An instruction manual

Universal temperature transmitter

Typical application

▲ Widely used in various industrial fields

1. Overview

1.1 Safety guidance

This operational manual contains important information on how to use the transmitter correctly. The installation personnel of the transmitter should read this manual carefully before operation. In case of further explanation or special questions, which cannot be addressed in this manual, please contact our company for assistance on necessary information.

Please pay attention to the warning signs on the manual!

The operator must strictly follow the safety instructions and user's manual during operation. Furthermore, the operator should comply with the occupational safety rules, the accident prevention guidelines, the national standards and engineering specifications as well.

Please keep this manual in a safe place near the transmitter for easy access.

1.2 Icon description

⚠ Danger! - Hazard that may result in death or serious injury.

⚠ Warning!- Potential hazard that may result in death orserious injury.

⚠ Cautious!-Potential hazard that may cause minor injury.

! Reminder!-Potential hazard that may result in personal injury.

☞ Tips!-Tips and information for smooth operation of the equipment.

1.3 Manual user

⚠ Warning! This manual is suitable for technicians.

1.4 Limit of liability

The company will not be held responsible nor provide any warranty service, in case of transmitter damages caused by failure to follow the instruction manual, inappropriate use, self-modification or destruction.

1.5 Instructions for use

The temperature transmitter is suitable for temperature measurement in liquid or gas and process industries. Operators are responsible for checking whether the equipment is suitable for operating conditions. If you have any questions, please contact our sales department to ensure the correct application of the transmitter. The Company shall not bear any responsibility for the influence caused by improper selection.

The purchased model is suitable for certain gas or liquid medium as described in the measurement samples. The user must ensure the compatibility of contact media and transmitter.

⚠ Warning!
Inappropriate use may lead to danger!

2. Product overview

series temperature transmitter products use PT100 as signal measuring element, and through computer automatic testing, the temperature compensation of zero point and sensitivity in wide temperature range is carried out by laser resistance adjustment technology. The amplification circuit is located in the stainless steel case, which converts the sensor signal into standard output signal, giving full play to the technical advantages of the sensor, so that the series temperature transmitter has excellent performance. It has anti-interference, overload, small temperature drift, high stability, high measurement accuracy, and is an ideal temperature measurement instrument in the field of industrial automation.

3. Working principle

Temperature transmitter is the resistance effect produced by PT100 sensor under the influence of temperature. It generates a differential voltage signal by special processing unit conversion. This signal is transformed into standard analog or digital signal by special amplifier.

4. Product Features

a) Wide Voltage Supply, Nonlinear Correction, High Precision

b) Small size, light weight and easy installation

c) Strong anti-lightning, frequency-cut jamming design and anti-jamming ability

d) Connection Reverse and Overvoltage Protection and Current Limiting Protection

5. Technical parameters

Measuring media : Liquid 、 gas

Overall material: 304 stainless

Protective Pipe Material 304 Stainless Steel (Contact)

Process connection 304 stainless(contacted)

Casing 304 stainless

Display case ABS engineering plastic(digital tube display)

Hessman connector ABS engineering plastic

Overall weight :150g (L=30mm) 160g (L=50mm)

170g (L=100mm) 180g (L=150mm)

190g (L=200mm) 210g (L=300mm)

Display plus 80g

Casing weight

120g (L=35mm) 130g (L=85mm)

140g (L=135mm) 150g (L=185mm)

170g (L=285mm)

Scope of measurement: -50～100℃ (See the range parameter selection table for details.)

Supply voltage: 12～36VDC 15～36VDC (with display)

Output signal: 4～20mA、RS485 (Standard Modbus-RTU Protocol)

Accuracy class: 0.5%FS

Ambient temperature:-40～85℃

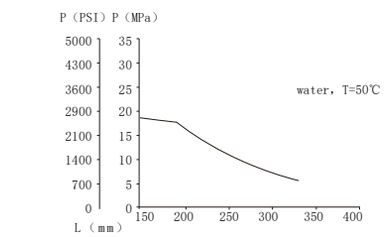
Stability : ±0.1% FS/year

Protection lever: IP65 (no display) IP54 (display)

Working conditions: ambient temperature-40～85℃

Ambient humidity0%～95%RH (No condensation)

Pressure Resistance: Pressure on thermal protection tube varies with length as shown in the figure below.



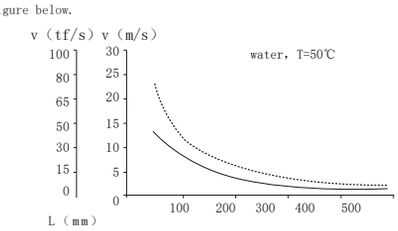
Diameter of protective tube6/10mm Tube wall thickness1mm	L:Immersion length	P:Process pressure

Response time: 18S without casing and 55s with casing

(If it is necessary to increase the response speed, the heat conducting medium can be added into the casing.)

(accord withIEC60751,0.4/sFlow, 10℃Stepping)

Medium velocity: The range of medium velocity that the protective tube bears decreases with the increase of insertion depth as shown in the figure below.



Diameter of protective tube6mm Tube wall thickness1mm	L:Immersion length
Diameter of protective tube10mm Tube wall thickness1mm	V:Current Speed

Power range : Current type≤0.02Us(W)

Digital type≤0.015Us(W)

Note:Us=Supplied voltage

Load characteristics: Current type load≤{(Us-9)/0.02 (Us=Power supply voltage)}Ω

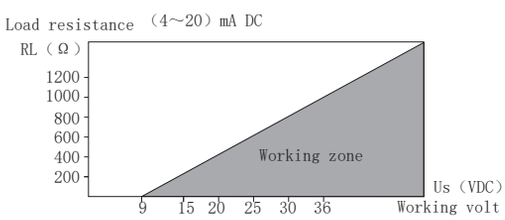


Figure5-1

6. Dimensions

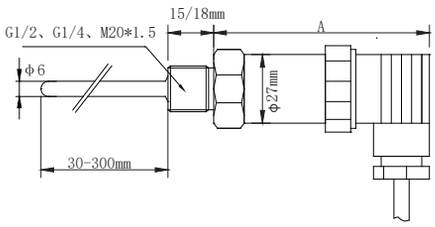
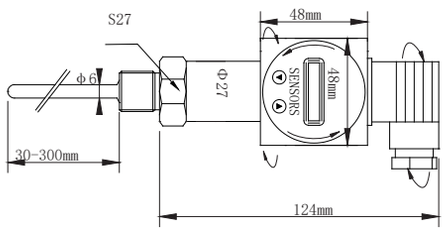


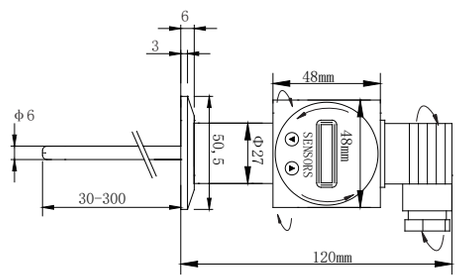
Figure 6-1 Threadless connection without display

length \ Difference	Analog output	Digital output
A	86mm	124mm



Note: The label can rotate 360 degrees.

Figure 6-2 Threaded connection display



Note: The label can rotate 360 degrees.

Figure 6-3 Hoop Connection Display

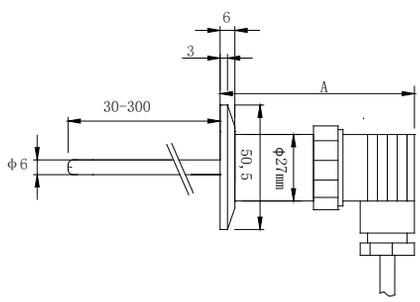


Figure 6-4 Hoop Connection No Display

length \ Difference	Analog output	Digital output
A	82mm	120mm

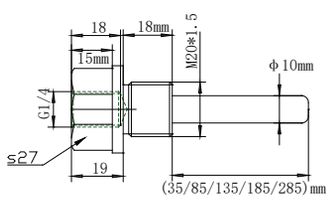


Figure 6-5 Casing Dimension Diagram

7. Installation and precautions

⚠ Warning!

a) Installed without pressure nor power supply.

⚠ Warning!

b) Transmitter should be installed by technician who read and understood this operational manual.

⚠ Danger!

c) This product is not explosion-proof, using in explosive area may cause serious injury and significant loss.

⚠ Warning!

d) It is prohibited to measure media that is not compatible with the transmitter.

☞ e) Please check if the package is in good order when receiving the product, confirm the transmitter model and specifications.

! f) No modification or change can be made to the device.

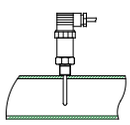
! g) Handle with care, do not throw, do not force during installation of transmitter.

☞ h) If the transmitter is installed in a bad site and will encounter dangerous damage such as lightning strike or overvoltage, we recommend that users protect against lightning strike and overvoltage between distribution box or power supply and transmitter.

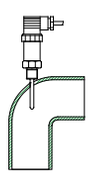
☞ i) If the pressure of the pipeline exceeds the pressure of the protective pipe, please customize the pressure-resistant product.

☞ j) During installation, wrenches should be used to tighten the transmitter from the hexagonal nuts at the bottom of the equipment to avoid directly rotating the upper part of the equipment and causing disconnection of the connecting wires.

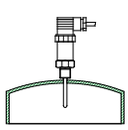
Installation of horizontal or side pipes for temperature transmitters.
The insertion depth is at least half the diameter of the pipe.
(At least 1 cm below the protective tube
The measurement accuracy should be ensured in the medium under test.



When installing the elbow of the temperature transmitter, the protective tube and the vertical elbow axes should contact the medium in reverse consistently. The insertion depth of the probe should be at least half of the diameter of the tube (at least 1 cm below the protective tube should be in the measured medium to ensure the measurement accuracy).



When the temperature transmitter is installed on the top of the container, the protective pipe should be inserted deep enough to avoid the error caused by temperature stratification.



!k) This product is a light current device, it must be laid separately from high current cables during wiring, and comply with relevant national wiring standard (GB/T50312-2016).

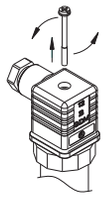
☞ l) Ensure that the supply voltage of the power supply meets the requirements of the power supply of the transmitter. Ensure that the measured temperature is within the range of the transmitter.

☞ m) Users should not disassemble themselves in order to avoid product damage.

8. wiring installation

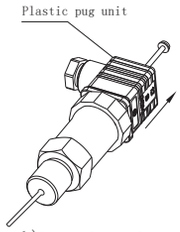
8.1 Wiring

Pull out the terminal block which is inside the casing of plug to connect the wire, wiring steps areas shown in the following figure.



a) Unscrew the star type M3 screw

Figure8-1



b) Remove plastic plug units indicated in the figure above.

Figure8-2

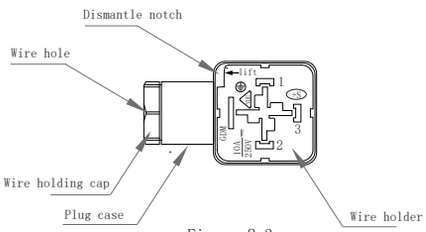


Figure 8-3

c) Remove wire holder from dismantle notch with flat screw driver.

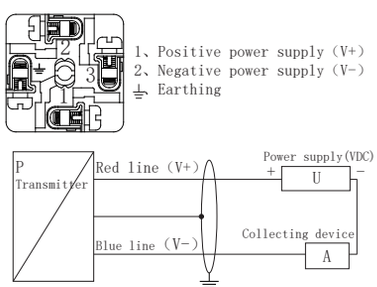
d) Lay shielded cable through the wire hole as figure8-3 after removing, connect wire at the terminal behind the wire holder as instructed in the figure, restore and screw the wire holding cap tightly.

☞ After wiring is completed, the wire outgoing direction can be changed by the direction of wire holder

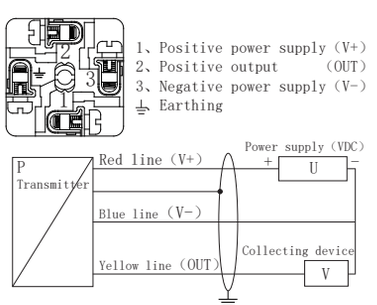
☞ It is required to ensure the outer diameter of the cable used is within the allowable range of the guard staple. And the cable must be fitted in the guard staple firmly and without clearance. The diameter of wire holding cap is 4～6 mm. (5 mm diameter shielded cable is recommended).

☞ The plug must be correctly and properly installed to ensure the protection level.

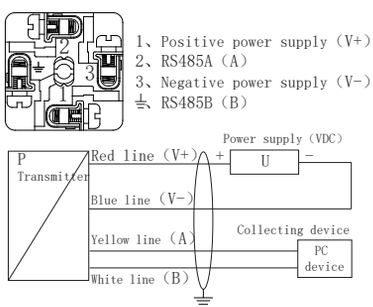
9. Wiring diagram



Current output wiring diagram 8-4 (two-wire system)



Voltage output wiring figure 8-5 (three-wire system)



RS485 (digital signal) 8-6 output wiring diagram (four-wire system)

☞ ⏚ Representing the shielded wire, all marked grounding points must be effectively grounded.

☞ The transmitter casing defaults to be ground, all field devices are required to be effectively grounded.

☞ Only the current output has reverse connection protection (no damage but does not work), current limiting and voltage limiting protection. Reversed connection of all other output signals can cause damage to the transmitter.

10. Protocol Description

(limited to RS485 signal output 485 all product addresses default to 01)

10.1. Basic technical parameters of the transmitter

(This protocol complies with the Modbus communication protocol, and uses a subset of the Modbus protocol which is RTU mode. RS485 half-duplex working mode)

a) Output signal: RS485 (Maximum distance can be up to 1000 meters. Maximum connection 32 channels)

b) Standard Modbus-RTU protocol
(03 function reads data, 06 function inputs setting data)

c) Data format: 9600, N, 8, 1 (9600bps, no parity, 8 data bits, 1 stop)

d) Response frequency: ≤ 5Hz

e) Response speed: ≥10ms

10.2. Modbus-RTU Read Data 03 Command Description (Data is hexadecimal)

Protocol format description					
	Device address	Function code	Data address	Number of read data	16CRC code(low before high after)
Host command	Address	03	00 00	CN	CRC0 CRC1
	Device address	Function code	Data byte	Sensor data	16CRC code(low before high after)
Return from machine	Address	03	02*CN	S_HN , S_LN	CRC0 CRC1

Communication example (reading a sensor signal):

The sensor communication device address of 0-100℃ is set to 01, ie [Address]=01 (Address range 01-254);

And, CRC0=84, CRC1=0a. Then send and return data should be as follows:

Send: 01 03 00 00 00 01 84 0A

Back: 01 03 02 02 AC B9 59

02AC is hexadecimal, converted to decimal 684;

Data output: 0-2000 corresponds to so the current pressure is T=684/10-50=18.4℃

Query example (read the current device address, only to be completed independently by a single sensor)

Send:FF 03 00 0F 00 01 A1 D7

Back:FF 03 02 00 01 50 50

Then: the address of this device is 01 (hexadecimal)

10.3. Modbus-RTU input 06 command detailed description (data is hexadecimal)

Protocol format description					
	Device address	Function code	Data address	New address	16CRC code (low before high after)
Host command	Address	06	00 0F	H L	CRC0 CRC1
	Device address	Function code	Data address	New address	16CRC code (low before high after)
Return from machine	Address	06	00 0F	H L	CRC0 CRC1

Example of modification

For example, change 01 address to 09 address:

Send 01 06 00 0F 00 09 79 CF

Retun 01 06 00 0F 00 09 79 CF

Then the original address 01 is modified to 09 successfully, and the modification of address can be done offline or online. It can work directly without re-powering at completion.

10.4. Precautions for use

☞a) Single RS485 bus must adopt a “hand-to-hand” bus structure. Do not use a star connection or a fork connection. The address code is set from near to far, that is, the management computer is connected to the No. 1 controller, No. 2 is connected to No. 1, No. 3 is connected to No. 2, and so on...

⚠ Warning!

b) The AC power supply and the case of the equipment must be grounded properly and well. There are many places where there are triangular sockets which in fact, have no grounding at all. Be alerted. When the grounded properly, the equipment to release the energy by combining with the lightning protection design when struck by the lightning surge and the static electricity, to protect the RS485 bus equipment and related chips from damage. Do not use the RS485 bus if there is no grounding or not properly grounded, to avoid equipment burnout and casualties.

☞c) Wire must use multi-strand shielded twisted pair cable with diameter of more than 0.3 mm2 (multiple strands are for spare). Use PVC pipe separately to avoid lining with strong current to avoid interference from strong current.

☞d) 485 (A) and 485 (B) must be twisted together, because 485 communication uses differential mode communication principle, and twisted pair anti-interference performance is good. It is wrong not to use twisted pairs, and other types of cables.

☞e) Connect the RS485 converter and the reference ground GND (power supply negative) of all access controllers, and use the remaining one or all of the multiple twisted pair cables for the series GND; if the reference ground is not connected, it will also affect the communication time. Nowhere, high frequency radiation, mainly from distributed capacitance and inductance, produces a common mode effect.

☞f) The shield of the network communication line is grounded. It is required for grounding, otherwise the potentially danger of the bus is unknown.

☞g) If multiple machines or cables are too long for communication, add 120 ohm matching resistors between 485 (A) and 485 (B) at the head and end of the 485 bus, to improve the communication performance quality. (Must be pair twisted)

☞h) The transmission rate, number of load nodes and transmission distance should be reasonably arranged, to achieve remote low-node for low-speed, short distance multi-node for high-speed principle.

i) The data communication shall be verified to protect the transmission accuracy. Generally, the Modbus-RTU is verified by the crc-16 verification mode, and the error rate is less than 1/1billion.

j) If necessary, choose the company's isolated type model 485, the price is generally higher.

10.5. 16CRC verify

The 16CRC verification is a standard error check method used by the Modbus protocol. Generally, it has detailed descriptions and procedures, which is not explained here.

11. Initial start

⚠ Warning!

a) Before starting, it is a must to check if the transmitter is installed correctly, and if there is any obvious damage.

⚠ Warning!

b) The transmitter must be operated by professional technicians who read and understood this operating manual.

⚠ Warning!

c) The transmitter is only suitable for working conditions that meet the technical requirements!

12. After sales service

a) The company is responsible for all the maintenance costs during the warranty period, after inspected by the technician of the company and confirmed there is quality failure.

⚠ Warning!

b) Please clean the residual media before returning, especially substances that is harmful to human health, such as corrosive, toxic, carcinogenic or radioactive substances;

c) Please keep the warranty card and certificate in a safe place, and return with the product when there is need of repairing;

d) If there is any faulty with the transmitter, please contact our after-sales service. If you need to send the transmitter back to the company for repair after confirming the problem. Please attach the following information:
Description of the site environment;
Fault phenomenon;
Delivery address and contact information;

12.1Common fault analysis and elimination

Fault phenomenon	Cause analysis	Elimination method
• The transmitter has no output signal.	• The transmitter is not powered. • Fault connection.	• Supply power to transmitter correctly according to the wiring diagram.
• Output irregular jumps whenthe pressure is constant	• The transmitteris not grounded • Strong RF interference on site • No shielded cable applied	• Use shielded cable and ground the shield • The transmitter is properly connected to the earth
• The transmitter output does not match with the measured pressure	• The supply voltage is incorrect •The external load is too large	• Whether it is within the power supply range • Adjust the external load

If the fault phenomenon does not fall within the above range, please contact our after-sales.

12.2 Calibration

Zero and full-scale drift may occur during the use of the transmitter. If the above phenomenon occurs after long time use,it is recommended to send the transmitter back to us for calibration to ensure high accuracy.

13. Transportation and storage

The transmitter should be kept in a sturdy cardboard box (large device requires a wooden box), free move in the box is not allowed,be careful when handling, do not handle with roughly. Store area . should meet the following conditions:

☞a) Protect from rain and moisture.

☞b) Free from mechanical shock or shock.

☞c) Temperature range -20 ~ 55 ° C.

☞d) The relative humidity is not more than 80%.

☞e) No corrosive gas in the environment.

14. Unpacking precautions

☞a) After unpacking, check the packing list to confirm if the documents and accessories are complete.
The packed documents are:

A copy of the instruction manual.

A product certificate.

A warranty card.

☞b) Observe if there is any damage caused during transportation, for proper following up.

c) We hope that the user can safely keep the “warranty card”, please don't misplace it, otherwise you can't return to the factory for free repair!

15. Instructions for ordering

⚠ Warning!

When purchasing the pressure transmitter, the user should select the appropriate model to make sure it meets specifications of the contact media ,such as the pressure , temperature , protection level and environmental conditions