BWM417

Digital Single Axis Inclinometer Modbus Output

Data Sheet

BWM 417

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Introduction

BWM417 is a cost-effective single-axis tilt sensor with the latest MEMS technology and digital output developed by Bewis. The measuring range is ±180°, the highest accuracy is 0.01°, and the working temperature is -40°C-+85°C. The product uses a high-precision MEMS accelerometer and a high-resolution differential digital-to-analog converter with built-in automatic compensation and filtering algorithms that minimize errors caused by environmental changes. The static gravity field is converted into a angle change, and the horizontal angle value is directly output by digital means. The product has high long-term stability, small temperature drift,use simplely, and strong resistance to external interference,it is the best choice of inclination for measurement and mapping, military equipment, industrial automation etc.

Features

- Single-axis inclination measurement
- Resolution 0.001°
- Measuring range: ±180°
- Accuracy 0.01°
- IP67 protection
- DC 9~35V Voltage input
- RS232, RS485, TTL optional
- Shock resistance > 2000g
- Small size 90×40.5×26mm (customizable)

Applications

- Industrial automatic leveling
- medical instruments
- Automatic solar tracking
- Tower leaning monitoring
- Crane inclination control
- Structural deformation monitoring
- Measuring and mapping instrument
- Military equipment automation

Specifications

Electrical Specifications

Parameters	Conditions	Min	Typical	Max	Units
Power Supply DC		9	12	35	V
Operating Current	Non-loaded	20	30	40	mA
Operating Temperature		-40	25	+85	℃
Store Temperature		-55	25	+100	℃

Performance Specifications

Parameters	Condition	BWM417	Units
Measuring Range		0~±180	°
Measuring Axis		X	
Accuracy	Room Temperature	0.01	°
Resolution		0.001	°
Zero Temperature Drift	-40℃~85℃	±0.005	°/℃
EMC	According to GBT17626		
Output Frequency	Max	100	Hz
Shock Resistance	2000g，3times/axis		
Weight	150g(including the box)		
Mean Time Between Failure	≥ 100000h		
Resistance	≥ 100 MΩ		

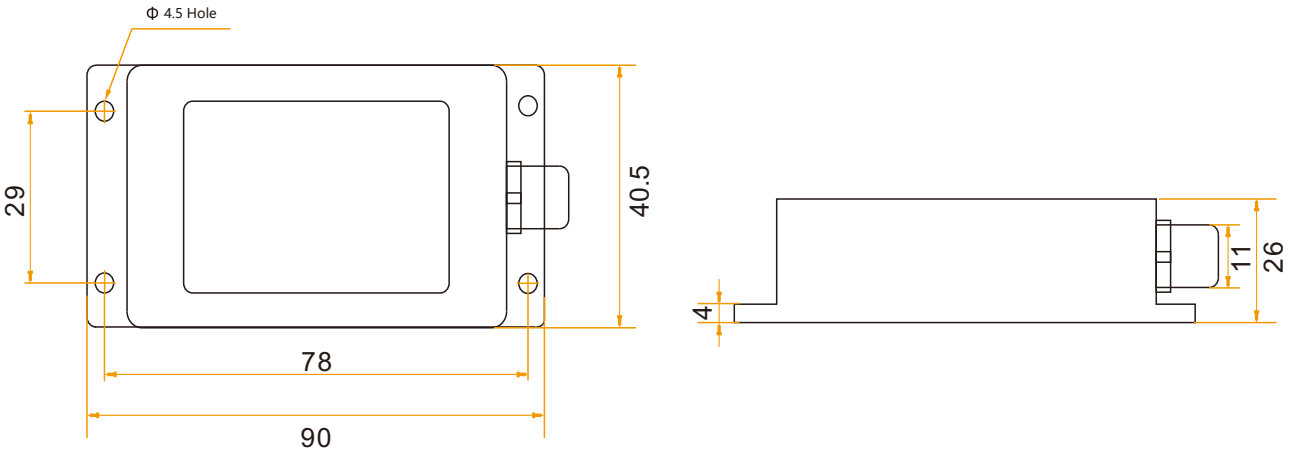
Resolution: the minimum change that is detectable and discern in the measurement range of the senor.
Accuracy: the error between the square roots of the actual angle and the multiple measured (≥16 times) angles of the sensor.

Mechanical Characteristics

Connector	metal plug (cable is 1.5m for standard)
Protection Level	IP67
Shell Material	Magnesium aluminum alloy anodic oxidation
Installation	4X4mm diameter screws

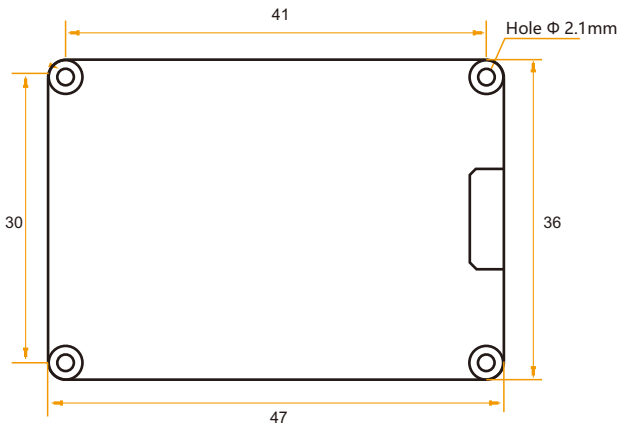
Package size

Size: 90X40.5X26 (mm)



Bare plate product size

Size: 47X36X15 (mm) The length and width dimensions are ±1mm error, please refer to the actual size.

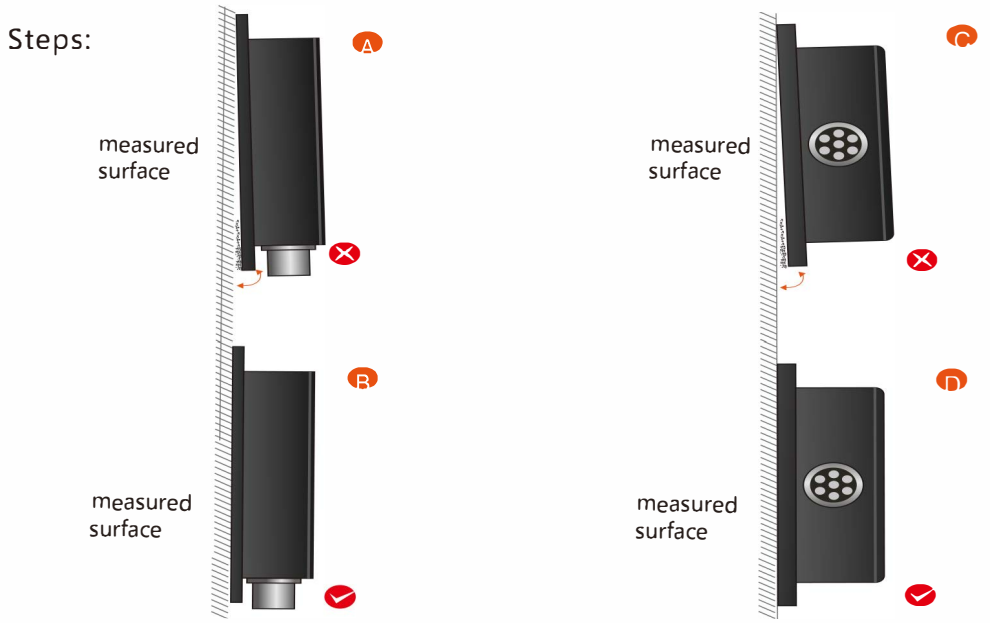


Installation

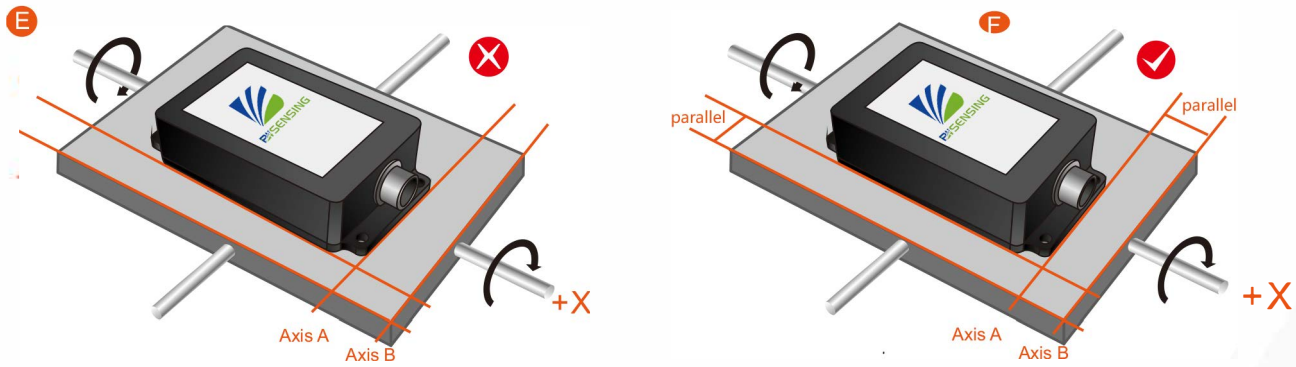
This series of products can be installed vertically or horizontally.

The following points should be taken when installing the sensor:

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



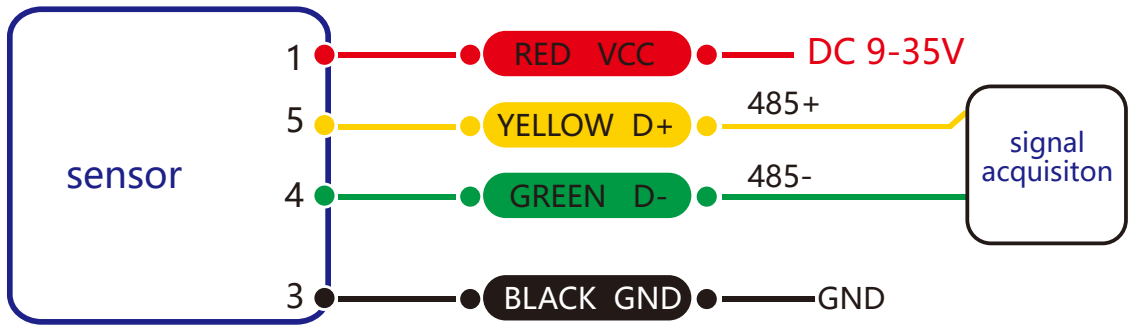
Secondly, the bottom edge of the sensor and the axis of the object to be measured cannot be generated at an angle as shown in Figure E, it should be parallel or orthogonal during installation. This product can only be installed vertically. The correct installation method is shown in Figure F.



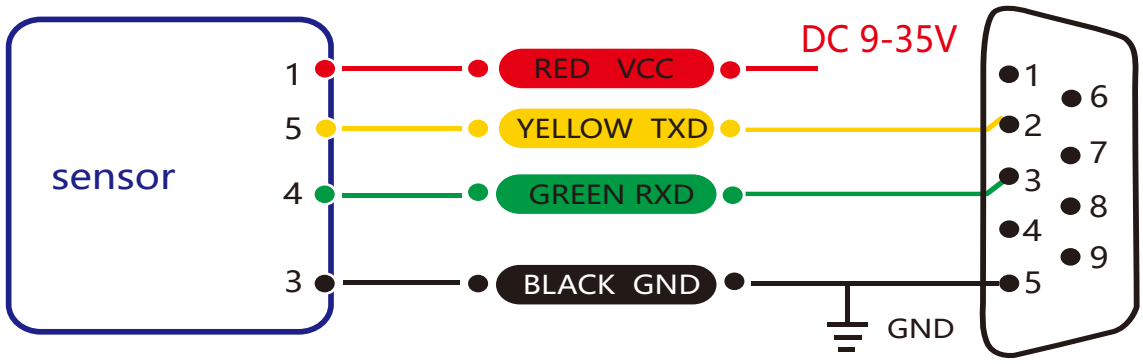
Finally, the installation surface of the sensor must be fixed with the measured surface tightly and smoothly, to avoid measurement error that may be caused by the acceleration and vibration.

Electrical connectin

	RED	BLUE	BLACK	GREEN	YELLOW
Cable color &Function	1	2	3	4	5
	VCC DC 9-35V	NC	GND	RXD (B、D-)	TXD (A、D+)



RS 485wiring diagram



RS 232 wire diagram

Software debugging

Download the serial port debugging assistant with Mod-bus function from Bewis official website (https://www.bwsensing.com/download.html), you can also use the more convenient and intuitive PC software.

The BWM417 accessory software can be connected to the inclinometer on the computer for angle display(Through RS232-USB adaptor). The software debugging interface is shown in the figure below. Using the tilt angle to debug the host computer, the current X-axis tilt angle can be displayed conveniently , and other parameters can be modified and set.

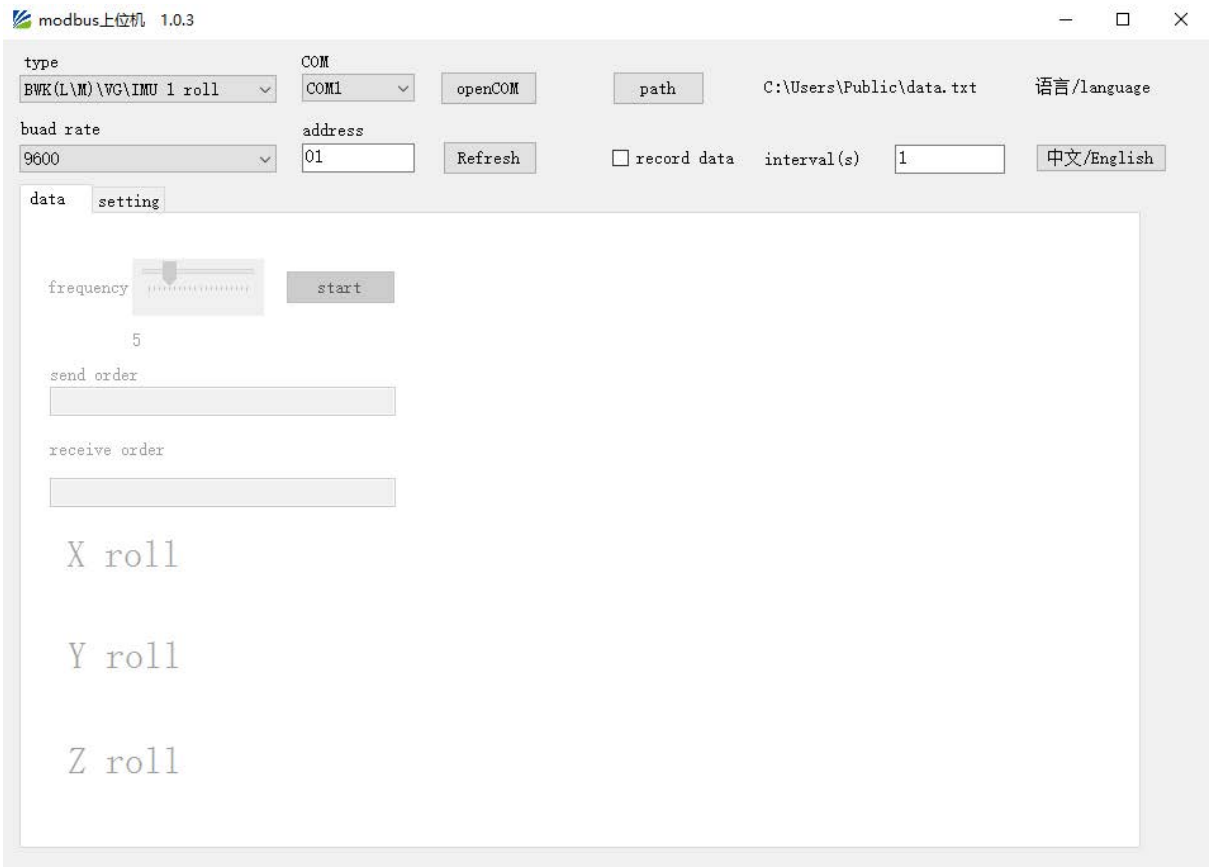
Software usage steps:

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 the serial port.

③ Click "Start "and the tilt angle of the inclinator in the X direction will be displayed on the screen.

Note: You can switch to Chinese or English version by the Upper right button



Communacation Protocol

1 Data Frame Form: (8 data bits, 1 stop bit , No parity check, default baud rate 9600)

Address code (1 byte)	Function code (1 byte)	The high address of the first register (1 byte)	The low address of the first register (1 byte)	The high umber of registers (1byte)	The low umber of registers (1byte)	CRC check (2byte)
01	03 (read) 06 (write)	XX	XX	XX	XX	XXXX

Data format: 16 hexadecimal
Address code: default is 01 (Note: The address must not exceed 255)
Function code: 03 represents the read register and 06 represents the pre register
Address of register: register start address that needs to be operated
Number of registers: number of registers to be operated on
CRC checksum: calculated by the host computer (It is recommended to use CRC calculation software)
Register data storage order:
X axis angle: register 00 01
Product address: register 00 03
Zero type: register 00 04

2 Command Format:

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

Address code (1 byte)	Function code (1 byte)	The high address of the first register (1 byte)	The low address of the first register (1 byte)	The high umber of registers (1byte)	The low umber of registers (1byte)	CRC check (2byte)
01	03	00	01	00	01	D5CA

Response command:

Address code (1 byte)	Function code (1 byte)	Number of bytes (1 byte)	Data-high (1 byte)	Data-low (1byte)	CRC check (2byte)
01	03	02	xx	xx	xxxx

Note: The data field is a hexadecimal number (PLC or configuration software uses 16-bit registers to read data directly is decimal). After decimal, 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 degrees, the data field 1230, the decimal is 4656, the real data = (4656-20000) / 100 = -153.44 degrees .

2.2 Set absolute and relative zeros Command: 01 06 00 0A 00 00 A9 C8

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0A	0x0000 Absolute zero 0x0001 Relative zero	xx xx

Response command:

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0A	0x0000 Absolute zero 0x0001 Relative zero	xx xx

Note:
absolute zero: Based on the factory-calibrated zero point
Relative zeros: Base on the zero point set at the current position.

2.3 Query absolute and relative zeros Command : 01 03 00 04 00 01 C5 CB

Address code (1 byte)	Function code (1 byte)	The high address of the first register (1 byte)	The low address of the first register (1 byte)	The high umber of registers (1byte)	The low umber of registers (1byte)	CRC check (2byte)
0x01	0x03	0x00	0x04	0x00	0x01	0xC5 CB

Response command :

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

2.4 Set module address Command: 01 06 00 0D 00 03 58 08

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0D	module address	xxxx

Response command:

Low address (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
module address	0x06	0x00	0x0D	module address	xx xx

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

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0B	0x0002	0x79 C9

Response command :

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0B	0x0002	0x79 C9

Note: the data field is 0x00, 00 stands for 2400;
0x00 01 stands for 4800;
0x00 02 represents 9600 (default);
0x00 03 stands for 19200;
0x00 04 stands for 115200.

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

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0F	0x0000	0xB9 C9

Response command :

Address code (1 byte)	Function code (1 byte)	Function code (1 byte)	Function code (1 byte)	Data domain (2byte)	CRC check (2byte)
0x01	0x06	0x00	0x0F	0x0000	0xB9 C9

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

Ordering Information

Product No.	Protocol	Encapsulation
BWM417-180-232	RS 232	IP67/Mental joints
BWM417-180-485	RS 485	IP67/Mental joints
BWM417-180-TTL	TTL	IP67/Mental joints

Implementation Standards

Enterprise quality system standards: ISO9001: 2008 standard (certificate number: 10114Q16846ROS)

- CE certification (certificate number: 3854210814)
- ROHS (certificate number: SO814260031)
- GB/T 191 SJ 20873-2003 General specification for inclinometer and level
- GBT 18459-2001 sensor static performance index calculation method
- JJF 1059-1999 Measurement uncertainty evaluation and representation
- GBT 14412-2005 Mechanical vibration and shock Mechanical installation of accelerometer
- GJB 450A-2004 General requirements for equipment reliability
- GJB 909A Quality control of key parts and important parts of
- GJB899 reliability identification and acceptance test
- GJB150-3A high temperature test
- GJB150-4A low temperature test
- GJB150-8A rain test
- GJB150-12A sand dust test
- GJB150-16A vibration test
- GJB150-18A impact test
- GJB150-23A tilt and rocking test
- GB/T 17626-3A RF electromagnetic field radiation immunity test
- GB/T 17626-5A surge (shock) impulse immunity test
- GB/T 17626-8A power frequency magnetic field immunity test
- GB/T 17626-11A Resistance to voltage sag, short - term interruption and voltage change

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Modbus Output

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