Angle transmitter
(Type 485)

1. Product introduction

1.1 Product Overview

Inclination transmitter is a standard industrial biaxial inclination meter, by detecting the inclination Angle in the use environment to judge the tilt state of the equipment, can be used outdoors for a long time. Widely used in industrial dip Angle measurement and dangerous house monitoring, ancient building protection monitoring, bridge tower incline measurement, tunnel monitoring, dam monitoring, weighing system tilt compensation, drilling tilt control and other industries, safe and reliable, beautiful appearance, convenient installation.

1.2 Functional characteristics

☐ Kalman filtering algorithm is adopted to make the angle value collected by the equipment accurate and stable.

☐ It has a wide angle measurement range and good linearity of output signal, which can be used in most environments.

☐ Special 485 circuit and standard ModBus RTU communication protocol are adopted. Communication address and baud rate can be set.

☐ 5~30V DC wide voltage range power supply.

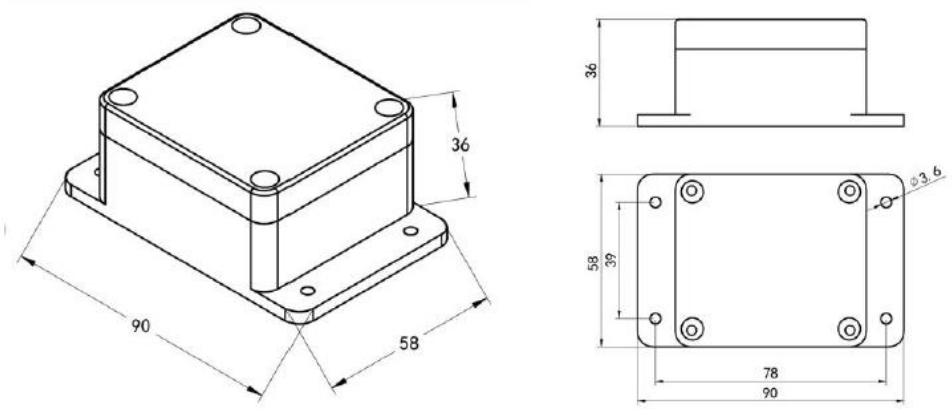
☐ It has the characteristics of wide measuring range, good linearity, convenient use, easy installation, long transmission distance, etc.

1.3 Technical parameters

DC power supply (default)	DC 5-30V
Maximum power consumption	≤0.15W
Operating temperature	-40℃~60℃
range	X-axis - 180 °~180 ° Y-axis - 90 °~90 ° Z-axis - 180 °~180 °
Resolution	0.01°
accuracy	Static accuracy 0.05 °, dynamic accuracy 0.1 °
Response time	＜1S
Protection grade	IP65
Default cable length	60cm
Overall dimension	90*58*36mm
Output signal	RS485 (Modbus protocol)

2. Boundary dimension and installation method

2.1 Overall dimensions



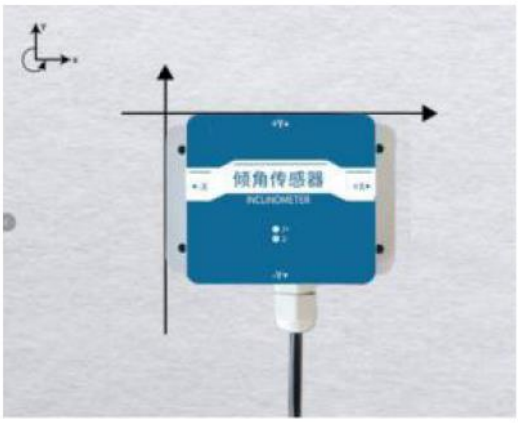
Equipment dimension drawing (unit: mm)

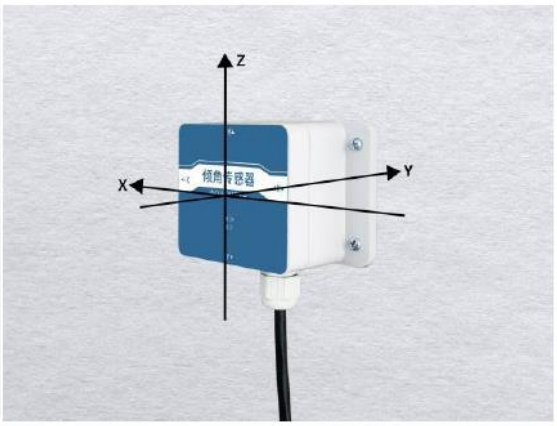
2.2 Installation method

The module is installed horizontally by default. When the module needs to be placed vertically, it can be installed vertically.

Vertical installation method: When installing vertically, rotate the module 90 ° around the X axis and place it vertically. Select "Vertical" from the "Installation Direction" option in the configuration bar of the upper computer. After setting, calibration is required before use.

For vertical installation, the X axis is horizontal to the left, the Y axis is vertical to the wall and inward, and the Z axis is counterclockwise rotation direction of the module.





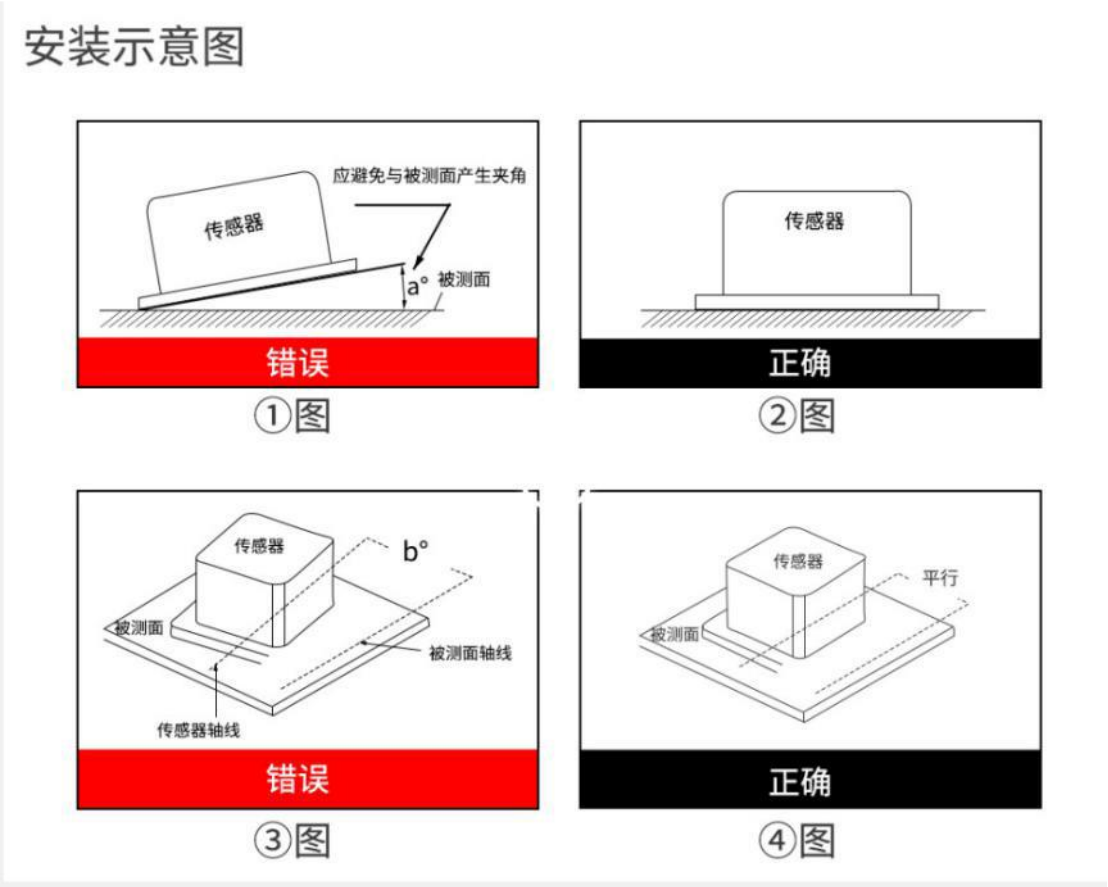
Horizontal installation (top view angle)　　Vertical installation

3. Usage

Please install the tilt transmitter according to the correct installation method. Incorrect installation will lead to measurement error. Pay special attention to two "faces" and two "lines":

(1) The mounting surface of the tilt transmitter and the measured surface must be fixed tightly, smoothly and stably. If the mounting surface is uneven, it is easy to cause the included angle error of the transmitter measurement.

(2) The axis of the tilt transmitter must be parallel to the axis to be measured, and the two axes should not have an included angle as far as possible.



(3) Place the device on the desktop. The right is the X axis, the up is the Y axis, and the vertical

to the desktop is the Z axis. The direction of rotation is defined according to the right hand rule, that is, the thumb of the right hand points to the X axis, and the bending direction of the four fingers is the direction of increasing rotation around the axis. The X axis angle is the rotation direction around the X axis, the Y axis angle is the rotation direction around the Y axis, and the Z axis angle is the rotation direction around the Z axis.

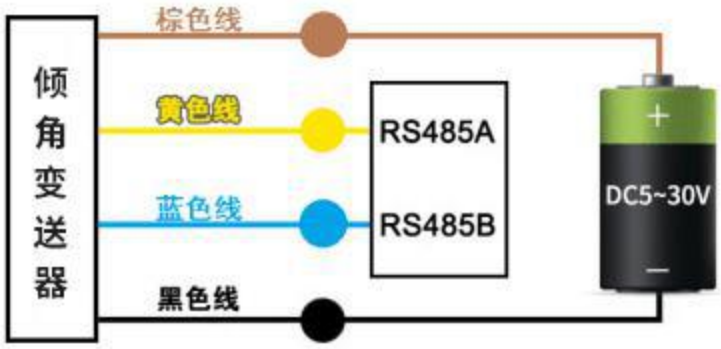
4. Equipment installation instructions

4.2 Interface description

Wide voltage power input of 5~30V is acceptable. When wiring 485 signal lines, it should be noted that lines A and B should not be connected reversely, and the addresses of multiple devices on the bus should not conflict.

4.3 Wiring instructions

Linear color	explain	remarks
brown	Power supply positive	5~30V DC
black	Power supply ground	GND
Yellow	485-A	485-A
Blue	485-B	485-B



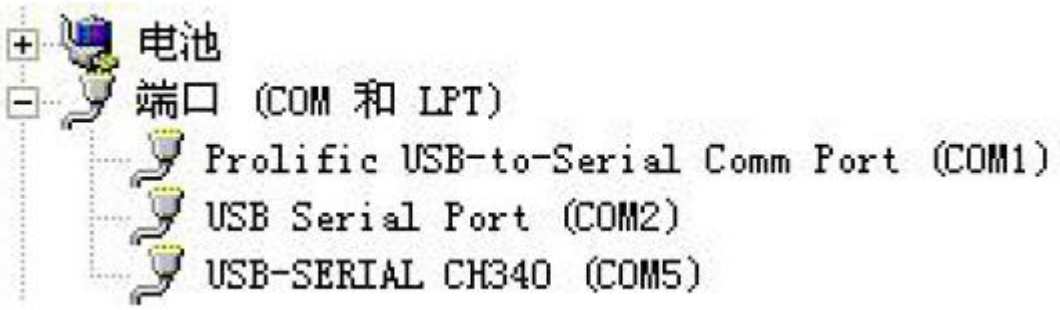
5. Installation and use of configuration software

5.1 Software selection

Open the data package, select "Debugging software" - "485 parameter configuration software", find and open it.

5.2 Parameter Setting

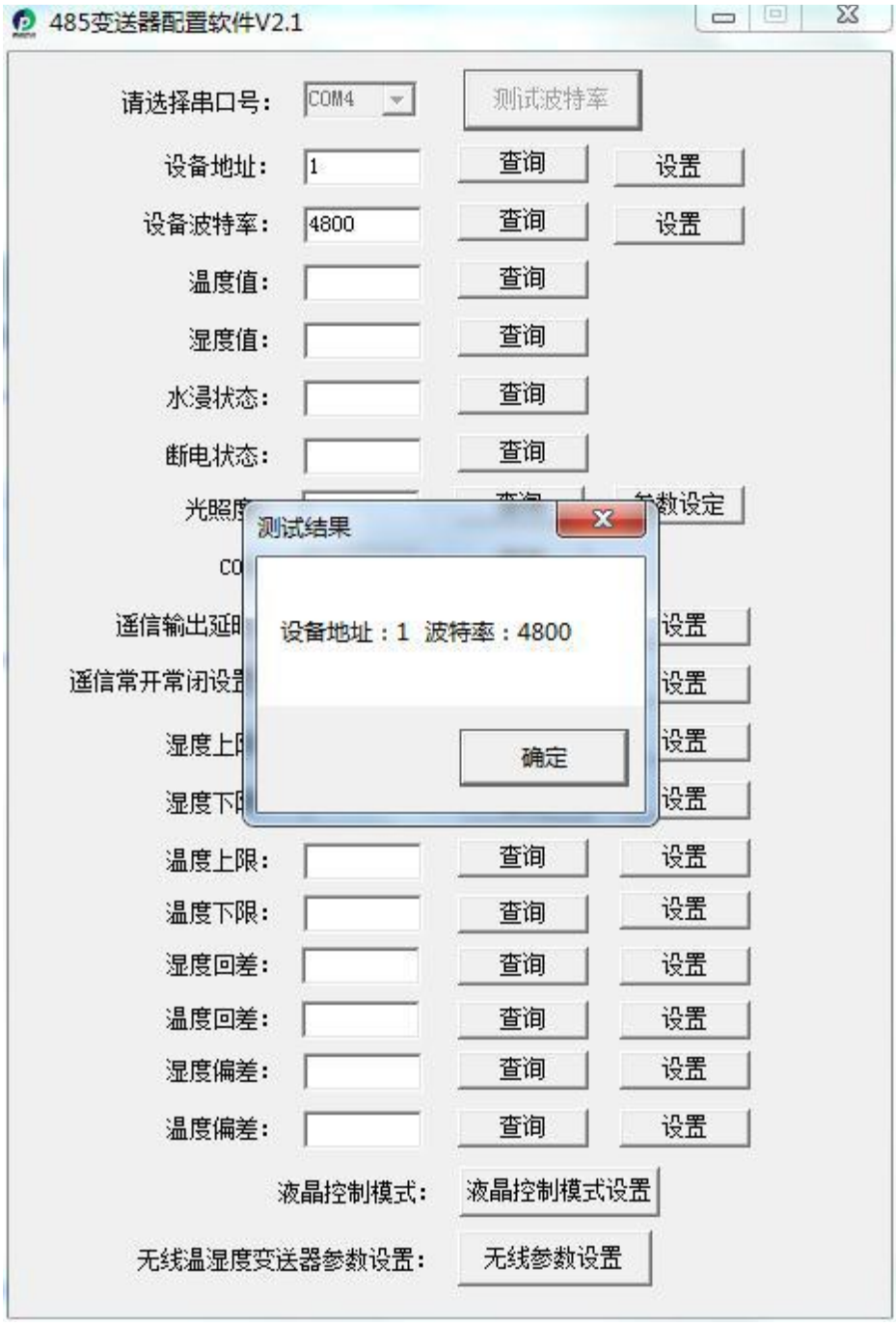
① Select the correct COM port (view the COM port in "My Computer - Properties - Device Manager - Port"). The following figure lists the drive names of several different 485 converters.



② . Connect only one device and power it on. Click the test baud rate of the software, and the software will test the baud rate and address of the current device. The default baud rate is 4800bit/s, and the default address is 0x01.

③ Modify the address and baud rate as required, and query the current function status of the device.

④ If the test is not successful, please recheck the equipment wiring and 485 driver installation.



6. Communication Protocol

6.1 Basic communication parameters

code	8-bit binary
Data bits	8-bit
Stop bit	1 bit
Error checking	CRC (Redundant cyclic code)
Baud rate	Optional. The factory default value is 4800bit/s

6.2 Definition of Data Frame Format

The Modbus-RTU communication protocol is adopted in the following format:

The time of the initial structure ≥4 bytes

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

End structure ⩾4 bytes of time

Address code: is the address of the transmitter, unique in the communication network (factory default 0x01).

Function code: Indicates the function of the command sent by the host.

Data area: The data area refers to the specific communication data. Note that 16bits of data is the highest byte!

CRC code: a two-byte verification code.

Host query frame structure:

Address code	Function code	Register starting address	Length of register	Check code low byte	Check code high byte
1 byte	1 byte	2 byte	2 byte	1 byte	1 byte

Slave response frame structure:

Address code	Function code	Number of valid bytes	Data area 1	Data area 2	Data area n	Check code low byte	Check code high byte
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte	1 byte	1 byte

6.3 Register address

Register address	PLC or configuration address	content	operation	Definition description
0000H	40001 (decimal)	X-axis angle	read only	Read the x-axis tilt angle and enlarge it by 100 times
0001 H	40002 (decimal)	Y-axis angle	read only	Read the tilt angle of y-axis and enlarge it by 100 times
0002H	40003 (decimal)	Z-axis angle	read only	Read the z-axis tilt angle and enlarge it by 100 times
0050 H	40081 (decimal)	X-axis deviation value	Reading and writing	16 bit signed integer, 100 times larger
0051 H	40082 (decimal)	Y-axis deviation value	Reading and writing	16 bit signed integer, 100 times larger
0055H	40086 (decimal)	Z-axis deviation value	Reading and writing	16 bit signed integer, 100 times larger
0052 H	40083 (decimal)	Installation method	Reading and writing	65H: Horizontal installation (default) 66H: vertical installation
0053 H	40084 (decimal)	X Y axis calibration	Write only	67H: XY axis zero point calibration
0054H	40085 (decimal)	Z-axis calibration	Write only	52H: Z-axis zero point calibration
07D0 H	42001 (decimal)	Device address	Reading and writing	1~254 (factory default 1)
07D1 H	42002 (decimal)	Device baud rate	Reading and writing	0 stands for 2400 1 stands for 4800 2 stands for 9600

6.4 Example and explanation of communication protocol

6.4.1 Example: Read the real-time value of device address 0x00

Interrogation frame

Address code	Function code	Start Address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

Reply frame

Address code	Function code	Return the number of valid bytes	X-axis angle	Check code low byte	Check code high byte
0x01	0x03	0x02	0x04 0x7E	0x3A	0xA4

Calculation of x-axis angle:

X-axis angle: 047E H (hex)=1150=>x-axis angle=11.50 °

6.4.2 Example: Read the real-time value of y-axis angle of device address 0x01

Interrogation frame

Address code	Function code	Start Address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x00 0x01	0x00 0x01	0xD5	0xCA

Reply frame

Address code	Function code	Return the number of valid bytes	Y-axis angle	Check code low byte	Check code high byte
0x01	0x03	0x02	0x0A 0xC8	0xBF	0x72

Y axis angle calculation:

Y-axis angle: 0AC8 H (hexadecimal)=2760=>Y-axis angle=27.60 °

6.4.3 Example: read the installation mode of device address 0x52

Interrogation frame

Address code	Function code	Start Address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x00 0x52	0x00 0x01	0x25	0xDB

Reply frame

Address code	Function code	Return the number of valid bytes	Installation method	Check code low byte	Check code high byte
0x01	0x03	0x02	0x00 0x66	0x38	0x6E

66H indicates vertical installation

6.4.4 Example: use 0x53 register to calibrate XY axis

Interrogation frame

Address code	Function code	Variable address	Write data	Check code low byte	Check code high byte
0x01	0x06	0x00 0x53	0x00 0x67	0x38	0x31

Reply frame

Address code	Function code	Variable address	Return Data	Check code low byte	Check code high byte

0x01	0x06	0x00 0x53	0x00 0x67	0x38	0x31

Write 0067 to 0x53 register to complete XY axis calibration of the device

Example: Use 0x54 register to calibrate Z-axis

Interrogation frame

Address code	Function code	Variable address	Write data	Check code low byte	Check code high byte
0x01	0x06	0x00 0x54	0x00 0x52	0x49	0xe7

Reply frame

Address code	Function code	Variable address	Return Data	Check code low byte	Check code high byte
0x01	0x06	0x00 0x54	0x00 0x52	0x49	0xe7

Write 0052 to 0x54 register to complete Z-axis calibration of the device

Simultaneous calibration can be completed on the configuration software

7. Common problems and solutions

7.1 The device cannot be connected to PLC or computer

Possible causes:

1) The computer has multiple COM ports, and the selected port is incorrect.

2) The device address is incorrect, or there are devices with duplicate addresses (0x01 is the factory default).

3) Baud rate, check mode, data bit, stop bit error.

4) 485 bus is disconnected, or A and B lines are connected reversely.

5) If the number of equipment is too large or the wiring is too long, power shall be supplied nearby, 485 intensifiers shall be added, and 120 Ω terminal resistance shall be added at the same time.

6) The USB to 485 drive is not installed or damaged.

7) Equipment damage.

7.2 Notes

When the Y axis is near 90 °, it is the Euler angle blind area of the equipment. At this time, the X output angle is inaccurate, and you should pay attention to avoid this angle during installation and use.