



BEWIS



BWM417H Series

Modbus Single-axis Inclinometer

Data Sheet



Introduction

BWM417H is a cost-effective single-axis tilt sensor with the latest MEMS technology and digital output developed by BEWIS.

The measuring range is $\pm 180^\circ$, the highest accuracy is 0.01° , and the working temperature is -40°C - $+85^\circ\text{C}$. 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 to minimize errors caused by environmental changes.

It converts the change of the static gravitational field into the inclination angle change, and directly outputs the horizontal tilt value by digital means.

This product has high long-term stability, small temperature drift, simple use and strong resistance to external interference. It is the best choice for measurement and mapping, solar CSP tracking, and industrial automation and other industries.

Features

- Single-axes inclination measurement
- Resolution: 0.001°
- Size: $L90 \times W40.5 \times H26\text{mm}$ it can be
- DC 9~35V Voltage input
- Highest Accuracy: 0.01°
- Measuring range: $0 - \pm 180^\circ$
- IP67 protection
- RS232, RS485, TTL optional

Applications

- Automatic industrial leveling
- Medical device
- Solar energy automatic tracking
- Monitor the tilt of the tower pole
- Control of inclination Angle of crane
- Deformation monitoring of the structure
- The analyzer includes the measuring and mapping instrument
- Automation of military equipment

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	°C
Store Temperature		-55	25	+100	°C

Performance Specifications

Parameters	Condition	BWM417H	Units
Measuring Range		0-±180	°
Measuring Axis		X	
Accuracy	Room Temperature	0.01	°
Resolution		0.001	°
Precision compensated(Tower)	-30°C~70°C	±0.025	°
Precision compensated(Trough)	-10°C~80°C	±0.05	°
Output Frequency	Max	100/10	Hz/ms
Shock Resistance	2000g , 3times/axis		
Weight	280g		
Mean Time Between Failure	≥ 30000h		
Resistance	≥ 100 MΩ		

Resolution: the minimum change that is detectable and discern in the measurement range of the sensor.

Accuracy: the error between the square roots of the actual angle and the multiple measured (≥16 times) angles of the sensor.

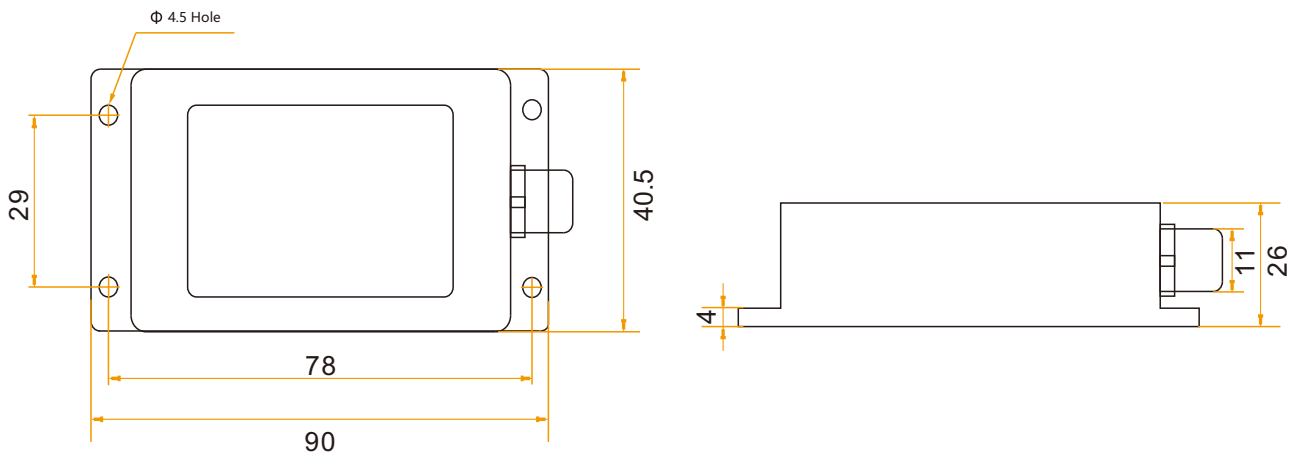


Mechanical Characteristics

Connector	Aviation plug(standard cable is 1.5m) it can be connected to the encoder
Protection Level	IP67
Shell Material	Magnesium aluminum alloy anodic oxidation
Installation	4X4mm diameter screws

Package size

Size : 90X40.5X26 (mm)



Accuracy Test

Test Equipment: the angle is adjustable, high&low temperature is adjustable

Measuring Range: 0-90°

Operation Temperature: -30°C-70°C

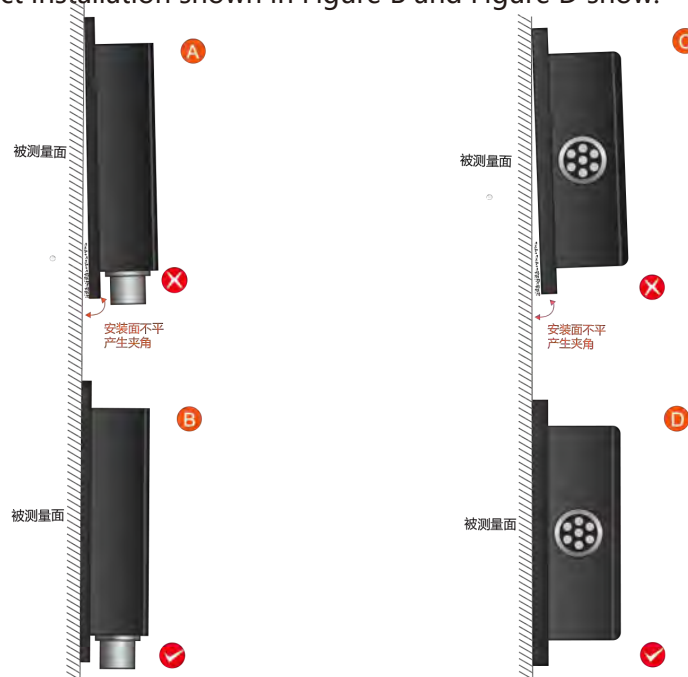
Our temperature drift detection is placing the sensor in the incubator, adjusting the incubator temperature from -30° to 70°, the maximum error of the test sensor angle does not exceed $\pm 0,025^\circ$. This error is a comprehensive error.

Installation

this model can only be installed by **vertical -The pendulum pose**

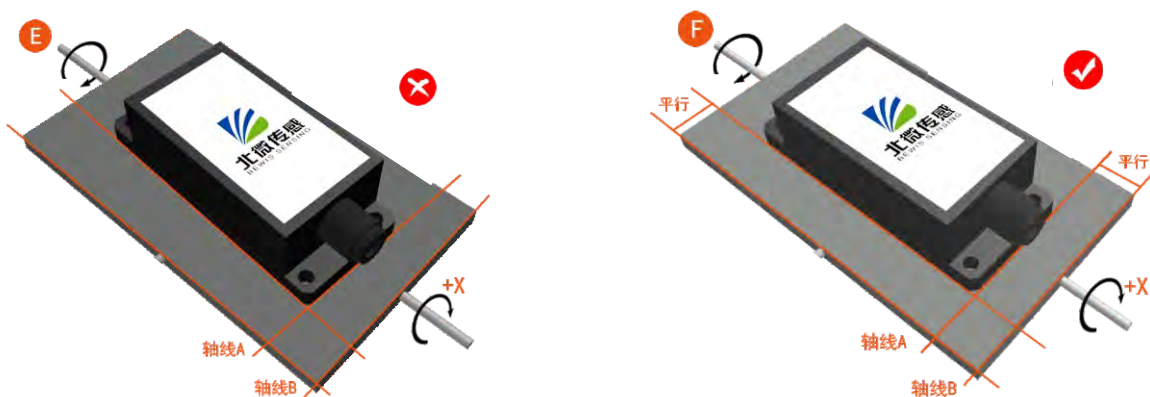
The correct installation method can avoid errors; the sensor installation should follow the points below:

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



Second, the sensor bottom line and the measured object axis can not be produced as shown in the E diagram of the angle. The installation should keep the bottom edge of the sensor parallel or orthogonal to the axis of rotation of the measured object.

This product can only be pendulum installed. The correct installation method is shown in Figure F.

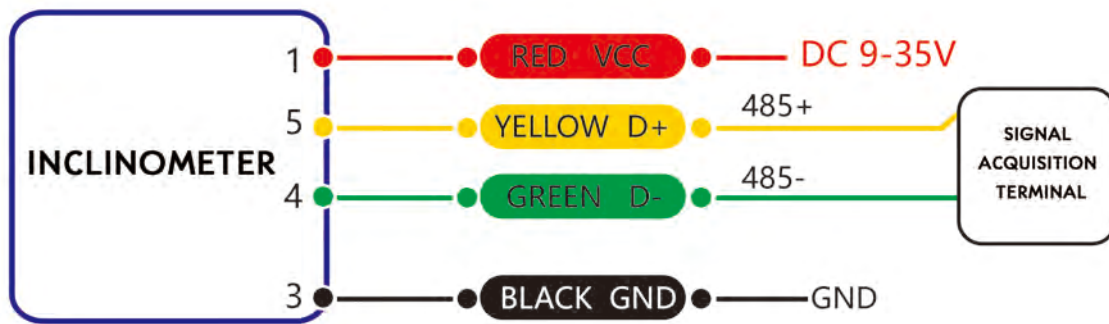


Finally, the sensor mounting surface and the surface to be measured must be fixed, contact smooth, stable rotation, to avoid the acceleration and vibration generated by the measurement error.

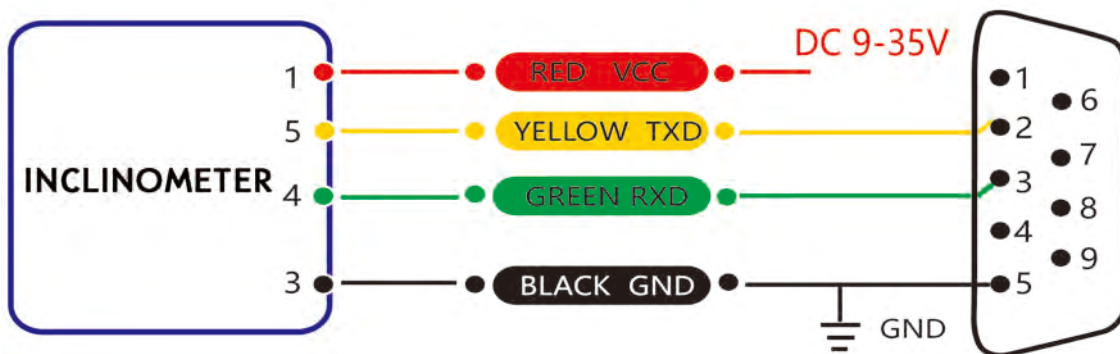
Electrical Connections

Wiring Diagram

RED	BLUE	BLACK	GREEN	YELLOW
1	2	3	4	5
DC 9-35V	NC	GND	Receive RXD B、 D-	Transmit TXD A、 D+



RS 485



RS 232

Software debugging

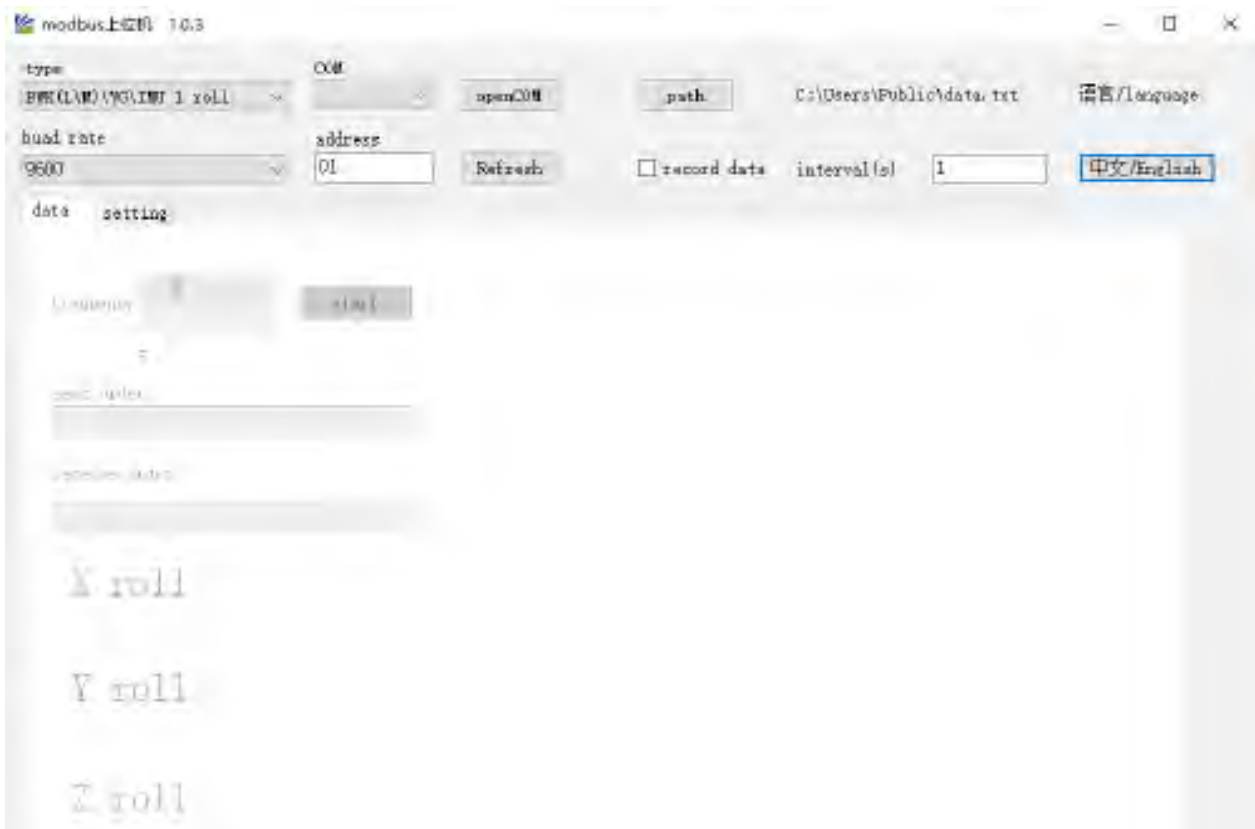
Download the serial port debugging assistant with Mod-bus function from Bewis official website (Supports-Download), you can also use the more convenient and intuitive PC software.

The BWM417H accessory software can be connected to the inclinometer on the computer for angle display. 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 by user

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 inclinometer in the X direction will be displayed on the screen.

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



Communication 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: address no more than 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 (recommended by 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 of the first register (1 byte)	The low address of 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

Command response:

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: data fields are 16 hexadecimal numbers (PLC or configuration software, read directly with 16 bit registers, data is decimal), decimal, real data = (data domain -20000) /100.

If the data field is 3D52, converted to decimal is 15698, Real data = (15698-20000) /100=-43.02 degrees, data field 1230, decimal is 4656, 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	00x000 Absolute zero 0x0001 Relative zero	xx xx

Command response:

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: The factory calibration zero point as the benchmark;

Relative zero: 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

Command response:

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	xx xx

2.4Set 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	xx xx

Command response:

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	0x00 02	0x79 C9

Command response:

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	0x00 02	0x79 C9

Note: the data field is 0x00 00 stands for 2400;
 0x00 01 stands for 4800;
 0x00 02 stands for 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	0x00 00	0xB9 C9

Command response:

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	0x00 00	0xB9 C9

Note:
 For all previous set items, changes are required to send the Save Command, otherwise, after the power is cut, these settings will revert to the previous state.



Ordering Information

Product No.	Protocol	Encapsulation
BWM417H-180-485	RS 485	IP67/Aviation Plug
BWM417H-180-232	RS 232	IP67/Aviation Plug
BWM417H-180-TTL	TTL	IP67/Aviation Plug

Implementation Standards

- Enterprise quality system standards : ISO9001:2008 (Certificate No. : 10114Q16846ROS)
- CE Certification (Certificate No. : 3854210814)
- ROHS (Certificate No. : SO814260031)

BWM417H Series

Modbus single -axes Inclinator

Bewis Sensing Technology LLC

Address: Building 30, No.58 Xiuxi Road, Wuxi City,
Jiangsu, China

Tel: +86 15050672146

Email: support@bwsensing.com

Web: www.bwsensing.com