RS-DIP-N01-1

Tilt Transmitter (485 type)

User Manual

Document version:V1.5

Catalog

1. Product Introduction

1.1 Product overview

The tile transmitter is a standard industrial dual-axis inclinator, which judges the tilt state of the equipment by detecting the tilt angle in the operating environment, and can be used outdoors for a long time. It is widely used in industrial tilt measurement and dangerous building monitoring, ancient building protection monitoring, bridge tower tilt measurement, tunnel monitoring, dam monitoring, weighing system tilt compensation, drilling tilt control and other industries. It is safe and reliable, with beautiful appearance, and easy to install.

1.2 Function features

- The Kalman filter algorithm is adopted to make the angle value collected by the equipment accurate and stable.
- It has a wide angle measurement range, and the output signal has good linearity, which can be used in most environments.
- Adopt dedicated 485 circuit, standard ModBus-RTU communication protocol, 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, easy to use, easy to install, and long transmission distance etc.

1.3 Technical parameter

DC power supply (default)	DC 5-30V	
Maximum power consumption	≤0.15W	
Equipment components temperature resistance and humidity	-40℃~60℃, 0~95%RH(non-condensing)	
Angle measurement range	X-axis -180°~180°, Y-axis -90°~90°, Z-axis -180°~180°	
Resolution	0.01°	
Typical accuracy	X, Y axis	Static accuracy ±0.1°, dynamic accuracy ±0.5°
	Z axis	Static accuracy ±0.5°, dynamic have integral error
Temperature drift	±(0.5°~1°), (-40°C ~ +60°C)	
Accelerated speed range	±16g	
Response time	＜2s	
Protection class	IP65	
Default cable length	60cm, cable length can be customized	
Dimensions	90*58*36mm	
Output signal	RS485(Modbus protocol)	

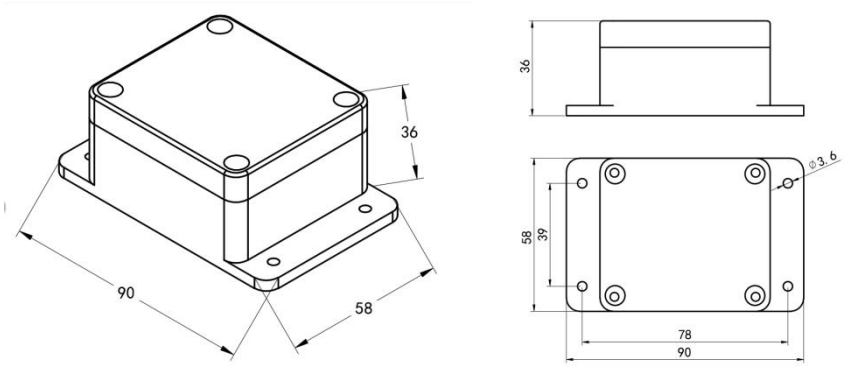
The performance data stated above were obtained under test conditions using our test system and software. In order to continuously improve products, we reserve the right to change design features and specifications without prior notice.

1.4 Product selection

RS-				Company code
	DIP-			Tilt transmitter
		N01-		RS485 (Modbus-RTU protocol)
			-1	Shell

2. Dimensions and installation method

2.1 Dimensions



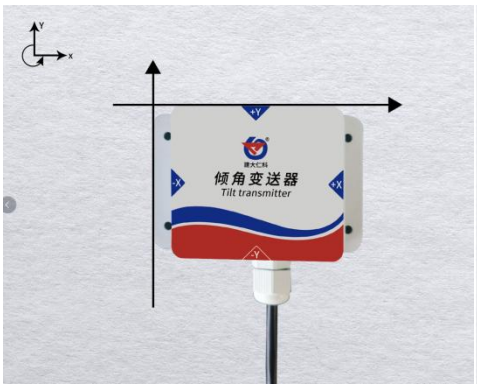
Equipment dimension drawings (unit: mm)

2.2 Installation method

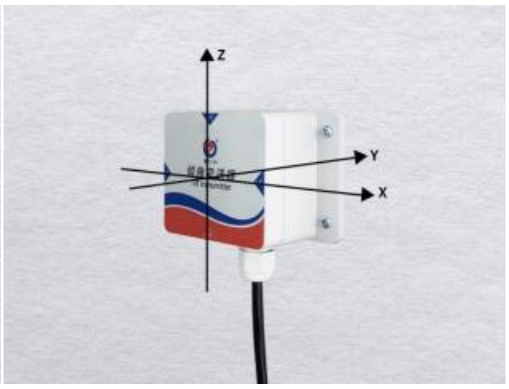
The default installation direction of the module is horizontal installation. When the module needs to be placed vertically, it can be installed vertically.

Vertical installation method: When installing vertically, place the module vertically by rotating 90° around the X axis, and select “vertical” in the “installation direction” option in the configuration bar of the host computer. After the setting is completed, calibration is needed before use.

When installed vertically, the X axis is horizontal to the right, and the Y axis is perpendicular to the wall and inward.Z-axis is the anticlockwise rotation direction of the module.



Horizontal installation (overview angle)



Vertical installation

3. How to use

Please install the tilt transmitter according to the correct installation method. Incorrect installation will cause measurement errors,especially take attention to the two "faces" and the two "lines":

(1) The mounting surface of the transmitter and the surface to be measured must be fixed tightly, flat and stable. If the mounting surface is uneven, it will easily to cause the measurement angle error of the transmitter.

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

Installation diagram

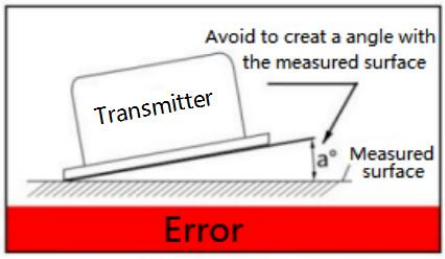


Figure ①

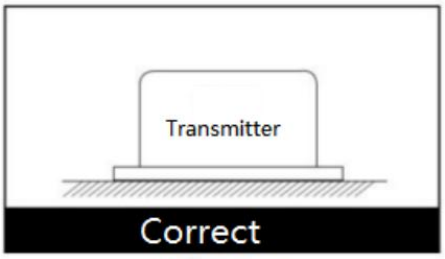


Figure ②

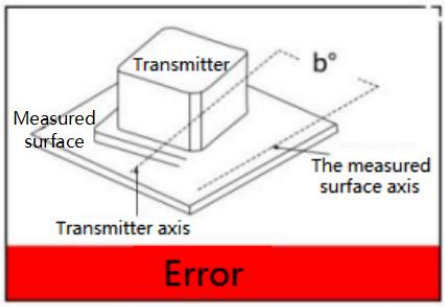


Figure ③

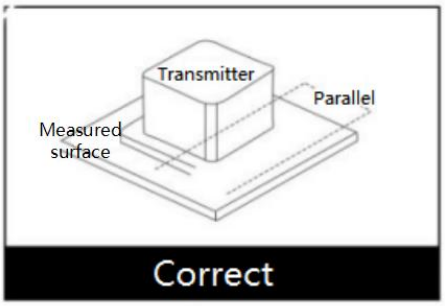


Figure ④

(3) Place the device on the desktop, to the right is the X axis, to up is the Y axis, vertical to the desk and outward is the Z axis. The rotating direction is defined per the right-hand rule, that is, the thumb of the right hand points to the X axis, and the direction in which the four fingers are bent is the rotating direction around this axis. The X-axis angle is the angle with rotating direction around the X-axis, the Y-axis angle is the angle with rotating direction around the Y-axis, and the Z-axis angle is the angle with rotating direction around the Z-axis.

4. Equipment installation instructions

4.1 Inspection before equipment installation

Equipment List:

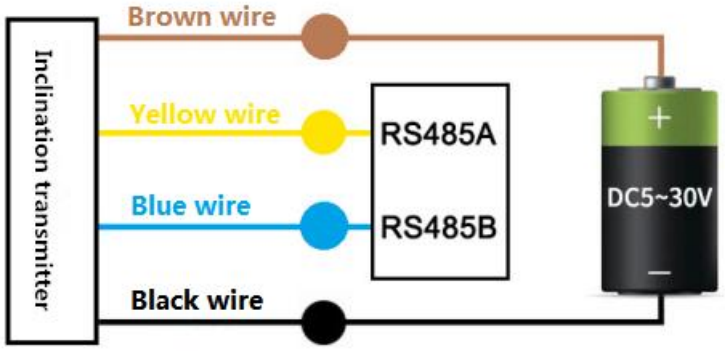
- 1pc tilt transmitter device
- Certificate of conformity, warranty card
- Installing screw pack

4.2 Interface Description

Wide voltage power input 5~30V can be used. When wiring the 485 signal line, be noted that wires A and B cannot be connected inversely, and the addresses of multiple devices on the bus must not conflict.

4.3 Wiring instructions

Thread color	Description	Remarks
brown	Power is positive	5~30V DC
black	Power ground	GND
yellow	485-A	485-A
blue	485-B	485-B



5. Configuration software installation and usage

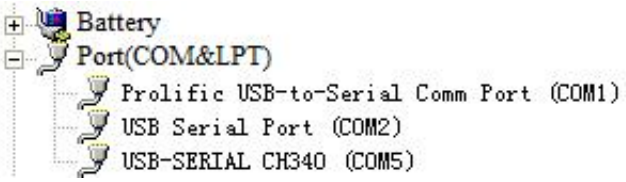
5.1 Software selection

Open the data package, select "Debugging software" --- "485 parameter configuration software", find 

and just open it.

5.2 Parameter settings

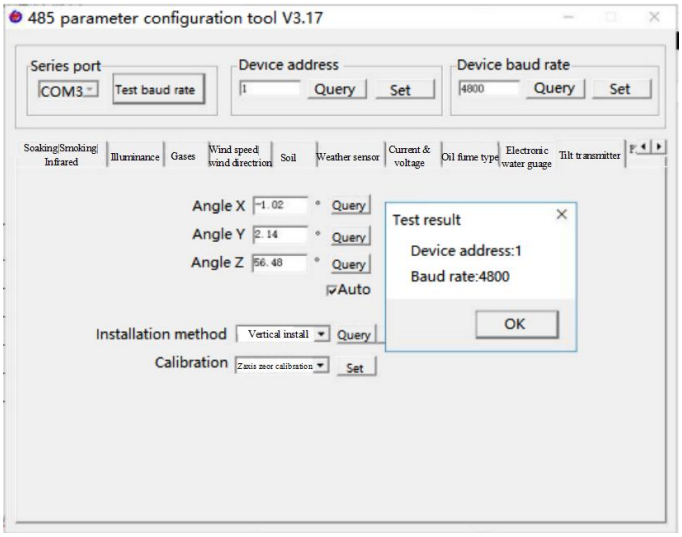
① Select the correct COM port (check the COM port in "My Computer—Properties—Device Manager—Port"), the following figure lists the driver names of several different 485 converters。



② Connect only one device alone and power it on, click the test baud rate of the software, 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 according to the needs of use, and you can query the current function status of the device at the same time.

④ If the test is unsuccessful, please recheck the equipment wiring and 485 driver installation.



6. Communication protocol

6.1 Basic communication parameters

Encode	8-bit binary
Data bit	8-bit
Parity bit	no
Stop bit	1 bit
Error checking	CRC (Redundant Cyclic Code)
Baud rate	1200bit/s, 2400bit/s, 4800bit/s, 9600bit/s, 19200bit/s, 38400bit/s, 57600 bit/s, 115200bit/s can be set, the factory default is 4800bit/s

6.2 Data frame format definition

Adopting Modbus-RTU communication protocol, the format is as follows:

Initial structure ≥ 4 bytes time

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

Time to end structure ≥ 4 bytes

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

Function code:The command function instruction issued by the host.

Data area: The data area is the specific communication data, please note the the 16bits data high byte are in front!

CRC code: two-byte check code.

Host query frame structure:

Address code	Function code	Register start address	Register length	Check code low byte	Check code high byte
1byte	1byte	2byte	2byte	1byte	1byte

Slave response frame structure：

Address code	Function code	Effective bytes number	Data area 1	Data area 2	Data area N	Check code low byte	Check code high byte
1byte	1byte	1byte	2byte	2byte	2byte	1byte	1byte

6.3 Register address

Register address	PLC or configuration address	Content	Operating	Definition description
0000H	40001(Decimal)	x-axis angle	Read only	Read the tilt angle of the x-axis and enlarge it by 100 times
0001H	40002(Decimal)	y-axis angle	Read only	Read the tilt angle of the y-axis and enlarge it by 100 times
0002H	40003(Decimal)	z-axis angle	Read only	Read the tilt angle of the z-axis and enlarge it by 100 times
0003H	40004(Decimal)	x-axis angle*206	Read only	Read the tilt angle of the x-axis and enlarge it by 10 times
0004H	40005(Decimal)	y-axis angle*206	Read only	Read the tilt angle of the y-axis and enlarge it by 10 times
0005H	40006(Decimal)	z-axis angle*206	Read only	Read the tilt angle of the z-axis and enlarge it by 10 times
000AH	40011(Decimal)	x-axis accelerated speed*206	Read only	Read the accelerated speed of the x-axis and enlarge it by 100 times
000BH	40012(Decimal)	y-axis accelerated speed*206	Read only	Read the accelerated speed of the y-axis and enlarge it by 100 times
000CH	40013(Decimal)	z-axis accelerated speed*206	Read only	Read the accelerated speed of the z-axis and enlarge it by 100 times
00C8H	40201(Decimal)	x-axis angle	Read only	Read the tilt angle of the x-axis and enlarge it by 100 times
00C9H	40202(Decimal)	y-axis angle	Read only	Read the tilt angle of the y-axis and enlarge it by 100 times
00CAH	40203(Decimal)	z-axis angle	Read only	Read the tilt angle of the z-axis and enlarge it by 100 times
00CBH	40204(Decimal)	x-axis angle*206	Read only	Read the tilt angle of the x-axis and enlarge it by 10 times

00CCH	40205(Decimal)	y-axis angle*206	Read only	Read the tilt angle of the y-axis and enlarge it by 10 times
00CDH	40206(Decimal)	z-axis angle*206	Read only	Read the tilt angle of the z-axis and enlarge it by 10 times
00CEH	40207(Decimal)	x-axis accelerated speed*206	Read only	Read the accelerated speed of the x-axis and enlarge it by 100 times
00CFH	40208(Decimal)	y-axis accelerated speed*206	Read only	Read the accelerated speed of the y-axis and enlarge it by 100 times
00D0H	40209(Decimal)	z-axis accelerated speed*206	Read only	Read the accelerated speed of the z-axis and enlarge it by 100 times
0050 H	40081(Decimal)	x-axis deviation value	Read and write	16-bit signed integer, enlarge it by 100 times
0051 H	40082(Decimal)	y-axis deviation value	Read and write	16-bit signed integer, enlarge it by 100 time
0055H	40086(Decimal)	z-axis deviation value		16-bit signed integer, enlarge it by 100 time
0052 H	40083(Decimal)	Installation method	Read and write	65H: Horizontal installation (default) 66H: Vertical installation
0053 H	40084(Decimal)	XY 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	Read and write	1~254 (factory default 1)
07D1 H	42002(Decimal)	Device baud rate	Read and write	0 represent 2400 1 represent 4800 2 represent 9600 3 represent 19200 4 represent 38400 5 represent 57600 6 represent 115200 7 represent 1200

Note: 00C8, 00C9, 00CA register can also read X, Y, Z axis angle value, and its function is:It is convenient to configure nodes when the tilt transmitter connect to host, concentrator and other devices.

6.4 Communication protocol example and explanation

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

Inquiry frame

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

X-axis angle calculation:

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

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

Inquiry frame

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

address code

address code	function code	Returns 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 method of device address 0x52

Inquiry frame

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

66H means vertical installation method.

6.4.4 Example: Use 0x53 register to calibrate XY axis.

Inquiry frame

Address	Function	Variable	Write data	Check code low	Check code high

code	code	address		byte	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 the 0x53 register to complete the device XY axis calibration.

6.4.5 Example: Use 0x54 register to calibrate Z axis.

Inquiry 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 the 0x54 register to complete the device Z axis calibration.

Simultaneity calibration can be completed on the configuration software.

7. Common problems and solutions

7.1 The device cannot be connected to the PLC or computer

Possible reason:

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

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

3) The baud rate, check method, data bit and stop bit are wrong.

4) The 485 bus is disconnected, or the A and B wires connection are reversed.

5) If the number of equipment is too large or the wiring is too long, power supply should be nearby, add 485 booster, and add 120Ω terminal resistance.

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

7) The equipment is damaged.

7.2 Note

When the Y-axis is around 90°, it is the Euler angle blind zone of the equipment. At the moment, the X output angle is not accurate, so please pay attention to avoid this angle during installation

and use.

8. Contact information

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9. Document history

V1.0 Document establishment

V1.1 Add Z-axis function description

V1.2 Add the register description when connecting to host

V1.3 Add humidity usage range

V1.4 Standardize the typical precision description

V1.5 Add accelerated speed register description, only partial product have this register