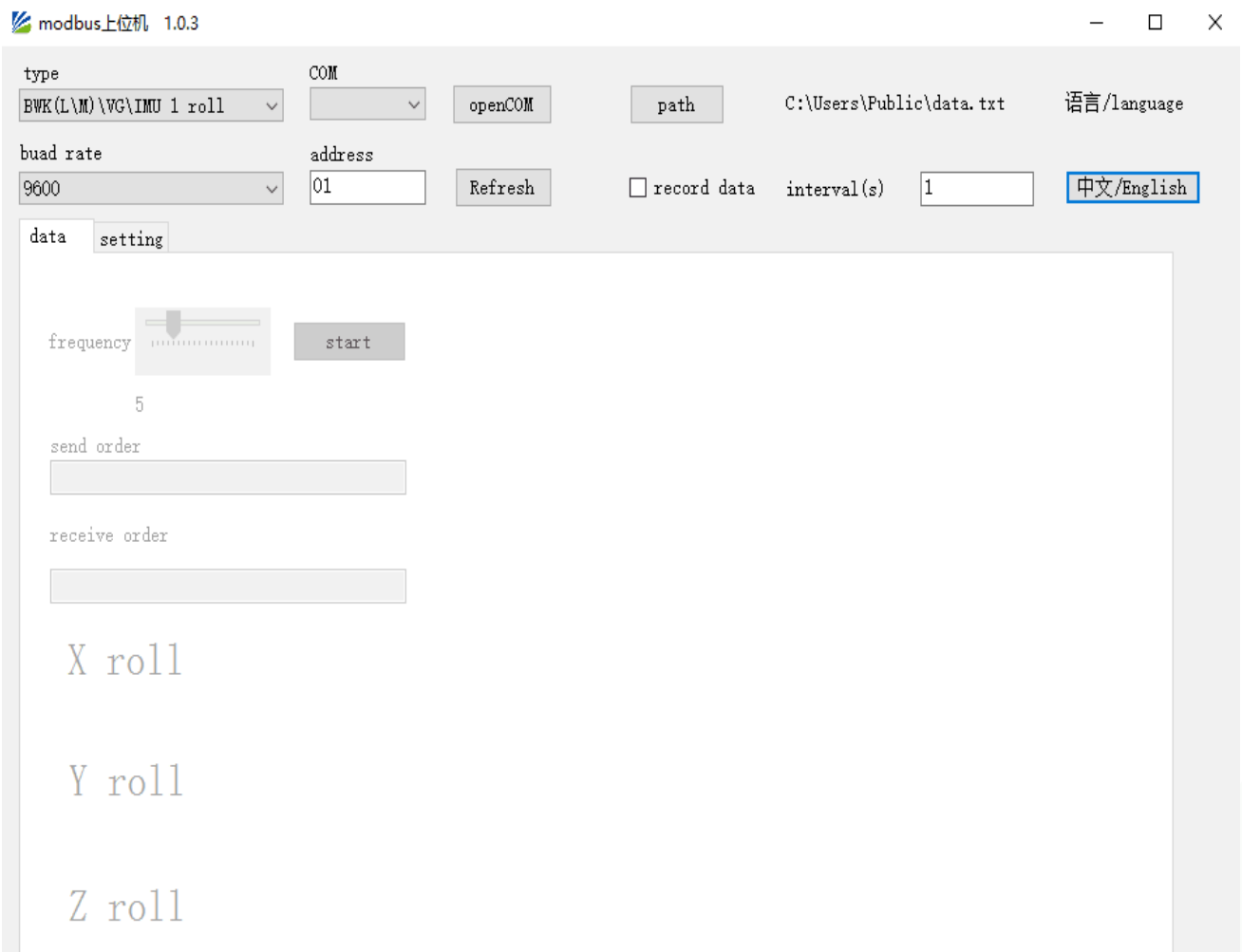
BW-IMU127C supporting serial debugging software can be connected to the inclinometer on the computer for angle display. The software debugging interface is as shown in the figure below. Using the debug software, it can conveniently display the current X-direction tilt angle, and you can also modify and set other parameters by yourself.

Software usage steps

① Connect the serial port hardware of the inclinometer correctly and connect the power supply.

② Select the computer serial port and baud rate and click to connect to the serial port.

③ Click Start and the tilt angle of the inclinometer in the X and Y directions will be displayed on the screen.



Protocol

1 Data Frame Format:

(8 data bits, 1 stop bit, non verification, default rate 9600)

Address Code (1byte)	Function Code (1byte)	The first high address register (1byte)	The first low address register (1byte)	High register number (1byte)	Low register number (1byte)	CRC (2byte)
0x01	0x03 (read) 0x06 (write)	xx	xx	xx	xx	xxxx

Data format: Hexadecimal
Address code: Default 01 (**note:** it should not exceed 25)
Function Code: 03 represents reading register,06 represents presetting register.
Register Address: The starting address the register need to be operated
Register amount: The amount need to operate
Checksum: The CRC 16 (Modbus RTU) is calculated by the host (recommended by the CRC calculation software).
Uhjlvwhu gdwd vwrudjh rughu= [0d{lv dqjoh=Uhjlvwhu 33 34 \0d{lv dqjoh=uhjlvwhu 33 35 Surgxfw Dgguhvv=Uhjlvwhu 33 36]hur w|sh=uhjlvwhu 33 37

2 Command Format:

2.1 Read angle of X-axis Command: 01 03 00 01 00 01 D5 CA

Address Code (1byte)	Function Code (1byte)	The first high address register (1byte)	The first low address register (1byte)	High register number (1byte)	Low register number (1byte)	CRC (2byte)
0x01	0x03	0x00	0x01	0x00	0x01	0xD5CA

Command response:

Address Code (1byte)	Function Code (1byte)	Number of bytes (1byte)	High number (2byte)	Low number (2byte)	Wrong CRC checksum (2byte)
0x01	0x03	0x02	xx	xx	xxxx

Note: The data field is a hexadecimal number (PLC or configuration software uses 16-bit registers to directly read data in decimal). After conversion to decimal, the real data = (data field - 20,000) / 100. If the data field is 3D52, the conversion to decimal is 15698, the real data = (15698-20000) / 100 = -43.02°

2.2 Read angle of Y-axis Command: 01 03 00 02 00 01 25 CA

Address Code (1byte)	Function Code (1byte)	The first high address register (1byte)	The first low address register (1byte)	High register number (1byte)	Low register number (1byte)	CRC (2byte)
0x01	0x03	0x00	0x02	0x00	0x01	xxxx

Command response:

Address Code (1byte)	Function Code (1byte)	Number of bytes (1byte)	Data field high (2byte)	Data field low (2byte)	CRC (2byte)
0x01	0x03	0x02	xx	xx	xxxx

2.3 Read angle of both X-axis and Y-axis Command： 01 03 00 01 00 02 95 CB

Address Code (1byte)	Function Code (1byte)	The high address register (1byte)	The first low address register	High register number	Low register number	CRC (2byte)
0x01	0x03	0x00	0x01	0x00	0x02	xxxx

Command response:

Address Code (1byte)	Function Code (1byte)	Number of bytes (1byte)	The angle of X-axis (2byte)	The angle of Y-axis (2byte)	.....	CRC (2byte)
0x01	0x03	0x04	xx xx	xx xx	.....	xxxx

2.4 Set the communication rate Command： 01 06 00 0B 00 02 79 C9

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	Function Code (1byte)	Data field (2byte)	CRC (2byte)
0x01	0x06	0x00	0x0B	0x0002	0x79 9C

Command response:

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	Function Code (1byte)	Data field (2byte)	CRC (2byte)
0x01	0x06	0x00	0x0B	0x0002	0x79 9C

Note: Data field is 0x00 00 represents 2400
0x00 01 represents 4800
0x00 02 represents 9600 (the default value)
0x00 03 represents 19200
0x00 04 represents 115200

2.5 Set relative/absolute zero

Command: 01 06 00 0A 00 00 A9 C8

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	Function Code (1byte)	Data field (2byte)	CRC (2byte)
0x01	0x06	0x00	0x0A	0000: absolute zero 0001: relative zero	0xA9 C8

Command response:

Address Code (1byte)	Function Code (1byte)	Function Code (1byte)	Function Code (1byte)	Data field (2byte)	CRC (2byte)
0x01	0x06	0x00	0x0A	0000: absolute zero 0001: relative zero	0xA9 C8

Note: absolute zero: Based on the factory-calibrated zero point.
relative zero: Reference to the zero after the current installation.

2.6 Query relative/absolute zero

Command: 01 03 00 04 00 01 C5 CB

Address Code (1byte)	Function Code (1byte)	The high address register (1byte)	The low address register (1byte)	High register number	Low register number	CRC (1byte)
0x01	0x03	0x00	0x04	0x00	0x01	0xC5 CB

Command response:

Address Code (1byte)	Function Code (1byte)	Number of bytes (1byte)	Data field high (1byte)	Data field low (1byte)	CRC (2byte)
0x01	0x03	0x02	xx	xx	xxxx

2.7 Set module address

Command: 01 06 00 0D 00 03 58 08

Address Code (1byte)	Function Code (1byte)	The high address register (1byte)	The low address register (1byte)	Data field (2byte)	CRC (2byte)
0x01	0x06	0x00	0x0D	XXXX	XXXX

Command response:

Address Code (1byte)	Function Code (1byte)	The high address register (1byte)	The low address register (1byte)	Data field (2byte)	CRC (2byte)
XXXX	0x06	0x00	0x0D	XXXX	XXXX

Note: XXXX indicates that the address range to be modified is 0000~00FF

2.8 Save settings Command: 01 06 00 0F 00 00 B9 C9

Address Code (1byte)	Function Code (1byte)	The high address register (1byte)	The low address register (1byte)	High number of registers (1byte)	Data field (2byte)	Checksum (2byte)
0x01	0x06	0x00	0x0F	0x00	0x0000	0xB9C9

Command response:

Address Code (1byte)	Function Code (1byte)	The high address register (1byte)	The low address register (1byte)	Data field (2byte)	Checksum (2byte)
0x01	0x06	0x00	0x0F	0x0000	0xB9C9

Note: For all the previous setting items, you need to send the save command after modification. Otherwise, after power off, these settings will be restored to the state before the setting.

2.9 Read three-axis acceleration Command: 01 03 00 28 00 06 45 C0

Address (1byte)	Function (1byte)	High address of register	Low address of register	High order of the number of registers	Low order of the number of registers	Checksum (2byte)
0x01	0x03	0x00	0x28	0x00	0x06	0x45C0

Command response:

Address (1byte)	Function (1byte)	Byte (1byte)	X axis angle (4byte)	Y axis angle (4byte)	Z axis angle (4byte)	Checksum (2byte)
0x01	0x03	0x0C	X	Y	Z	CRC

Note: The Data of each axis is 32-bit single-precision floating-point type (4 bytes), with the low bit in the front and the high bit in the back.

2.10 Read three-axis angular velocity Command: 01 03 00 2E 00 06 A5 C1

Address (1byte)	Function (1byte)	High address of register	Low address of register	High order of the number of registers	Low order of the number of registers	Checksum (2byte)
0x01	0x03	0x00	0x2E	0x00	0x06	0xA5C1

Command response:

Address (1byte)	Function (1byte)	Byte (1byte)	X axis angle (4byte)	Y axis angle (4byte)	Z axis angle (4byte)	Checksum (2byte)
0x01	0x03	0x0C	X	Y	Z	CRC

Note: The Data of each axis is 32-bit single-precision floating-point type (4 bytes), with the low bit in the front and the high bit in the back.

Ordering Information

Product number	Way of communication	Package condition
BW-IMU127C-485	RS 485	IP67 Package/Metal Connector
BW-IMU127C-232	RS232	IP67 Package/Metal Connector
BW-IMU127C-TTL	TTL	IP67 Package/Metal Connector

Executive standard

- Enterprise Quality System Standard: ISO9001:2008 Standard (Certificate No.:23919Q1045IROS)
- CE certification (certificate number: M.2019.103.UY1151)
- ROHS (certificate number:G 190930099)

BW-IMU127C Serials

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